9000X AF Drives

Application manual

Powering Business Worldwide

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Cover Photo: Eaton's Series 9000X AF Drives.

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Safety

Definitions and symbols

⚠ WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

⚠

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

⚠ WARNING

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

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous high voltage

⚠ WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

Cautions and notices

Read this manual thoroughly and make sure you understand the procedures before you attempt to install, set up, or operate this 9000X AF Drives from Eaton's electrical sector.

⚠ CAUTION

Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

⚠ CAUTION

The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill.

NOTICE

The inputs, unlike the outputs, cannot be changed in RUN state.

Chapter 1 — Basic application

Introduction

The Basic Application is easy to use with a minimum number of parameters. It operates like the default setup of the Standard Application. It is the default setting on delivery from the factory. If any configuration changes are needed, select the Standard Application in menu M5. Fieldbus control is not available in the Basic Application, but fieldbus monitoring is the same as the Standard Application.

The parameters of the Basic Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Motor protection functions in the basic application

The Basic Application provides almost all the same protection functions as the other applications:

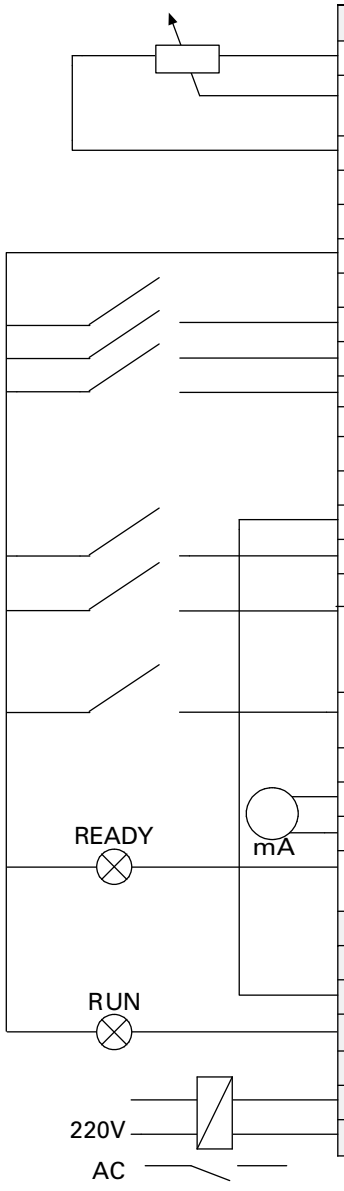
- External fault protection
- Input phase supervision
- Undervoltage protection
- Output phase supervision
- Earth fault protection
- Motor thermal protection
- I_{in} reference fault (auto reset)

Unlike the other applications, the Basic Application does not provide any parameters for choosing the response function or limit values for the faults. The motor thermal protection is explained in more detail on **Page 147** in Appendix A.

Control I/O

Table 1-1. Basic application default I/O configuration

Reference potentiometer
1 - 10 kW



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range	Voltage input frequency reference
		0 - 10V DC	
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range	Current input frequency reference
5	AI2-	0 - 20 mA	
6	+24V	Control voltage output	Voltage for switches. etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward	Contact closed = start forward
9	DIN2	Start reverse	Contact closed = start reverse
10	DIN3	External fault input	Contact open = no fault
			Contact closed = fault
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	DIN4 / DIN5 / Frequency ref.
15	DIN5	Multi-step speed select 2	Open / Open / Ref.U$_{in}$ Closed / Open / Multi-step ref.1 Open / Closed / Multi-step ref.2
16	DIN6	Fault reset	Closed / Closed / Refl$_{in}$ Contact open = no action
			Contact closed = fault reset
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analog output	Range 0 - 20 mA/R$_L$, max. 500W
20	DO1	Digital output	Programmable
		READY	Open collector, I ≤ 50 mA, U ≤ 48V DC
OPTA2			
21	RO1	Relay output 1	Range 0 - 20 mA/R
22	RO1	RUN	
23	RO1		
24	RO2	Relay output 2	
25	RO2	FAULT	
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3:
CMA and CMB Grounding

- ●● CMB connected to GND
  ●● CMA connected to GND
- ●● CMB isolated from GND
  ●● CMA isolated from GND
- ●● CMB and CMA internally connected
  ●● together, isolated from GND

= Factory default.

Basic application — Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number

Parameter = Name of parameter

Min = Minimum value of parameter

Max = Maximum value of parameter

Unit = Unit of parameter value; Given if available

Default = Value preset by factory

ID = ID number of the parameter

① = Parameter value can only be changed after the drive has been stopped

② = Use TTF method to program these parameters. See **Page 55**.

Monitoring values (control keypad: menu M7)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information.

Table 1-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	DO1, RO1, RO2		17	Relay output status
V7.16	Analog Iout	mA	26	AO1
M7.17	Multimonitor			Displays three selectable monitor values

Basic parameters (control keypad: M1 → G1.1)

Table 1-3. Basic parameters — G1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1	Min frequency	0.00	Par. 1.2	Hz	0.00	101	
P1.2	Max frequency	Par. 1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	IH is the nominal current rating of the 9000X inverter.
P1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 460V 5: 575V	110	Motor nameplate value.
P1.7	Nominal frequency of the motor	0.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.8	Nominal speed of the motor	0	20000	rpm	1720	112	Motor nameplate value.
P1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.10	Preset speed 1	0.00	Par. 1.2		10.00	105	Speeds preset by operator
P1.11	Preset speed 2	0.00	Par. 1.2		40.00	106	Speeds preset by operator
P1.12	Input phase supervision	0	3		2	730	0 = No action 1 = Warning 2 = Fault 3 = Fault, coast

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad Control Menu in the 9000X AF Drives User Manual.

Table 1-4. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
R2.1	Keypad reference	P1.1	P1.2		0		
P2.2	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
P2.3	Stop button	0	1		1	114	0 = No 1 = Yes
P2.4	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter sets or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Chapter 2 — Standard application

Introduction

Select the Standard Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

The Standard Application is typically used in pump and fan applications and conveyors for which the Basic Application is too limited but where no special features are needed.

- The Standard Application has the same I/O signals and the same control logic as the Basic Application.
- Digital input DIN3 and all the outputs are freely programmable.

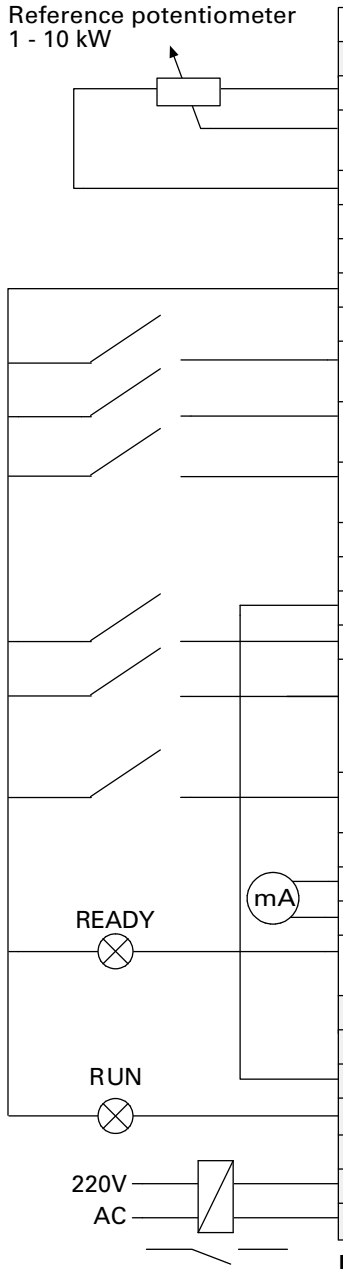
Additional functions:

- Programmable Start/Stop and reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One skip frequency area
- Programmable V/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Standard Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

Table 2-1. Standard application default I/O configuration



Terminal		Signal	Description		
OPTA1					
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.		
2	AI1+	Analog input, voltage range 0 - 10V DC	Voltage input frequency reference		
3	AI1-	I/O Ground	Ground for reference and controls		
4	AI2+	Analog input, current range	Current input frequency reference		
5	AI2-	0 - 20 mA			
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A		
7	GND	I/O ground	Ground for reference and controls		
8	DIN1	Start forward (programmable)	Contact closed = start forward		
9	DIN2	Start reverse (programmable)	Contact closed = start reverse		
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault		
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V		
12	+24V	Control voltage output	Voltage for switches (see #6)		
13	GND	I/O ground	Ground for reference and controls		
14	DIN4	Multi-step speed select 1	DIN4	DIN5	Frequency ref.
15	DIN5	Multi-step speed select 2	Open Closed Open Closed	Open Open Closed Closed	Ref.U_{in} Multi-step ref.1 Multi-step ref.2 Ref.I_{in}
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset		
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V		
18	AO1+	Output frequency Analog output	Programmable Range 0 - 20 mA/R_L, max. 500W		
19	AO1-				
20	DO1	Digital output READY	Programmable Open collector, I ≤ 50 mA, U ≤ 48V DC		
OPTA2					
21	RO1	Relay output 1			
22	RO1	RUN			
23	RO1				
24	RO2	Relay output 2			
25	RO2	FAULT			
26	RO2				

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3:
CMA and CMB Grounding

- CMB connected to GND, CMA connected to GND
- CMB isolated from GND, CMA isolated from GND
- CMB and CMA internally connected together, isolated from GND

= Factory default.

Standard application — Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8. The descriptions are arranged according to the ID number of the parameter.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number

Parameter = Name of parameter

Min = Minimum value of parameter

Max = Maximum value of parameter

Unit = Unit of parameter value; Given if available

Default = Value preset by factory

ID ID number of the parameter

① Parameter value can only be changed after the drive has been stopped

② Use TTF method to program these parameters. See **Page 55.**

Monitoring values (control keypad: menu m7)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information.

Table 2-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	DO1, RO1, RO2		17	Relay output status
V7.16	Analog Iout	mA	26	AO1
M7.17	Multimonitor			Displays three selectable monitor values

Table 2-3. Special

Code	Parameter	Unit	ID	Description
V7.18.1	Current unfiltered	A	1113	
V7.18.2	Torque unfiltered	%	1125	
V7.18.3	DC bus voltage unfiltered	Vdc	44	
V7.18.4	Status word		43	
V7.18.5	U phase current unfiltered	A	39	
V7.18.6	U phase current unfiltered	A	40	
V7.18.7	W phase current unfiltered	A	41	

Basic parameters (control keypad: menu M1 → G1.1)

Table 2-4. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2	Hz	0.00	101	
P1.1.2	Max frequency	Par. 1.1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	IH is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 460V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	30.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	300	20000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.30	1.00		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	3		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.12	Remote control source	1	3		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.13	Local reference	0	3		2	173	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P1.1.14	Remote reference	0	3		0	174	See par. 1.1.13
P1.1.15	Identification	0	2		0/No Action	631	0 = No action 1 = V/Hz 2 = V/Hz with boost
P1.1.16	V/Hz boost	0	1		0/None	109	0 = None 1 = Automatic torque boost
P1.1.17	Preset speed 1	0.00	Par. 1.1.2	Hz	10.00	105	
P1.1.18	Preset speed 2	0.00	Par. 1.1.2	Hz	15.00	106	

Input signals (control keypad: menu M1 → G1.2)

Table 2-5. Input signals — G1.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1	Start/Stop logic selection	0	7		0	300	0 = Forw - Rev 1 = Start - Rev 2 = Start - Enable 3 = Start Pulse - Stop Pulse 4 = ForwardP - ReverseP 5 = StartP - ReverseP 6 = StartP - EnableP
P1.2.2	DIN3 function	0	7		1	301	0 = Not used 1 = External fault closed 2 = External fault open 3 = Run enable 4 = Acc./Dec. time select 5 = Force remote 6 = Reverse if P1.2.1 = 3 7 = Force local
P1.2.3	Current reference offset	0	1		1	302	0 = 0 - 20mA 1 = 4 - 20mA
P1.2.4	Reference scaling minimum	0.00	P1.2.5	Hz	0.00	303	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.5	Reference scaling maximum	0.00	320.00	Hz	0.00	304	Selects the frequency that corresponds to the max reference signal 0.00 = No scaling
P1.2.6	Reference inversion	0	1		0	305	0 = Not Inverted 1 = Inverted
P1.2.7	Reference filter time	0.00	10.00	s	0.10	306	0 = No filtering
P1.2.8	AI1 Signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.1	377	TTF programming method used. See **Page 55**
P1.2.9	AI2 Signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.2	388	TTF programming method used. See **Page 55**.
P1.2.10	Start delay	0.00	300.00	s	0.00	1494	

Rising edge required to start.
CP = control place.

Output signals (control keypad: menu M1 → G1.3)

Table 2-6. Output signals — G1.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	TTF programming method used. See Page 6-3.
P1.3.2	Analog output 1 function	0	8		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V)
P1.3.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No Filtering
P1.3.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4 mA
P1.3.6	Analog output 1 scale	10	1000	%	100	311	
P1.3.7	Digital output 1 function	0	16		1	312	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = FC overheat warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Warning 9 = Reversed 10 = Preset speed 1 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit 1 superv. 14 = Remote control active 15 = Thermistor fault/warng 16 = Fieldbus input data
P1.3.8	Relay output 1	0	16		2	313	Same as P1.3.7
P1.3.9	Relay output 2	0	16		3	314	Same as P1.3.7
P1.3.10	Output frequency limit 1 supervision	0	2		0	315	0 = No (No Limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.11	Output frequency limit 1; supervised value	0	Par. 1.1.2	Hz	0	316	
P1.3.12	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		AnOUT:0.1	471	
P1.3.13	Analog output 2 function	0	8		4	472	See par. 1.3.2
P1.3.14	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.15	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.16	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4 mA
P1.3.17	Analog output 2 scale	10	1000	%	100	476	

Drive control parameters (control keypad: menu M1 → G1.4)

Table 2-7. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve ramp time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve ramp time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P1.4.8	DC braking current	0.00	IL	A	0.7 x IH	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop
P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	.1 X I_H	I_L	A	I_H	519	

Skip frequency parameters (control keypad: menu M1 → G1.5)

Table 2-8. Skip frequency parameters — G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.2	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.2	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency acc./dec. ramp	0.1	10	Times	1.0	518	

Table 2-9. Motor control parameters (control keypad: menu M1 → G1.6)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	4		0	600	SVX: 0 = Frequency control 1 = Speed control SPX: 2 = Torque control 3 = Closed loop speed control 4 = Closed loop torque control
P1.6.2	V/Hz boost	0	1		0	109	0 = Not used 1 = Automatic torque boost
P1.6.3	V/Hz ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0	40	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	16.0	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On
P1.6.12	Load drooping	0.00	100.00		0	620	Drooping % of nominal speed at nominal torque
P1.6.13	Identification	0	2		0	631	0 = No action 1 = V/Hz 2 = V/Hz with boost
Closed loop parameter group 1.6.14 (SPX only)							
1.6.14.1	MagnCurrent	0.00	100.00	A	0.00	612	
1.6.14.2	Speed Control Kp	1	1000		30	613	
1.6.14.3	Speed Control Ti	0.0	500.0	ms	30.0	614	
1.6.14.5	Accel.Compens.	0.00	300.00	s	0.00	626	
1.6.14.6	Slip Adjust	0	500	%	100	619	
1.6.14.7	Start Magn Curr	0.1 x I_H	2 x I_H	A	0.00	627	
1.6.14.8	Start Magn Time	0.0	600.0	s	0.0	628	
P1.6.17.9	Start 0SpeedTime	0	32000	ms	100	615	
P1.6.17.10	Stop 0 SpeedTime	0	32000	ms	100	616	
P1.6.17.11	StartUp Torque	0	3		0/Not	621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P1.6.17.12	Startup Torq FWD	-300.0	300.0	%	0.0	633	
P1.6.17.13	Startup Torq REV	-300.0	300.0	%	0.0	634	
P1.6.17.15	Encoder1FiltTime	0	100	ms	0	618	
P1.6.17.17	CurrentControlKp	0.00	100.00	%	40.00	617	

Protections (control keypad: menu M1 → G1.7)

Table 2-10. Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	5		0	700	0 = None 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting 6 = Fault, Restart
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.18	Field weakening area load	10	150	%	50	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2	600	s	20	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.25	Earth fault currrent level	0.0	100.0	%	50.0	1333	Sets the level of ground fault current for a fault

Table 2-11. Regulator warning parameters — G1.7.26

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.26.1	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.26.2	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.26.3	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.26.4	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 → G1.8)

Table 2-12. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0.00	60.00	s	30.00	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = According to par. 1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto - Restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		0	738	

Cold weather parameters (control keypad: menu M1 → G1.9)

Table 2-13. Cold weather parameters — G1.9

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.9.1	Cold weather enable	0.00	1		0	1490	0 = Disable 1 = Enable
P1.9.2	Cold weather voltage	0.00	20.00	%	2.00	1491	
P1.9.3	Cold weather timeout	0.00	10.00	min	0.00	1492	

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the 9000X AF Drives User Manual.

Table 2-14. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	3		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O Select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
P2.4	Stop button	0	1		1	114	0 = No 1 = Yes
P2.5	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter sets or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Chapter 3 — Local/remote control application

Introduction

Select the Local/Remote Control Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

- The Local/Remote Application utilizes digital input DIN6 to select between Local and Remote control. For each control location, the frequency can be selected from either the keypad, I/O terminals, or fieldbus
- All outputs are freely programmable

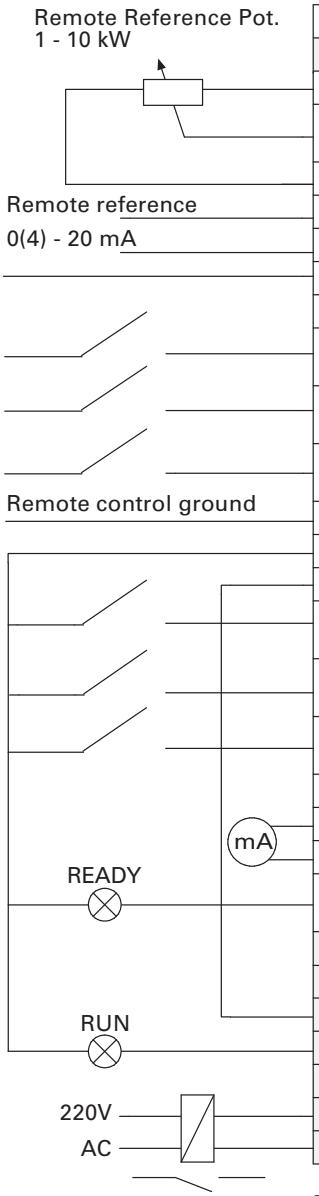
Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Second I/O programmable stay/stop and reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One skip frequency area
- Programmable v/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Local/Remote Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

Table 3-1. Local/remote application default I/O configuration



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 - 10V DC	Place B input frequency reference range 0 - 10V DC
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range	Place A frequency reference
5	AI2-	0 - 20 mA	range 0 - 20 mA
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Remote start forward (programmable)	Contact closed = start forward
9	DIN2	Remote start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see terminal 6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Local start forward (programmable)	Contact closed = start forward
15	DIN5	Local start reverse (programmable)	Contact closed = start reverse
16	DIN6	Local/Remote selection	Contact open = Local is active Contact closed = Remote is active
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AO1+	Output frequency Analog output	Programmable Range 0 - 20 mA, R_L, max. 500W
19	AO1-		
20	DO1	Digital output READY	Programmable Open collector, I ≤ 50 mA, V ≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3:
CMA and CMB Grounding

- CMB connected to GND, CMA connected to GND
- CMB isolated from GND, CMA isolated from GND
- CMB and CMA internally connected together, isolated from GND

= Factory default.

Local/remote control application — Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number

Parameter = Name of parameter

Min = Minimum value of parameter

Max = Maximum value of parameter

Unit = Unit of parameter value; Given if available

Default = Value preset by factory

ID = ID number of the parameter

① = Parameter value can only be changed after the drive has been stopped

② = Use TTF method to program these parameters. See **Page 55.**

Monitoring values (control keypad: menu M7)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information.

Table 3-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	DO1, RO1, RO2		17	Relay Output Status
V7.16	Analog Iout	mA	26	AO1
M7.17	Multimonitor			Displays three selectable monitor values

Table 3-3. Special

Code	Parameter	Unit	ID	Description
V7.18.1	Current unfiltered	A	1113	
V7.18.2	Torque unfiltered	%	1125	
V7.18.3	DC bus voltage unfiltered	Vdc	44	
V7.18.4	Status word		43	
V7.18.5	U phase current unfiltered	A	39	
V7.18.6	U phase current unfiltered	A	40	
V7.18.7	W phase current unfiltered	A	41	

Basic parameters (control keypad: menu M1 → G1.1)

Table 3-3. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2	Hz	0.00	101	
P1.1.2	Max frequency	Par. 1.1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	I_H is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 460V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	30.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	300	20000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.30	1.00		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	4		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus 4 = I/O Terminal B
P1.1.12	Remote control source	1	4		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus 4 = I/O Terminal B
P1.1.13	Local reference	0	4		2	173	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus 4 = Motor Potentiometer
P1.1.14	Remote reference	0	4		0	174	See par. 1.1.13
P1.1.15	Identification	0	4		0/No Action	631	0 = No Action 1 = V/Hz 2 = V/Hz with boost 4 = I/O Terminal B
P1.1.16	V/Hz boost	0	1		0/None	109	0 = None 1 = Automatic torque boost
P1.1.17	Jogging speed	0.00	Par. 1.1.2	Hz	0.00	124	

Input signals (control keypad: menu M1 → G1.2)

Table 3-4. Input signals — G1.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1	Start/Stop logic selection	0	8		0	300	0 = Forw - Rev 1 = Start - Rev 2 = Start - Enable 3 = Start Pulse - Stop pulse 4 = Forw - Motor potentiometer Up 5 = ForwardP - ReverseP 6 = StartP - ReverseP 7 = StartP - EnableP 8 = StartP - Motor potentiometer Up
P1.2.2	DIN3 function	0	11		1	301	0 = Not used 1 = External fault closed 2 = External fault open 3 = Run enable 4 = Acc./Dec. time select 5 = Reverse if P1.2.1 = 3 6 = Jogging Speed 7 = Fault Reset 8 = Acc./Dec. Prohibit 9 = DC Brake command 10 = Motor potentiometer down 11 = Force remote
P1.2.3	AI1 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.2	388	TTF programming method used. See Page 6-3.
P1.2.4	AI1 signal inversion	0	1		0	323	0 = Normal 1 = Inverted
P1.2.5	AI1 signal filter time	0.00	10.00	s	0.10	324	0 = No filtering
P1.2.6	AI2 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.2	388	TTF programming method used. See Page 6-3.
P1.2.7	AI2 signal range	0	2		1	325	0 = 0–100% 1 = 4 - 20mA/20% to 100% 2 = Custom range
P1.2.8	AI2 custom minimum setting	0.00	100.00	%	0.00	326	
P1.2.9	AI2 custom maximum setting	0.00	100.00	%	100.00	327	
P1.2.10	AI2 Signal Inversion	0	1		0	328	0 = Normal 1 = Inverted
P1.2.11	AI2 signal filter time	0.00	10.00	s	0.10	329	0 = No filtering
P1.2.12	Place B Start/Stop logic selection	0	6		0	363	0 = Forw - Rev 1 = Start - Rev 2 = Start - Enable 3 = Start Pulse - Stop pulse 4 = ForwardP - ReverseP 5 = StartP - ReverseP 6 = StartP - EnableP
P1.2.13	Reference scaling minimum	0.00	P1.2.5	Hz	0.00	303	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.14	Reference scaling maximum	0.00	320.00	Hz	0.00	304	Selects the frequency that corresponds to the max reference signal 0.00 = No scaling
P1.2.15	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0	331	
P1.2.16	Motor potentiometer frequency reference memory reset	0	2		1	367	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P1.2.17	Start pule memory	0	1		0	498	0 = Run state not copied 1 = Run state copied
P1.2.18	Start delay	0.00	300.00	s	0.00	1494	

Rising edge required to start.
CP = control place.
Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Output signals (control keypad: menu M1 → G1.3)

Table 3-5. Output signals — G1.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	TTF programming method used. See Page 6-3.
P1.3.2	Analog output 1 function	0	8		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V)
P1.3.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No filtering
P1.3.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4 mA
P1.3.6	Analog output 1 scale	10	1000	%	100	311	
P1.3.7	Digital output 1 function	0	22		1	312	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = FC overheat warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Warning 9 = Reversed 10 = Jogging speed selected 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit 1 superv. 14 = OP freq. limit 1 superv. 15 = Torque limit superv. 16 = Ref limit superv. 17 = Ext. Brake control 18 = Remote control active 19 = FC Limit supv. 20 = Unrequested rotation 21 = Ext. Brake Control Inverted 22 = Thermister fault/warn
P1.3.8	Relay output 1	0	16		2	313	Same as P1.3.7
P1.3.9	Relay output 2	0	16		3	314	Same as P1.3.7
P1.3.10	Output frequency limit 1 supervision	0	2		0	315	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision

Output signals — G1.3 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.11	Output frequency limit 1; supervised value	0	Par. 1.1.2	Hz	0	316	
P1.3.12	Output frequency limit 2 supervision	0	2		0	346	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.13	Output frequency limit 2; supervised value	0	Par. 1.1.2	Hz	0	347	
P1.3.14	Torque limit supervision	0	2		0	348	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.15	Torque limit supervision value	0.0	200.0	%	0.0	349	
P1.3.16	Reference limit supervision	0	2		0	350	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.17	Reference limit supervision value	0	Par. 1.1.2	%	0	351	
P1.3.18	External brake-off delay	0.0	100.0	s	0.5	352	
P1.3.19	External brake-on delay	0.0	100.0	s	1.5	353	
P1.3.20	FC temperature supervision	0	2		0	354	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.21	FC temperature supervised value	-10	75	°C	0	355	
P1.3.22	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		AnOUT:0.1	471	
P1.3.23	Analog output 2 function	0	8		4	472	See par. 1.3.2
P1.3.24	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.25	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.26	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4 mA
P1.3.27	Analog output 2 scale	10	1000	%	100	476	

Drive control parameters (control keypad: menu M1 → G1.4)

Table 3-6. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve ramp time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve ramp time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp + Run enable coast 3 = Coast + Run enable ramp
P1.4.8	DC braking current	0.00	I_L	A	0.7 x I_H	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop
P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	0.1 X I_H	2 X I_L	A	I_H	519	

Skip frequency parameters (control keypad: menu M1 → G1.5)

Table 3-7. Skip frequency parameters — G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.2	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.2	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency range 2 low limit	0.00	Par. 1.5.4	Hz	0.00	511	
P1.5.4	Skip frequency range 2 high limit	0.00	Par. 1.1.2	Hz	0.00	512	0 = Skip frequency range 2 not used
P1.5.5	Skip frequency range 3 low limit	0.00	Par. 1.5.6	Hz	0.00	513	
P1.5.6	Skip frequency range 3 high limit	0.00	Par. 1.1.2	Hz	0.00	514	0 = Skip frequency range 3 not used
P1.5.7	Skip frequency acc./dec. ramp	0.10	10	Times	1	518	

Motor control parameters (control keypad: menu M1 → G1.6)

Table 3-8. Motor control parameters — G1.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	4		0	600	SVX: 0 = Frequency control 1 = Speed control SPX: 2 = Torque Control 3 = Closed loop speed control 4 = Closed loop torque control
P1.6.2	V/Hz boost	0	1		0	109	0 = Not used 1 = Automatic torque boost
P1.6.3	V/Hz ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	16.0	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On
P1.6.12	Load drooping	0.00	100.00		0.01	620	Drooping % of nominal speed at nominal torque
P1.6.13	Identification	0	2		0	631	0 = No action 1 = V/Hz 2 = V/Hz with Boost

Closed loop parameter group 1.6.14 (Spx only)

Table 3-8. Motor control parameters — G1.6 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
1.6.14.1	MagnCurrent	0.00	100.00	A	0.00	612	
1.6.14.2	Speed Control Kp		1000		30	613	
1.6.14.3	Speed Control Ti		500.0	ms	30.0	614	
1.6.14.5	Accel.Compens.	0.00	300.00	s	0.00	626.00	
1.6.14.5	Slip Adjust	0	500	%	100	619	
1.6.14.6	Start Magn Curr	0.1 x I_H	2 x I_H	A	0.00	627	
1.6.14.7	Start Magn Time	0.0	600.0	s	0.0	628	
P1.6.17.9	Start 0SpeedTime	0	32000	ms	100	615	
P1.6.17.10	Stop 0 SpeedTime	0	32000	ms	100	616	
P1.6.17.11	StartUp Torque	0	3		0/Not	621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P1.6.17.12	Startup Torq FWD	-300.0	300.0	%	0.0	633	
P1.6.17.13	Startup Torq REV	-300.0	300.0	%	0.0	634	
P1.6.17.15	Encoder1FiltTime	0	100	ms	0	618	
P1.6.17.17	CurrentControlKp	0.00	100.00	%	40.00	617	

Protections (control keypad: menu M1 → G1.7)

Table 3-9. : Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	5		0	700	0 = None 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting 6 = Fault, Restart
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.18	Field weakening area load	10.0	150.0	%	50.0	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2	600	s	20	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.25	Earth fault currrent level	0.0	50.0	%	50.0	1333	Sets the level of ground fault current for a fault

Table 3-10: Motor regulator warnings — G1.7.26

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.26.1	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.26.2	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.26.3	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.26.4	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 → G1.8)

Table 3-10. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0	60	s	30	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = According to par. 1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto - Restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		1	738	

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the keypad control menu in the 9000X AF Drives User Manual.

Table 3-11. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	3		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
P2.4	Stop button	0	1		1	114	0 = No 1 = Yes
P2.5	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter sets or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Note: Parameter P2.1, Control place, defaults to 3- I/O Select to disable the Keypad L/R button since Local/Remote selection with this application is normally controlled with Digital Input 6 (DIN6). Select Keypad L/R in parameter P2.1 to enable the Keypad L/R button.

Chapter 4 — Multi-step speed control application

Introduction

Select the Multi-Step Speed Control Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

The Multi-Step Speed Control Application can be used in applications where fixed speeds are needed. Totally 15 + 2 different speeds can be programmed: one basic speed, 15 multi-step speeds and one jogging speed. The speed steps are selected with digital signals DIN3, DIN4, DIN5 and DIN6. If jogging speed is used, DIN3 can be programmed from fault reset to jogging speed select.

The basic speed reference can be either voltage or current signal via analog input terminals (2/3 or 4/5). The other one of the analog inputs can be programmed for other purposes.

- All outputs are freely programmable

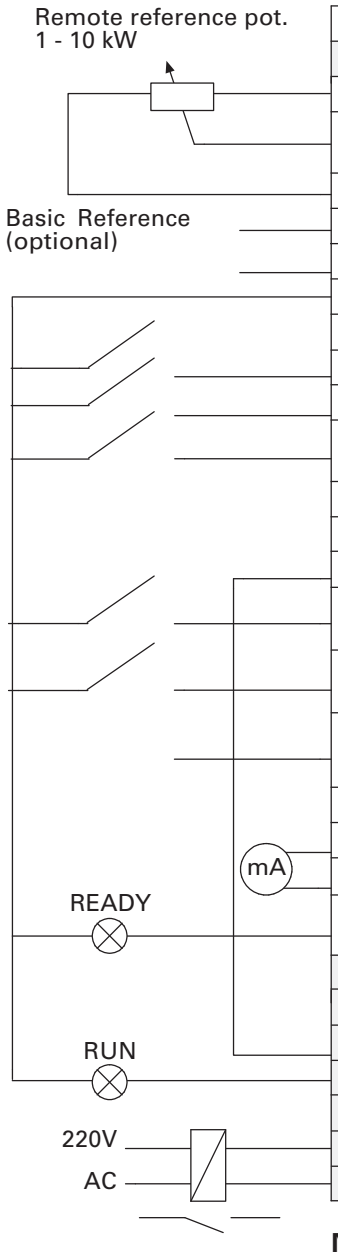
Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One skip frequency area
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Multi-Step Speed Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

Table 4-1. Multi-step speed control application default I/O configuration



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 - 10V DC	Basic reference (programmable) range 0 - 10V DC
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range	Basic reference (programmable) range 0 - 20 mA
5	AI2-	0 - 20 mA	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward (programmable)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see terminal 6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	**Sel1 / Sel2 / Sel3 / Sel4 (with DIN3)** 0 / 0 / 0 / 0 Basic speed 1 / 0 / 0 / 0 Speed 1 0 / 1 / 0 / 0 Speed 2 ... / ... / ... / ... ... 1 / 1 / 1 / 1 Speed 15
15	DIN5	Multi-step speed select 2	
16	DIN6	Multi-step speed select 3	
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analog output	Range 0 - 20 mA, R_L, max. 500W
20	DO1	Digital output READY	Programmable Open collector, I ≤ 50 mA, V ≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3:
CMA and CMB Grounding

- CMB connected to GND, CMA connected to GND
- CMB isolated from GND, CMA isolated from GND
- CMB and CMA internally connected together, isolated from GND

= Factory default.

Multi-step speed control application — Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number

Parameter = Name of parameter

Min = Minimum value of parameter

Max = Maximum value of parameter

Unit = Unit of parameter value; Given if available

Default = Value preset by factory

ID = ID number of the parameter

① = Parameter value can only be changed after the drive has been stopped

② = Use TTF method to program these parameters. See **Page 55.**

Monitoring values (control keypad: menu M7)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information.

Table 4-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	DO1, RO1, RO2		17	Relay output status
V7.16	Analog Iout	mA	26	AO1
M7.17	Multimonitor			Displays three selectable monitor values

Table 4-3. Special

Code	Parameter	Unit	ID	Description
V7.18.1	Current unfiltered	A	1113	
V7.18.2	Torque unfiltered	%	1125	
V7.18.3	DC bus voltage unfiltered	Vdc	44	
V7.18.4	Status word		43	

Basic parameters (control keypad: menu M1 → G1.1)

Table 4-3. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2	Hz	0.00	101	
P1.1.2	Max frequency	Par. 1.1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	I_H is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 460V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	30.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	300	20000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.30	1.00		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	3		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.12	Remote control source	1	3		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.13	Local reference	0	3		2	173	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P1.1.14	Remote reference	0	3		0	174	See par. 1.1.13
P1.1.15	Identification	0	2		0/No Action	631	0 = No action 1 = V/Hz 2 = V/Hz with boost
P1.1.16	V/Hz boost	0	1		0/None	109	0 = None 1 = Automatic torque boost
P1.1.17	Jogging speed ref.	0.00	Par. 1.1.2	Hz	0.00	124	
P1.1.18	Preset speed 1	0.00	Par. 1.1.2	Hz	5.00	105	Multi-step speed 1
P1.1.19	Preset speed 2	0.00	Par. 1.1.2	Hz	10.00	106	Multi-step speed 2
P1.1.20	Preset speed 3	0.00	Par. 1.1.2	Hz	12.50	126	Multi-step speed 3
P1.1.21	Preset speed 4	0.00	Par. 1.1.2	Hz	15.00	127	Multi-step speed 4
P1.1.22	Preset speed 5	0.00	Par. 1.1.2	Hz	17.50	128	Multi-step speed 5
P1.1.23	Preset speed 6	0.00	Par. 1.1.2	Hz	20.00	129	Multi-step speed 6
P1.1.24	Preset speed 7	0.00	Par. 1.1.2	Hz	22.50	130	Multi-step speed 7
P1.1.25	Preset speed 8	0.00	Par. 1.1.2	Hz	25.00	133	Multi-step speed 8
P1.1.26	Preset speed 9	0.00	Par. 1.1.2	Hz	27.50	134	Multi-step speed 9
P1.1.27	Preset speed 10	0.00	Par. 1.1.2	Hz	30.00	135	Multi-step speed 10
P1.1.28	Preset speed 11	0.00	Par. 1.1.2	Hz	32.50	136	Multi-step speed 11
P1.1.29	Preset speed 12	0.00	Par. 1.1.2	Hz	35.00	137	Multi-step speed 12
P1.1.30	Preset speed 13	0.00	Par. 1.1.2	Hz	40.00	138	Multi-step speed 13
P1.1.31	Preset speed 14	0.00	Par. 1.1.2	Hz	45.00	139	Multi-step speed 14
P1.1.32	Preset speed 15	0.00	Par. 1.1.2	Hz	60.00	140	Multi-step speed 15

Input signals (control keypad: menu M1 → G1.2)

Table 4-4. Input signals — G1.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1	Start/Stop logic selection	0	6		0	300	0 = Forw - Rev 1 = Start - Rev 2 = Start - Enable 3 = Start Pulse - Stop pulse 4 = ForwardP - ReverseP 5 = StartP - ReverseP 6 = StartP - EnableP
P1.2.2	DIN3 function	0	12		1	301	0 = Not used 1 = External fault closed 2 = External fault open 3 = Run enable 4 = Acc./Dec. time select 5 = Force remote 6 = Reverse if P1.2.1 = 3 7 = Jogging speed 8 = Fault reset 9 = Acc./Dec. Prohibit 10 = DC braking command 11 = Preset speed 12 = Force local
P1.2.3	Current reference offset	0	1		1	302	0 = 0 - 20mA 1 = 4 - 20mA
P1.2.4	Reference scaling minimum	0.00	P1.2.5	Hz	0.00	303	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.5	Reference scaling maximum	0.00	320.00	Hz	0.00	304	Selects the frequency that corresponds to the max reference signal 0.00 = No scaling
P1.2.6	Reference inversion	0	1		0	305	0 = Not inverted 1 = Inverted
P1.2.7	Reference filter time	0.00	10.00	s	0.10	306	0 = No filtering
P1.2.8	AI1 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.1	377	TTF programming method used. See **Page 55**
P1.2.9	AI2 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.2	388	TTF programming method used. See **Page 55**.
P1.2.10	Start delay	0.00	300.00	s	0.00	1494	

Remember to place jumpers of block X2 accordingly. See *9000X AF Drives User Manual, Chapter 4*.
CP = control place; cc = closing contact; oc = opening contact.

Output signals (control keypad: menu M1 → G1.3)

Table 4-5. Output signals — G1.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	TTF programming method used. See **Page 55**.
P1.3.2	Analog output 1 function	0	8		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V)
P1.3.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No filtering
P1.3.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4 mA
P1.3.6	Analog output 1 scale	10	1000	%	100	311	
P1.3.7	Digital output 1 function	0	22		1	312	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = FC overheat warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Warning 9 = Reversed 10 = Jogging speed selected 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit 1 superv. 14 = OP freq. limit 1 superv. 15 = Torque limit superv. 16 = Ref limit superv. 17 = Ext. Brake control 18 = Remote control active 19 = FC limit supv. 20 = Unrequested rotation 21 = Ext. Brake Control Inverted 22 = Thermister fault/warn
P1.3.8	Relay output 1	0	22		2	313	Same as P1.3.7
P1.3.9	Relay output 2	0	22		3	314	Same as P1.3.7
P1.3.10	Output frequency limit 1 supervision	0	2		0	315	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.11	Output frequency limit 1; supervised value	0	Par. 1.1.2	Hz	0	316	
P1.3.12	Output frequency limit 2 supervision	0	2		0	346	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.13	Output frequency limit 2; supervised value	0	Par. 1.1.2	Hz	0	347	
P1.3.14	Torque limit supervision	0	2		0	348	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.15	Torque limit supervision value	0.0	200.0	%	0.0	349	
P1.3.16	Reference limit supervision	0	2		0	350	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision

Output signals (control keypad: menu M1 → G1.3) (continued)

Table 4.5. Output signals — G1.3 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.17	Reference limit supervision value	0.00	Par. 1.1.2	%	0.00	351	
P1.3.18	External brake-off delay	0.0	100.0	%	0.0	352	
P1.3.19	External brake-on delay	0.00	100.0	%	0.0	353	
P1.3.20	FC temperature supervision	0	2		0	354	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.21	FC temperature supervised value	-10	75	∞C	0	355	
P1.3.22	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		AnOUT:0.1	471	
P1.3.23	Analog output 2 function	0	8		4	472	See par. 1.3.2
P1.3.24	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.25	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.26	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4 mA
P1.3.27	Analog output 2 scale	10	1000	%	100	476	

Drive control parameters (control keypad: menu M1 → G1.4)

Table 4-6. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve Ramp Time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve Ramp Time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P1.4.8	DC braking current	0.00	I_L	A	0.7 x I_H	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop
P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	0.1 X I_H	2 X I_H	A	I_H	519	

Skip frequency parameters (control keypad: menu M1 → G1.5)

Table 4-7. Skip frequency parameters — G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.2	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.2	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency range 2 low limit	0.00	Par. 1.5.4	Hz	0.00	511	
P1.5.4	Skip frequency range 2 high limit	0.00	Par. 1.1.2	Hz	0.00	512	0 = Skip frequency range 2 not used
P1.5.5	Skip frequency range 3 low limit	0.00	Par. 1.5.6	Hz	0.00	513	
P1.5.6	Skip frequency range 3 high limit	0.00	Par. 1.1.2	Hz	0.00	514	0 = Skip frequency range 3 not used
P1.5.7	Skip frequency acc./dec. ramp	0.1	10	Times	1	518	

Motor control parameters (control keypad: menu M1 → G1.6)

Table 4-8. Motor control parameters — G1.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	4		0	600	SVX: 0 = Frequency control 1 = Speed control SPX: 2 = Torque control 3 = Closed loop speed control 4 = Closed loop torque control
P1.6.2	V/Hz boost	0	1		0	109	0 = Not used 1 = Automatic torque boost
P1.6.3	V/Hz ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	16.0	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On
P1.6.12	Load drooping	0.00	100.00		0	620	Drooping % of nominal speed at nominal torque

Motor control parameters (control keypad: menu M1 → G1.6) (continued)

Table 4.8. Motor control parameters — G1.6 (continued)

P1.6.13	Identification	0	2		0.01	631	0 = No action 1 = V/Hz 2 = V/Hz with boost
~~Closed loop parameter group 1.6.14 (SPX only)~~							
Code	**Parameter**	**Min.**	**Max.**	**Unit**	**Default**	**ID**	**Note**
1.6.14.1	MagnCurrent	0.00	100.00	A	0.00	612	
1.6.14.2	Speed Control Kp	1	1000		30	613	
1.6.14.3	Speed Control Ti	0.0	500.0	ms	30.0	614	
1.6.14.5	Accel.Compens.	0.00	300.00	s	0.00	626.00	
1.6.14.5	Slip Adjust	0	500	%	100	619	
1.6.14.6	Start Magn Curr	0.1 x I_H	2 x I_H	A	0.00	627	
1.6.14.7	Start Magn Time	0.0	600.0	s	0.0	628	
P1.6.17.9	Start 0SpeedTime	0	32000	ms	100	615	
P1.6.17.10	Stop 0 SpeedTime	0	32000	ms	100	616	
P1.6.17.11	StartUp Torque	0	3		0/Not	621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P1.6.17.12	Startup Torq FWD	-300.0	300.0	%	0.0	633	
P1.6.17.13	Startup Torq REV	-300.0	300.0	%	0.0	634	
P1.6.17.15	Encoder1FiltTime	0	100	ms	0	618	
P1.6.17.17	CurrentControlKp	0.00	100.00	%	40.00	617	

Protections (control keypad: menu M1 → G1.7)

Table 4-9. Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	6		0	700	0 = None 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting 6 = Fault, Restart
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	

Protections (control keypad: menu M1 → G1.7) (continued)

Table 4.9. Protections — G1.7 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No Action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.18	Field weakening area load	10	150	%	50	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2	600	s	20	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.25	Earth fault currrent level	0.00	100.0		50.0	1333	Sets the level of ground fault current for a fault

Table 4-10. Motor regulator warnings — G1.7.26

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.26.1	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.26.2	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.26.3	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.26.4	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 → G1.8)

Table 4-10. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0.00	60.00	s	30.00	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = According to par. 1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto - Restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		0	738	

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the 9000X AF Drives User Manual.

Table 4-11. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	3		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O Select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
P2.4	Stop button	0	1		1	114	0 = No 1 = Yes
P2.5	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter set3s or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Chapter 5 — PID control application

Introduction

Select the PID Control Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

In the PID Control Application, there are two I/O terminal control places; place A is the PID controller and source B is the direct frequency reference. The control place A or B is selected with digital input DIN6.

The PID controller reference can be selected from the analog inputs, fieldbus, motorized potentiometer, enabling the PID Reference 2 or applying the control keypad reference. The PID controller actual value can be selected from the analog inputs, fieldbus, the actual values of the motor or through the mathematical functions of these.

The direct frequency reference can be used for the control without the PID controller and selected from the analog inputs, fieldbus, motor potentiometer or keypad.

The PID Application is typically used to control level measuring or pumps and fans. In these applications, the PID Application provides a smooth control and an integrated measuring and controlling package where no additional components are needed

- Digital inputs DIN2, DIN3, DIN5 and all the outputs are freely programmable.

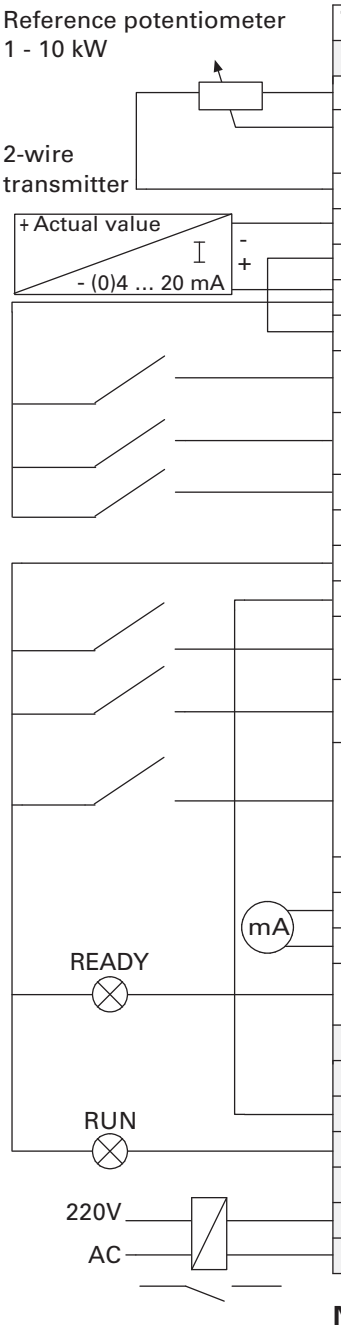
Additional functions:

- Analog input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at start and stop
- Three skip frequency areas
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sum point frequency addition to PID output
- The PID controller can additionally be used from control places I/O B, keypad and fieldbus
- Easy ChangeOver function
- Sleep function

The parameters of the PID Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

Table 5-1. PID application default I/O configuration (with 2-wire transmitter)



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 - 10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range 0 - 20 mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start/Stop Control place A (PID controller)	Contact closed = fault Contact open = no fault
9	DIN2	External fault input (programmable)	Contact closed = fault Contact open = no fault
10	DIN3	Fault reset (programmable)	Contact closed = fault reset
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Start/Stop Control place B (Direct frequency reference)	Contact closed = Start
15	DIN5	Jogging speed selection (programmable)	Contact closed = Jogging speed active
16	DIN6	Control place A/B selection	Contact open = Control place A is active Contact closed = Control place B is active
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AO1+	Output frequency Analog output	Programmable Range 0 - 20 mA/R$_L$, max. 500W
19	AO1-		
20	DO1	Digital output READY	Programmable Open collector, I ≤ 50 mA, U≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3: CMA and CMB Grounding

- CMB connected to GND, CMA connected to GND
- CMB isolated from GND, CMA isolated from GND
- CMB and CMA internally connected together, isolated from GND

= Factory default.

PID control application — Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number

Parameter = Name of parameter

Min = Minimum value of parameter

Max = Maximum value of parameter

Unit = Unit of parameter value; Given if available

Default = Value preset by factory

ID = ID number of the parameter

① = Parameter value can only be changed after the drive has been stopped

② = Use TTF method to program these parameters. See **Page 55.**

Monitoring values (control keypad: menu M7)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information. Note that the monitoring values V1.19 to V1.22 are available with the PID control application only.

Table 5-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	Analog input 2		27	AI3
V7.14	Analog input 3		27	AI4
V7.15	DIN1, DIN2, DIN3		15	Digital input status
V7.16	DIN4, DIN5, DIN6		16	Digital input status
V7.17	DO1, RO1, RO2		17	Relay output status
V7.18	Analog Iout	mA	26	AO1
V7.19	PID reference	Varies	20	
V7.20	PID actual value	Varies	21	
V7.21	PID error	Varies	22	
V7.22	PID output	%	23	
V7.23	PT-100 tempurature	°C		Highest tempurature of used inputs
G7.24	Multimonitor			Displays three selectable monitor values

Table 5-2. Special

Code	Parameter	Unit	ID	Description
V7.18.1	Current unfiltered	A	1113	
V7.18.2	Torque unfiltered	%	1125	
V7.18.3	DC Bus voltage unfiltered	Vdc	44	

Basic parameters (control keypad: menu M1 → G1.1)

Table 5-3. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2	Hz	0.00	101	
P1.1.2	Max frequency	Par. 1.1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	I_H is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 460V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	30.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	300	20000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.30	1.00		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	3		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.12	Remote control source	1	3		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.13	Local reference	0	7		2	173	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = Keypad 5 = Fieldbus 6 = Motor potentiometer 7 = PID controller
P1.1.14	Remote reference	0	7		0	174	See par. 1.1.13
P1.1.15	Identification	0	2		0/No Action	631	0 = No Action 1 = V/Hz 2 = V/Hz with boost
P1.1.16	V/Hz boost	0	1		0/None	109	0 = None 1 = Automatic torque boost
P1.1.17	PID controller reference signal (Place A)	0	4		2	332	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus process data In 2 4 = Motor potentiometer
P1.1.18	PID controller gain	0.0	1000.0	%	100.0	118	
P1.1.19	PID controller I-Time	0.00	320.00	s	1.0	119	
P1.1.20	PID controller D-Time	0.00	100.00	s	0.00	132	
P1.1.21	Sleep frequency	Par. 1.1.1	Par. 1.1.2	Hz	10.00	1016	
P1.1.22	Sleep delay	0	3600	s	30	1016	
P1.1.23	Wake up level	P1.2.27	P1.2.28	P1.2.43	25.00	1018	
P1.1.24	Wake up function	0	1		0	1019	0 = Wake-up at fall below wake up level (1.1.23) 1 = Wake-up at exceeded wake up level (1.1.23)
P1.1.25	Jogging speed	0.00	Par. 1.1.2	Hz	0.00	124	

Input signals (control keypad: menu M1 → G1.2)

Table 5-4. Input signals — G1.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1	DIN2 function	0	14		1	319	0 = Not used 1 = External fault closed 2 = External fault open 3 = Run enable 4 = Acc./Dec. time select 5 = Not used 6 = Not used 7 = Force remote 8 = Forward/reverse 9 = Jogging frequency 10 = Fault reset 11 = Acc./Dec. Prohibit 12 = DC Brake command 13 = Motor potentiometer UP 14 = Force local
P1.2.2	DIN3 function	0	14		1	301	Same as above except: 12 = DC Brake command 13 = Motor potentiometer down 14 = Force local
P1.2.3	DIN5 function	0	14		1	330	Same as above except: 12 = DC Brake command 13 = PID Ref2 select 14 = Force local
P1.2.4	PID sum point reference	0	7		0	376	0 = None 1 = AI1+PID output 2 = AI2+PID output 3 = AI3+PID output 4 = AI4+PID output 5 = PID keypad+PID output 6 = Fieldbus+PID output (ProcessDataIN3) 7 = Mot.pot.+PID output
P1.2.5	Actual value selection	0	7		0	333	0 = Actual value 1 1 = Actual 1 + Actual 2 2 = Actual 1 - Actual 2 3 = Actual 1 * Actual 2 4 = Max (Actual 1. Actual 2) 5 = Min (Actual 1. Actual 2) 6 = Mean (Actual 1. Actual2) 7 = Sqrt (Act1) + Sqrt (Act2)
P1.2.6	Actual value 1 selection	0	10		2	334	0 = Not used 1 = AI1 signal (c-board) 2 = AI2 signal (c-board) 3 = AI3 4 = AI4 5 = Fieldbus (ProcessDataIN2) 6 = Motor torque 7 = Motor speed 8 = Motor current 9 = Motor power 10 = Encoder frequency
P1.2.7	Actual value 2 selection	0	10		0	335	0 = Not used 1 = AI1 signal (c-board) 2 = AI2 signal (c-board) 3 = AI3 4 = AI4 5 = Fieldbus (ProcessDataIN2) 6 = Motor torque 7 = Motor speed 8 = Motor current 9 = Motor power 10 = Encoder frequency
P1.2.8	Actual 1 minimum scale	-100.00	100.00	%	0.00	336	0 = No minumum scaling
P1.2.9	Actual 1 maximum scale	-100.00	100.00	%	100.00	337	100 = No maximum scaling
P1.2.10	Actual 2 minimum scale	-100.00	100.00	%	0.00	338	0 = No minumum scaling

CP = control place; cc = closing contact; oc = opening contact.
Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Input signals (control keypad: menu M1 → G1.2) (continued)

Table 5-4. Input signals — G1.2 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.11	Actual 2 maximum scale	-100.00	100.00	%	100.00	339	100 = No maximum scaling
P1.2.12	Ai1 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.1	388	TTF programming method used. See **Page 55**.
P1.2.13	AI1 signal range	0	2		0	320	0 = 0–100% 1 = 4 - 20mA/20% to 100% 2 = Custom range
P1.2.14	AI1 custom minimum setting	0.00	100.00	%	0.00	321	
P1.2.15	A11 custom maximum setting	0.00	100.00	%	100.00	322	
P1.2.16	AI1 signal inversion	0	1		0	323	0 = Normal 1 = Inverted
P1.2.17	AI1 signal filter time	0.00	10.00	s	0.10	324	0 = No filtering
P1.2.18	AI2 signal selection	AnIN:0.1	AnIN:E.10		AnIN:A.2	388	TTF programming method used. See **Page 55**.
P1.2.19	AI2 signal range	0	2		1	325	0 = 0–100% 1 = 4 - 20mA/20% to 100% 2 = Custom range
P1.2.20	AI2 custom minimum setting	0.00	100.00	%	0.00	326	
P1.2.21	AI2 custom maximum setting	0.00	100.00	%	100.00	327	
P1.2.22	AI2 signal inversion	0	1		0	328	0 = Normal 1 = Inverted
P1.2.23	AI2 signal filter time	0.00	10.00	s	0.10	329	0 = No filtering
P1.2.24	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0	331	
P1.2.25	Motor potentiometer frequency reference memory reset	0	2		1	367	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P1.2.26	Motor potentiometer PID reference memory reset	0	2		1	370	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P1.2.27	PID minimum limit	-1000.00	P1.2.28	P1.2.43	0.00	359	
P1.2.28	PID maximum limit	P1.2.27	1000	P1.2.43	100.00	360	
P1.2.29	Error value inversion	0	1		0	340	0 = Normal 1 = Inverted
P1.2.30	PID reference rise time	0.0	100.0	s	5.0	341	
P1.2.31	PID reference fall time	0.0	100.0	s	5.0	341	
P1.2.32	Reference scaling minimum place B	0.00	P1.2.29	Hz	0.00	344	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.33	Reference scaling maximum place B	P1.2.28	P1.1.2	Hz	0.00	345	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.34	AI3 signal selection	AnIN:0.1	AnIN:E.10		AnIN:0.1	141	TTF programming method used. See **Page 55**.
P1.2.35	AI3 signal range	0	1		1	143	0 = 0–100% 1 = 4 - 20mA/20% to 100%
P1.2.36	AI3 signal inversion	0	1		0	151	0 = Normal 1 = Inverted
P1.2.37	AI3 signal filter time	0.00	10.00	s	0.10	142	0 = No filtering
P1.2.38	AI4 signal selection	AnIN:0.1	AnIN:E.10		AnIN:0.1	152	TTF programming method used. See **Page 55**.
P1.2.39	AI4 signal range	0	2		0	152	0 = 0–100% 1 = 4 - 20mA/20% to 100% 2 = Custom range

CP = control place; cc = closing contact; oc = opening contact.
Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Input signals (control keypad: menu M1 → G1.2) (continued)

Table 5-4. Input signals — G1.2 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.40	AI4 signal inversion	0	1		0	162	0 = Normal 1 = Inverted
P1.2.41	AI4 signal filter time	0.00	10.00	s	0.10	153	0 = No filtering
P1.2.42	Start delay	0.00	300.00	s	0.00	1494	
P1.2.43	Engineering unit	0	10		0	1796	0 = Percent 1 = Temp F 2 = Temp C 3 = PSIG 4 = BAR 5 = Feet 6 = Inches water column 7 = Gallons per minute 8 = Feet per minute 9 = CFM 10 = PPM

CP = control place; cc = closing contact; oc = opening contact.
Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Output signals (control keypad: menu M1 G1.3)

Table 5-5. Output signals — G1.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	TTF programming method used. See **Page 55**.
P1.3.2	Analog output 1 function	0	14		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V) 9 = PID controller reference value 10 = PID controller actual value 1 11 = PID controller actual value 2 12 = PID controller error value 13 = PID controller output 14 = PT100 tempurature
P1.3.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No filtering
P1.3.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4 mA
P1.3.6	Analog output 1 scale	10	1000	%	100	311	

Output signals (control keypad: menu M1 → G1.3) (continued)

Table 5.5. Output signals — G1.3 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.7	Digital output 1 function	0	23		1	312	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = FC overheat warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Warning 9 = Reversed 10 = Preset speed 1 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit 1 superv. 14 = OP freq. limit 1 superv. 15 = Torque limit superv. 16 = Ref limit superv. 17 = Ext. brake control 18 = Remote control active 19 = FC limit supv. 20 = Unrequested rotation 21 = Ext. Brake control inverted 22 = Thermister fault/warn 23 = Fieldbus input data
P1.3.8	Relay output 1	0	23		2	313	Same as P1.3.7
P1.3.9	Relay output 2	0	23		3	314	Same as P1.3.7
P1.3.10	Output frequency limit 1 supervision	0	2		0	315	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.11	Output frequency limit 1; supervised value	0	Par. 1.1.2	Hz	0	316	
P1.3.12	Output frequency limit 2 supervision	0	2		0	346	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.13	Output frequency limit 2; supervised value	0	Par. 1.1.2	Hz	0	347	
P1.3.14	Torque limit supervision	0	2		0	348	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.15	Torque limit supervision value	0.0	300.0	%	100.00	349	
P1.3.16	Reference limit supervision	0	2		0	350	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.17	Reference limit supervision value	0	Par. 1.1.2	%	0	351	
P1.3.18	External brake-off delay	0.00	100.0	s	0.5	352	
P1.3.19	External brake-on delay	0.00	100.0	s	1.5	353	
P1.3.20	FC temperature supervision	0	2		0	354	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.21	FC temperature supervised value	-10	75	°C	0	355	
P1.3.22	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		AnOUT:0.1	471	
P1.3.23	Analog output 2 function	0	14		4	472	See par. 1.3.2
P1.3.24	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.25	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.26	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4 mA
P1.3.27	Analog output 2 scale	10	1000	%	100	476	

Drive control parameters (control keypad: menu M1 G1.4)

Table 5-6. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve Ramp Time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve Ramp Time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not Used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying Start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P1.4.8	DC braking current	0.00	I_L	A	0.7 x I_H	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop
P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	0.1 X I_H	2 X I_H	A	I_H	519	

Skip frequency parameters (control keypad: menu M1 G1.5)

Table 5-7. Skip frequency parameters — G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.2	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.2	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency range 2 low limit	0.00	Par. 1.5.4	Hz	0.00	511	
P1.5.4	Skip frequency range 2 high limit	0.00	Par. 1.1.2	Hz	0.00	512	0 = Skip frequency range 2 not used
P1.5.5	Skip frequency range 3 low limit	0.00	Par. 1.5.6	Hz	0.00	513	
P1.5.6	Skip frequency range 3 high limit	0.00	Par. 1.1.2	Hz	0.00	514	0 = Skip frequency range 3 not used
P1.5.7	Skip frequency acc./dec. ramp	0.10	10	Times	1	518	

Motor control parameters (control keypad: menu M1 G1.6)

Table 5-8. Motor control parameters — G1.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	4		0	600	SVX: 0 = Frequency control 1 = Speed control SPX: 2 = Torque control 3 = Closed loop speed control 4 = Closed loop torque control
P1.6.2	V/Hz boost	0	1		0	109	0 = Not used 1 = Automatic torque boost
P1.6.3	V/Hz ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	16.0	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On
P1.6.12	Load drooping	0.00	100.00		0.01	620	Drooping % of nominal speed at nominal torque
P1.6.13	Identification	0	2		0	631	0 = No action 1 = V/Hz 2 = V/Hz with boost
Closed loop parameter group 1.6.14 (SPX only)							
1.6.14.1	MagnCurrent	0.00	100.00	A	0.00	612	
1.6.14.2	Speed Control Kp	1	1000		30	613	
1.6.14.3	Speed Control Ti	0.0	500.0	ms	30.0	614	
1.6.14.5	Accel.Compens.	0.00	300.00	s	0.00	626.00	
1.6.14.5	Slip Adjust	0	500	%	100	619	
1.6.14.6	Start Magn Curr	0.1 x I_H	2 x I_H	A	0.00	627	
1.6.14.7	Start Magn Time	0.0	600.0	s	0.0	628	
P1.6.17.9	Start 0speedtime	0	32000	ms	100	615	
P1.6.17.10	Stop 0 SpeedTime	0	32000	ms	100	616	
P1.6.17.11	StartUp Torque	0	3		0/Not	621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P1.6.17.12	Startup Torq FWD	-300.0	300.0	%	0.0	633	
P1.6.17.13	Startup Torq REV	-300.0	300.0	%	0.0	634	
P1.6.17.15	Encoder1FiltTime	0	100	ms	0	618	
P1.6.17.17	CurrentControlKp	0.00	100.00	%	40.00	617	

Protections (control keypad: menu M1 G1.7)

Table 5-9. Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	5		0	700	0 = None 1 = Warning 2 = Warning+previous Freq. 3 = Wrng+presetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.18	Field weakening area load	10	150	%	50	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2	600	s	20	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	No. of PT100 inputs	0	3		0	739	
P1.7.25	Response to PT100 fault	0	3		0	740	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.26	PT100 warning limit	-30	200	°C	120	741	
P1.7.27	PT100 fault limit	-30	200	°C	130	742	
P1.7.28	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.29	Earth fault currrent level	0.0	100.0	%	50.0	1333	Sets the level of ground fault current for a fault

Table 5-10. Motor regulator warnings — G1.7.30

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.26.1	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.26.2	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.26.3	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.26.4	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 G1.8)

Table 5-10. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0.00	60.00	s	30.00	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = According to par. 1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto - Restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		0	738	

Cold weather parameters (control keypad: menu M1 G1.9)

Table 5-11. Cold weather parameters — G1.9

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.9.1	Cold weather enable	0	1		0	1490	0 = Disable 1 = Enable
P1.9.2	Cold weather voltage	0.00	20.00	%	2.00	1491	
P1.9.3	Cold weather timeout	0	10	min	0	1492	

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the 9000X AF Drives User Manual.

Table 5-11. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	3		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O Select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
R2.4	PID Reference	Par. 1.2.27	Par. 1.2.28	Par. 1.2.43	50		
R2.5	PID Reference 2	Par. 1.2.27	Par. 1.2.28	Par. 1.2.43	0		
P2.6	Stop button	0	1		1	114	0 = No 1 = Yes
P2.7	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter sets or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Note: In local and remote control, the control mode is determined by DIN6 unless the PID is selected as the reference.

Chapter 6 — Multi-purpose control application

Introduction

Select the Multi-Purpose Control Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

Multi-purpose control application provides a wide range of parameters for controlling motors. It can be used for various kinds of different processes, where wide flexibility of I/O signals is needed and PID-control is not necessary (if you need PID-control functions, use PID-control Application or Pump and Fan Control Application).

The frequency reference can be selected e.g. from the analog inputs, joystick control, motor potentiometer and from a mathematical function of the analog inputs. There are parameters also for Fieldbus communication. Multi-step speeds and jogging speed can also be selected if digital inputs are programmed for these functions.

- The digital inputs and all the outputs are freely programmable and the application supports all I/O-boards

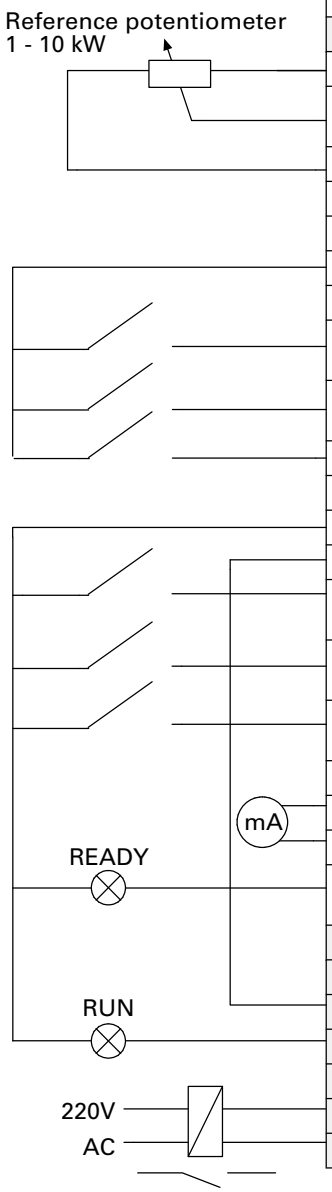
Additional functions:

- Analog input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three skip frequency areas
- Programmable V/Hz curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Joystick hysteresis
- Possibility to connect the FB Process data to any parameter and some monitoring values

The parameters of the Multi-Purpose Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

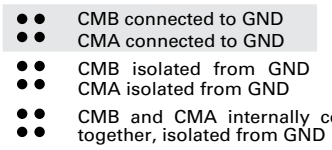
Table 6-1. Multi-purpose control application default i/o configuration and connection example



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 - 10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range	Current input frequency reference
5	AI2-	0 - 20 mA	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward (programmable)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	Fault reset (programmable)	Contact closed = fault reset
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see terminal 6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Jog speed selection (programmable)	Contact closed = jog speed active
15	DIN5	External fault (programmable)	Contact open = no fault Contact closed = fault
16	DIN6	Force Remote (programmable)	Contact open = Previous control place Contact closed = Force Remote
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AOA1+	Output frequency	Programmable
19	AOA1-	Analog output	Range 0 - 20 mA, R_L, max. 500W
20	DOA1	Digital output READY	Programmable Open collector, I ≤ 50 mA, V ≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3: CMA and CMB Grounding



= Factory default.

"Terminal To Function" (TTF) programming principle

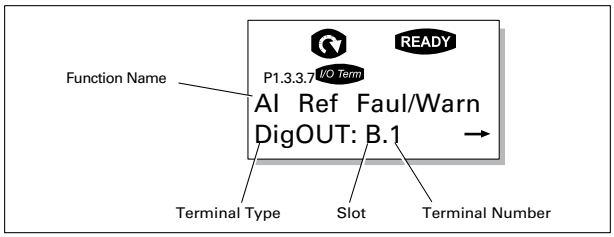
The programming principle of the input and output signals in the Multi-Purpose Control Application as well as in the Pump and Fan Control Application (and partly in the other applications) is different compared to the conventional method used in other SVX applications.

In the conventional programming method, Function To Terminal programming method (FTT), you have a fixed input or output that you define a certain function for. The applications mentioned above, however, use the Terminal To Function programming method (TTF) in which the programming process is carried out the other way round: Functions appear as parameters which the operator defines a certain input/output. See Caution on **Page 55**.

Defining an input/output for a certain function on keypad

Connecting a certain input or output with a certain function (parameter) is done by giving the parameter an appropriate value. The value is formed of the Board slot on the SVX control board (see 9000X AF Drives User Manual, Chapter 4) and the respective signal number as shown in **Figure 6.1**.

Figure 6.1. Defining input/output — function



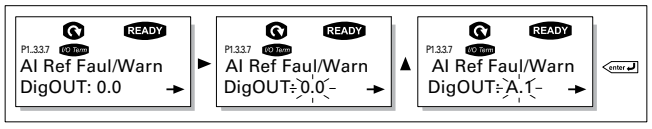
Example: You want to connect the digital output function Reference fault/warning (P1.3.3.7) to the digital output DO1 on the basic board OPTA1 (see 9000X AF Drives User Manual, Chapter 4).

First find the P1.3.3.7 on the keypad. Press the Menu button right once to enter the edit mode. On the value line, you will see the terminal type on the left (DigIN, DigOUT, An.IN, An.OUT) and on the right, the present input/output the function is connected to (B.3. A.2 etc.), or if not connected, a value (0.#).

When the value is blinking, hold down the Browser button up or down to find the desired board slot and signal number. The program will scroll the board slots starting from 0 and proceeding from A to E and the I/O selection from 1 to 10.

Once you have set the desired value, press the Enter button once to confirm the change. See **Figure 6.2**.

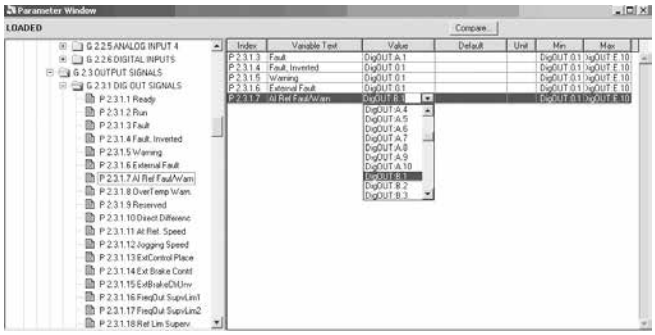
Figure 6.2. Defining input/output — values



Defining a terminal for a certain function with 9000X drive programming tool

If you use the 9000X Drive Programming Tool for parametrizing you will have to establish the connection between the function and input/output in the same way as with the control panel. Just pick the address code from the drop-down menu in the Value column See **Figure 6.3.**

Figure 6.3. Screenshot of 9000x drive programming tool; entering the address code



CAUTION

Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

NOTICE

The *inputs*, unlike the *outputs*, cannot be changed in RUN state.

Defining unused inputs/outputs

All unused inputs and outputs must be given the board slot value 0 and the value 1 also for the terminal number. The value 0.0 is also the default value for most of the functions.

However. if you want to use the values of a digital input signal for e.g. testing purposes only. you can set the board slot value to 0 and the terminal number to any number between 2…10 to place the input to a TRUE state. In other words, the value 1 corresponds to "open contact" and values 2 to 10 to closed contact.

In case of analog inputs, giving the value 1 for the terminal number corresponds to 0%, value 2 corresponds to 20% and any value between 3 and 10 corresponds to 100%.

Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min.	=	Minimum value of parameter
Max.	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory

ID = ID number of the parameter

① = Parameter value can only be changed after the drive has been stopped

② = Use TTF method to program these parameters. See **Page 55.**

Monitoring values (control keypad: menu M8)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information.

Table 6-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	°C	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	V	13	AI1
V7.12	Analog input 2	mA	14	AI2
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	Analog Iout	mA	26	AO1
V7.16	Analog input 3	mA	27	AI3
V7.17	Analog input 4	mA	14	AI4
V7.18	Torque reference	%	18	
V7.19	PT100 temp.	°C	42	Max PT100 temp
M7.20	Multimonitor			Displays three selectable monitor values
G7.21	Monitor 2			
V7.21.1	Current	A	1113	Unfiltered motor current
V7.21.2	Torque	%	1125	Unfiltered motor torque
V7.21.3	Dc voltage	V	44	Unfiltered DC link voltage
V7.21.4	Status word		43	Application status word
V7.21.5	Last active fault		37	
V7.21.6	On time hours	h	10	Power on trip counter
V7.21.7	DIN status word		56	DIN 1–6 (Low b) and OPT-B1 or B9 DIN (High b)
V7.21.8	Motor current FB	A	45	Motor current to 1 decimal place
V7.21.9	U phase current	A	39	
V7.21.10	V phase current	A	40	
V7.21.11	W phase current	A	41	
V7.21.12	PT100 Temp. In1	°C	50	
V7.21.13	PT100 Tem. In2	°C	51	
V7.21.14	PT100 Tem. In3	°C	52	
V7.21.15	PT100 Tem. In4	°C	69	
V7.21.16	PT100 Tem. In5	°C	70	
V7.21.17	PT100 Tem. In6	°C	71	
V7.22	Motor nom speed %	%	1590	
V7.23	Motor KW	KW	1692	

Operate menu-M8

The Operate Menu provides an easy-to-use method of viewing key numerical Monitoring Menu Items. It also allows the setting of the Keypad frequency or torque reference. See Chapter 5 of the 9000X User Manual for more information.

Table 6-3. Operate menu items

Code	Parameter	Unit	Description
O1	Output frequency	Hz	Output frequency to motor
O2	Frequency reference	Hz	Frequency reference to motor control
O3	Motor speed	rpm	Motor speed in rpm
O4	Motor current	A	
O5	Motor torque	%	In % of nominal motor torque
O6	Motor power	%	Motor shaft power in %
O7	Motor voltage	V	
O8	DC-bus voltage	V	
O9	Unit temperature	°C	Heatsink temperature
O10	Motortemperature	%	Calculated motor temperature
O11	U Phase current	A	Motor phase current
O12	V Phase current	A	Motor phase current
O13	W Phase current	A	Motor phase current
O14	Torque reference	%	Torque ref in torque control mode
R1	Keypad reference	Hz	Set keypad frequency reference
R4	Torque reference	Hz	Set keypad torque reference

Fieldbus control and status

The Multipurpose Application has more functionality with the fieldbus control. Bits 3 through 7 of the Fixed Control Word can be used to set digital outputs. The digital inputs are monitored with the DIN Status Word (ID 56). The mode of the control is monitored with the Application Status Word (ID 43), Bits 4, 8, 9, and 10.

Table 6-4. Fixed control word

Bit	Function	Note
B0	FB_Run	
B1	FB_Reverse	
B2	FB_Fault_Reset	
B3	FB_D01	See parameter 1.3.3.24
B4	FB_D02	See parameter 1.3.3.25
B5	FB_D03	See parameter 1.3.3.26
B6	FB_D04	See parameter 1.3.3.27
B7	FB_D05	See parameter 1.3.3.28
B8	Not used	
B9	Not used	
B10	Not used	
B11	FB_WD_Pulse	See parameter 1.7.32
B12	Not used	
B13	Not used	
B14	Not used	
B15	FB_Fault_Monitor (internal)	Select comm cards

Table 6-5. Status word

Code	General status Word (ID 1700)	Application status Word (ID 43)
B0	MC_Ready	Remote Active
B1	MC_Run	MC_Ready
B2	MC_Reverse	MC_Run
B3	MC_Fault	MC_Fault
B4	MC_Warning	FB_Ref_Active
B5	MC_Atspeed	Not used
B6	MC_Zerospeed	RunEnable
B7	MC_Fluxready	MC_Warning
B8	MC_TCspeedlimit active	Panel I/O control indicator
B9	MC_Detectedencoderdirection	Panel panel control indicator
B10	MC_UVfaststop	Panel fieldbus control indicator
B11	MC_DC_Brake	MC_DC_Brake
B12	FB_Ref_Active	Runrequest
B13	MC_Startdelay (not used)	Motor regulator status not zero
B14	Remote_Active	External brake control
B15	FB_WD_Pulse	Not used

Basic parameters (control keypad: menu M1 → G1.1)

Table 6-6. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2	Hz	0	101	
P1.1.2	Max frequency	Par. 1.1.1	320.00	Hz	60.00	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.1	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.1	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	IH is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 480V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	0.00	320.00	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	0	65000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x I_H	2 x I_H	A	I_H	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.3	1		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	3		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.12	Remote control 1 Source	1	3		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.13	Local reference	0	15		8	173	0 = AI1 1 = AI2 2 = AI1+AI2 3 = AI1 - AI2 4 = AI2 - AI1 5 = AI1 * AI1 6 = AI1 Joystick 7 = AI2 Joystick 8 = Keypad 9 = Fieldbus 10 = Motor potentiometer 11 = AI1,AI2 minimum 12 = AI1, AI2 maximum 13 = Max frequency 14 = AI1/AI2 selection 15 = Encoder A1
P1.1.14	Remote reference	0	15		0/AI1	174	See par. 1.1.13
P1.1.15	Identification	0	2		0/No Action	631	0 = No action 1 = ID No run SPX Only 2 = ID With Run
P1.1.16	V/Hz boost	0	1		0/None	109	0 = None 1 = Auto torque boost
P1.1.17	Jog speed ref	Par. 1.1.1	Par. 1.1.2	Hz	5	124	
P1.1.18	Preset speed 1	Par. 1.1.1	Par. 1.1.2	Hz	10	105	
P1.1.19	Preset speed 2	Par. 1.1.1	Par. 1.1.2	Hz	15	106	
P1.1.20	Preset speed 3	Par. 1.1.1	Par. 1.1.2	Hz	20	126	
P1.1.21	Preset speed 4	Par. 1.1.1	Par. 1.1.2	Hz	25	127	
P1.1.22	Preset speed 5	Par. 1.1.1	Par. 1.1.2	Hz	30	128	
P1.1.23	Preset speed 6	Par. 1.1.1	Par. 1.1.2	Hz	40	129	
P1.1.24	Preset speed 7	Par. 1.1.1	Par. 1.1.2	Hz	60	130	

Input signals

Basic settings (control keypad: menu M1 → G1.2.1)

Table 6-7. Input signals: basic settings — G1.2.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1.1	Start/Stop logic selection	0	7		0	300	0 = Forw-Rev 1 = Start-Rev 2 = Start-Enable 3 = StartP-StopP 4 = Strt-MotP UP 5 = ForwP-RevP 6 = StartP-RevP 7 = SartP-Enable
P1.2.1.2	MotPot ramp time	0.1	2000.0	Hz/s	10.0	331	
P1.2.1.3	MotPotMemFreqRef	0	2		1	367	0 = No reset 1 = Res: stop+P.D. 2 = Res: P.D.
P1.2.1.4	Adjust input	0	5		0	493	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Fieldbus
P1.2.1.5	Adjust minimum	-100.00	100.00	%	0.00	494	
P1.2.1.6	Adjust maximum	-100.00	100.00	%	0.00	495	
P1.2.1.7	Start delay	0.00	300.00	s	0.00	1494	
P1.2.1.8	CPX temp open delay	0.00	5.00	%	2.00	1399	

Analog input 1 (control keypad: menu M1 → G1.2.2)

Table 6-8. Analog input 1 parameters — G1.2.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.2.1	AI1 signal selection	AnIN:0.1	AnIN:E.10		A.1	377	TTF programming. See chapter 6.3
P1.2.2.2	AI1 filter time	0	10	s	0.1	324	0 = No filtering
P1.2.2.3	AI1 signal range	0	3		0	320	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.2.4	AI1 custom minimum setting	-160.00	160.00	%	0.00	321	
P1.2.2.5	AI1 custom maximum setting	-160.00	160.00	%	100.00	322	
P1.2.2.6	AI1 reference scaling. minimum value	0.00	320.00	Hz	0	303	Selects the frequency that corresponds to the min. reference signal
P1.2.2.7	AI1 reference scaling. maximum value	0.00	320.00	Hz	0.00	304	
P1.2.2.8	AI1 joystick hysteresis	0.00	20.00	%	0.00	384	
P1.2.2.9	AI1 sleep limit	0.00	100.00	%	0.00	385	
P1.2.2.10	AI1 sleep delay	0.00	320.00	s	0.00	386	
P1.2.2.11	AI1 joystick offset	-100.00	100.00	%	0.00	165	

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Analog input 2 (control keypad: menu M1 → G1.2.3)

Table 6-9. Analog input 2 parameters — G1.2.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.3.1	AI2 signal selection	AnIN:0.1	AnIN:E.10		A.2	388	TTF programming. See chapter 6.3
P1.2.3.2	AI2 filter time	0.00	10.00	s	0.10	329	0 = No filtering
P1.2.3.3	AI2 signal range	0.00	3.00		1.00	325	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.3.4	AI2 custom minimum setting	-160.00	160.00	%	0.00	326	
P1.2.3.5	AI2 custom maximum setting	-160.00	160.00	%	100.00	327	
P1.2.3.6	AI2 reference scaling, minimum value	0.00	320.00	Hz	0.00	393	Selects the frequency that corresponds to the min. reference signal
P1.2.3.7	AI2 reference scaling, maximum value	0.00	320.00	Hz	0.00	394	Selects the frequency that corresponds to the max. reference signal
P1.2.3.8	AI2 joystick hysteresis	0.00	20.00	%	0.00	395	Dead zone for joystick input
P1.2.3.9	AI2 sleep limit	0.00	100.00	%	0.00	396	Drive goes to sleep mode if input is below this limit for set time.
P1.2.3.10	AI2 sleep delay	0.00	320.00	s	0.00	397	
P1.2.3.11	AI2 joystick offset	-100.00	100.00	%	0.00	166	

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Analog input 3 (control keypad: menu M1 → G1.2.4)

Table 6-10. Analog input 3 parameters — G1.2.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.4.1	AI3 signal selection	AnIN:0.1	AnIN:E.10		0.10	141	TTF programming. See chapter 6.3
P1.2.4.2	AI3 filter time	0.00	10.00	s	0.10	142	0 = No filtering
P1.2.4.3	AI3 signal range	0.00	3.00		1.00	143	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.4.4	AI3 custom minimum setting	-160.00	160.00	%	0.00	144	
P1.2.4.5	AI3 custom maximum setting	-160.00	160.00	%	100.00	145	
P1.2.4.6	AI3 signal inversion	0.00	1.00		0.00	151	0 = Not inverted 1 = Inverted

Analog input 4 (control keypad: menu M1 → G1.2.5)

Table 6-11. Analog input 4 parameters — G1.2.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.5.1	AI4 signal selection	AnIN:0.1	AnIN:E.10		0.10	152	
P1.2.5.2	AI4 filter time	0.00	10.00	s	0.10	153	0 = No filtering
P1.2.5.3	AI4 signal range	0.00	3.00		1.00	154	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.5.4	AI4 custom minimum setting	-160.00	160.00	%	0.00	155	
P1.2.5.5	AI4 custom maximum setting	-160.00	160.00	%	100.00	156	
P1.2.5.6	AI4 signal inversion	0.00	1.00		0.00	162	0 = Not inverted 1 = Inverted

Free analog input signal selection (keypad: menu M1 → G1.2.6)

Table 6-12. Free analog input signal selection — G1.2.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.6.1	Scaling of current limit	0	5		0	399	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Fieldbus (FBProcessDataIN2)
P1.2.6.2	Scaling of DC- braking current	0	5		0	400	See par. 1.2.6.1
P1.2.6.3	Reducing of acc./dec Times	0	5		0	401	See par. 1.2.6.1
P1.2.6.4	Reducing of torque supervision	0	5		0	402	See par. 1.2.6.1
P1.2.6.5	Torque limit	0	5		0	485	See par. 1.2.6.1

Digital inputs (control keypad: menu M1 → G1.2.7)

Table 6-13. Digital input signals — G1.2.7

Code	Parameter	Min.	Max	Default	ID	Note
P1.2.7.1	Start signal 1	DigIN:0.1	DigIN:E.10	DigIN:A.1	403	See P1.2.1.1
P1.2.7.2	Start signal 2	DigIN:0.1	DigIN:E.10	DigIN:A.2	404	See P1.2.1.1
P1.2.7.3	Run enable	DigIN:0.1	DigIN:E.10	DigIN:0.2	407	Motor start enabled (CC)
P1.2.7.4	Reverse	DigIN:0.1	DigIN:E.10	DigIN:0.1	412	Direction forward (OC) Direction Reverse (OC)
P1.2.7.5	Preset speed 1	DigIN:0.1	DigIN:E.10	DigIN:0.1	419	See preset speeds in Basic Parameters
P1.2.7.6	Preset speed 2	DigIN:0.1	DigIN:E.10	DigIN:0.1	420	
P1.2.7.7	Preset speed 3	DigIN:0.1	DigIN:E.10	DigIN:0.1	421	
P1.2.7.8	Mot pot down	DigIN:0.1	DigIN:E.10	DigIN:0.1	417	Mot.pot. reference decreases (CC)
P1.2.7.9	Mot pot up	DigIN:0.1	DigIN:E.10	DigIN:0.1	418	Mot.pot. reference increases (CC)
P1.2.7.10	Fault reset	DigIN:0.1	DigIN:E.10	DigIN:A.3	414	All faults reset (cc)
P1.2.7.11	External fault (close)	DigIN:0.1	DigIN:E.10	DigIN:A.5	405	Ext. fault (F51) displayed (CC)
P1.2.7.12	External fault (open)	DigIN:0.1	DigIN:E.10	DigIN:0.2	406	Ext. fault (F51) displayed (OC)
P1.2.7.13	Acc/Dec time sel	DigIN:0.1	DigIN:E.10	DigIN:0.1	408	Acc/Dec time 1 (OC) Acc/Dec time 2 (CC)
P1.2.7.14	Acc/Dec prohibit	DigIN:0.1	DigIN:E.10	DigIN:0.1	415	Acc/Dec prohibited (CC)
P1.2.7.15	DC brake command	DigIN:0.1	DigIN:E.10	DigIN:0.1	416	DC braking active (CC)
P1.2.7.16	Jogging speed	DigIN:0.1	DigIN:E.10	DigIN:A.4	413	Jogging speed selected for frequency reference (CC)
P1.2.7.17	AI1/AI2 select	DigIN:0.1	DigIN:E.10	DigIN:0.1	422	AI2 is used as reference (CC) when ID117 = 14
P1.2.7.18	Force remote	DigIN:0.1	DigIN:E.10	DigIN:A.6	411	Force control place to Remote (CC)
P1.2.7.19	Parameter Set 1/ Set 2 sel	DigIN:0.1	DigIN:E.10	DigIN:0.1	496	Set 2 is used (CC) Set 1 is used (OC)
P1.2.7.20	Motor ctrl mode 1/2	DigIN:0.1	DigIN:E.10	DigIN:0.1	164	Mode 2 is used (CC) Mode 1 is used (OC)
P1.2.7.21	CPX temp open	DigIN:0.1	DigIN:E.10	DigIN:0.2	1686	CPX Temperature fault
P1.2.7.22	Force local	DigIN:0.1	DigIN:E.10	DigIN:0.1	1497	Force control place to remote (CC)
P1.2.7.23	Force comms	DigIN:0.1	DigIN:E.10	DigIN:0.1	1546	Force control place to remote (OC)
P1.2.7.24	O/P contactor interlock	DigIN:0.1	DigIN:E.10	DigIN:0.1	1547	Output contactor interlock input

CC = Closing Cont. , OC = Opening Cont..

Output signals

Delayed digital output 1 (keypad: menu M1 → G1.3.1)

Table 6-14. Delayed digital output 1 parameters — G1.3.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1.1	Digital output 1 signal selection	DigOUT:0.1	DigOUT:E:10		0.1	486	
P1.3.1.2	Digital output 1 function	0.00	30.00		1	312	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = FC overheat warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Warning 9 = Reverse 10 = Jogging spd selected 11 = At speed 12 = Mot. regulator active 13 = Freq. limit 1 superv. 14 = Freq. limit 2 superv. 15 = Torque limit superv. 16 = Ref. limit supervision 17 = External brake control 18 = Remote control active 19 = FC temp. limit superv. 20 = Reference inverted 21 = Ext. brake control inverted 22 = Therm. fault or warn. 23 = On/Off control 24 = Fieldbus input data 1 25 = Fieldbus input data 2 26 = Fieldbus input data 3 27 = Fieldbus input data 4 28 = Fieldbus input data 5 29 = SafeDisableA 30 = Charge switch state
P1.3.1.3	Digital output 1 on delay	0.00	320.00	s	0	487	0.00 = delay not in use
P1.3.1.4	Digital output 1 off delay	0.00	320.00	s	0	488	0.00 = delay not in use

Delayed digital output 2 (keypad: menu M1 → G1.3.2)

Table 6-15. Delayed digital output 2 parameters — G1.3.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.2.1	Digital output 2 signal selection	DigOUT:0.1	DigOUT:E.10		0.10	489	
P1.3.2.2	Digital output 2 function	DigOUT:0.1	DigOUT:E.10		0.00	490	See par. 1.3.1.2
P1.3.2.3	Digital output 2 on delay	0.00	320.00	s	0.00	491	0.00 = delay not in use
P1.3.2.4	Digital output 2 off delay	0.00	320.00	s	0.00	492	0.00 = delay not in use

Digital output signals (control keypad: menu M1 → G1.3.3)

Table 6-16. Digital output signals — G1.3.3

Code	Parameter	Min.	Max	Unit	Default	ID	Note
P1.3.3.1	Ready	DigOUT:0.1	DigOUT:E.10		DigOUT:A.1	432	Ready to run
P1.3.3.2	Run	DigOUT:0.1	DigOUT:E.10		DigOUT:B.1	433	Running
P1.3.3.3	Fault	DigOUT:0.1	DigOUT:E.10		DigOUT:B.2	434	Drive in fault state
P1.3.3.4	Inverted fault	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	435	Drive not in fault state
P1.3.3.5	Warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	436	Warning active
P1.3.3.6	External fault	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	437	External fault active
P1.3.3.7	Reference fault/warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	438	4 mA fault active
P1.3.3.8	Overtemperature warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	439	Drive overtemperature active
P1.3.3.9	Reverse	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	440	Output frequency < 0 Hz
P1.3.3.10	Unrequested direction	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	441	Reference <> Output frequency
P1.3.3.11	At speed	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	442	Reference = Output frequency
P1.3.3.12	Jogging speed	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	443	Jogging or preset speed command active
P1.3.3.13	Remote control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	444	IO control active
P1.3.3.14	External brake control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	445	See explanations on **Page 116**
P1.3.3.15	External brake control inverted	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	446	See explanations on **Page 116**
P1.3.3.16	Output frequency limit 1 supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	447	See ID315
P1.3.3.17	Output frequency limit 2 supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	448	See ID346
P1.3.3.18	Reference limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	449	See ID350
P1.3.3.19	Temperature limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	450	See ID354
P1.3.3.20	Torque limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	451	See ID348
P1.3.3.21	Motor thermal protection	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	452	
P1.3.3.22	Analog input supervision limit	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	463	See ID356
P1.3.3.23	Motor regulator activation	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	454	
P1.3.3.24	Fieldbus input data 1	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	455	FB CW B11
P1.3.3.25	Fieldbus input data 2	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	456	FB CW B12
P1.3.3.26	Fieldbus input data 3	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	457	FB CW B13
P1.3.3.27	Fieldbus input data 4	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	169	FB CW B14
P1.3.3.28	Fieldbus input data 5	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	170	FB CW B15
P1.3.3.29	Safe disable	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	1680	
P1.3.3.30	ChargeSwState	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	1681	
P1.3.3.31	Run 2	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	1690	Running
P1.3.3.32	Fault 2	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	1691	Faulted
P1.3.3.33	Current superv.	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	1907	

⚠ CAUTION

Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

Limit settings (control keypad: menu M1 → G1.3.4)

Table 6-17. Limit settings — G1.3.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.4.1	Output frequency limit 1 supervision	0	3		0	315	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision 3 = Brake-on control
P1.3.4.2	Output frequency limit 1; supervised value	0.00	Par. 1.1.2	Hz	0.00	316	
P1.3.4.3	Output frequency limit 2 supervision	0	4		0	346	0 = No (No limit) 1 = Low limit supervision 2 = High limit supervision 3 = Brake-off control 4 = Brake on/off-control
P1.3.4.4	Output frequency limit 2; supervised value	0.00	Par. 1.1.2	Hz	0.00	347	
P1.3.4.5	Torque limit supervision	0	3		0	348	0 = No (Not used) 1 = Low limit supervision 2 = High limit supervision 3 = Brake-off control
P1.3.4.6	Torque limit supervision value	-300.0	300.0	%	100.0	349	
P1.3.4.7	Reference limit supervision	0	2		0	350	0 = No (Not used) 1 = Low limit 2 = High limit
P1.3.4.8	Reference limit supervision value	0.0	Par. 1.1.2	%	0	351	
P1.3.4.9	External brake-off delay	0.0	100.0	s	0.50	352	
P1.3.4.10	External brake-on delay	0.0	100.0	s	1.50	353	
P1.3.4.11	FC temperature supervision	0	2		0	354	0 = No (Not used) 1 = Low limit 2 = High limit
P1.3.4.12	FC temperature supervised value	-10	75	°C	0	355	
P1.3.4.13	Ain Supv Input	0	4		0	356	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4
P1.3.4.14	Ain Supv Llim	0.00	Par. 1.3.4.15	%	10.00	357	
P1.3.4.15	Ain Supv Hlim	Par. 1.3.4.14	100.00	%	90.00	358	
P1.3.4.16	Current Supv	0	2		0	1906	See Par. 1.3.4.7
P1.3.4.17	Current Supv Val	0.0	3000.0	%	0.0	1907	

Analog output 1 (control keypad: menu M1 → G1.3.5)

Table 6-18. Analog output 1 parameters — G1.3.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.5.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	
P1.3.5.2	Analog output 1 function	0	15		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V) 9 = AI1 10 = AI2 11 = Output freq. (fmin - fmax) 12 = Motor torque (-2…+2xTNmot) 13 = Motor power (-2…+2xTNmot) 14 = PT100 temperature 15 = FB Data In 4
P1.3.5.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No filtering
P1.3.5.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.5.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4 mA
P1.3.5.6	Analog output 1 scale	10	1000	%	100	311	
P1.3.5.7	Analog output 1 offset	-100.00	100.00	%	0.00	375	
P1.3.5.8	AO1 Temp range min	-20	P1.3.5.9	C	-20	1531	
P1.3.5.9	AO1 Temp range max	P1.3.5.8	100	C	100	1532	

Analog output 2 (control keypad: menu M1 → G1.3.6)

Table 6-19. Analog output 2 parameters — G1.3.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.6.1	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		0.1	471	
P1.3.6.2	Analog output 2 function	0	15		4	472	See par. 1.3.5.2
P1.3.6.3	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.6.4	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.6.5	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4mA
P1.3.6.6	Analog output 2 scale	10	1000	%	100	476	
P1.3.6.7	Analog output 2 offset	-100.00	100.00	%	0.00	477	
P1.3.6.8	AO2 temp range min	-20	P1.3.6.9	C	-20	1533	
P1.3.6.9	AO2 temp range max	P1.3.6.8	100	C	100	1534	

Analog output 3 (control keypad: menu M1 → G1.3.7)

Table 6-20. Analog output 3 parameters — G1.3.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.7.1	Analog output 3 signal selection	AnOUT:0.1	AnOUT:E.10		0.1	478	
P1.3.7.2	Analog output 3 function	0	15		5	479	See par. 1.3.5.2
P1.3.7.3	Analog output 3 filter time	0.00	10.00	s	1.00	480	0 = No filtering
P1.3.7.4	Analog output 3 inversion	0	1		0	481	0 = Not inverted 1 = Inverted
P1.3.7.5	Analog output 3 minimum	0	1		0	482	0 = 0 mA 1 = 4 mA
P1.3.7.6	Analog output 3 scale	10	1000	%	100	483	
P1.3.7.7	Analog output 3 offset	-100.00	100.00	%	0.00	484	
P1.3.7.8	AO3 temp range min	-20	P1.3.7.9	C	-20	1535	
P1.3.7.9	AO3 temp range max	P1.3.7.8	100	C	100	1536	

Drive control parameters (control keypad: menu M1 → G1.4)

Table 6-21. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve ramp time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve ramp time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P1.4.8	DC braking current	0.00	I_L	A	0.7 x I_H	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop
P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	0	I_L	A	I_H	519	
P1.4.14	High speed mode	0	1		0/No	1522	0 = No 1 = Yes

Skip frequency parameters (control keypad: menu M1 → G1.5)

Table 6-22. Skip frequency parameters — G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.20	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.20	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency range 2 low limit	0.00	Par. 1.5.40	Hz	0.00	511	
P1.5.4	Skip frequency range 2 high limit	0.00	Par. 1.1.20	Hz	0.00	512	0 = Skip frequency range 2 not used
P1.5.5	Skip frequency range 3 low limit	0.00	Par. 1.5.60	Hz	0.00	513	
P1.5.6	Skip frequency range 3 high limit	0.00	Par. 1.1.20	Hz	0.00	514	0 = Skip frequency range 3 not used
P1.5.7	Skip frequency acc./dec. ramp	0.10	10.00	Times	1.00	518	

Motor control parameters (control keypad: menu M1 → G1.6)

Table 6-23. Motor control parameters — G1.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	4		0	600	SVX: 0 = Frequency control 1 = Speed control SPX: 2 = Torque control 3 = Closed loop speed control 4 = Closed loop torque control
P1.6.2	V/Hz boost	0	1		0	109	0 = Not used 1 = Automatic torque boost
P1.6.3	V/Hz ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	16.0	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On
P1.6.12	Motor control mode 2	0	4-Feb		2	521	See par. 1.6.1
P1.6.13	Speed controller P Gain (open loop)	0	32767		3000	637	
P1.6.14	Speed controller I gain (open loop)	0	32767		300	638	
P1.6.15	Load drooping	0.00	100.00		0.00	620	Drooping % of nominal speed at nominal torque
P1.6.16	Identification	0	2		0/No Action	631	0 = No action 1 = ID No run SPX Only 2 = ID With Run

Table 6-23. Motor control parameters — G1.6 (continued)

Closed loop parameter group 1.6.17 (SPX only)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.17.1	MagnCurrent	0	90	A	0	612	
P1.6.17.2	Speed Control Kp	1	1000		30	613	
P1.6.17.3	Speed Control Ti	-3200	3200	ms	100	614	
P1.6.17.4	Reserved	-32000	32000	x	0	1499	
P1.6.17.5	Accel.Compens.	0.00	300.00	s	0.00	626	
P1.6.17.6	Slip Adjust	0	500	%	75	619	
P1.6.17.7	Start Magn Curr	0	61	A	0	627	
P1.6.17.8	Start Magn Time	0	32000	ms	0	628	
P1.6.17.9	Start 0 SpeedTime	0	32000	ms	100	615	
P1.6.17.10	Stop 0 SpeedTime	0	32000	ms	100	616	
P1.6.17.11	StartUp Torque	0	3		0/Not	621	0 = Not used 1 = Torquememory 2 = Torque ref 3 = Torq Fwd/Rev
P1.6.17.12	Startup Torq FWD	-300.0	300.0	%	0.0	633	
P1.6.17.13	Startup Torq REV	-300.0	300.0	%	0.0	634	
P1.6.17.14	Reserved	-32000	32000	x	0	1499	
P1.6.17.15	Encoder1FiltTime	0.0	100.0	ms	0.0	618	
P1.6.17.16	Reserved	-32000	32000	x	0	1499	
P1.6.17.17	CurrentControlKp	0.00	100.00	%	40.00	617	
P.1.6.17.18	Reserved	-32000	32000	x	0	1499	

Protections (control keypad: menu M1 → G1.7)

Table 6-24. Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	5		0	700	0 = None 1 = Warning 2 = Warning+Previous freq. 3 = Wrng+PresetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting

Table 6-24. Protections — G1.7 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.18	Field weakening area load	10.0	150.0	%	50.0	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2.00	600.00	s	20.00	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	No. of PT100 inputs	0	3		0	739	
P1.7.25	Response to PT100 fault	0	3		0	740	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.26	PT100 warning limit	-30	200	°C	120	741	
P1.7.27	PT100 fault limit	-30	200	°C	130	742	
P1.7.28	PT100 numbers 2	0	3		0	743	
P1.7.29	PT100 flt resp 2	0	3		0	744	See external fault
P1.7.30	PT100warnlimit2	-30	200	°C	120	745	
P1.7.31	PT100 fltlimit 2	-30	200	°C	130	746	
P1.7.32	FB WatchdogDelay	0	10	s	0	1354	0 = Not monitored
P1.7.33	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.34	FB monitor delay	0	10	s	0	772	0 = Not monitored
P1.7.35	Ref fault select	0	4		1	770	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = Fieldbus
P1.7.36	SafeDisable mode	1	2		1	755	1 = Warning 2 = Fault
P1.7.37	Earth fault currrent level	0.0	100.0		15%	1333.0	Sets the level of ground fault current for a fault
P1.7.39	Earth fault currrent level	0	100		50%	1333	Sets the level of ground fault current for a fault

Table 6-25. Motor regulator warnings — G1.7.38

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
1.7.38.	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.38	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.38	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.38	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 → G1.8)

Table 6-25. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0.00	60.00	s	30.00	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = According to par. 1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto - Restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		1	738	
P1.8.12	Number of tries after CPX Temp Open	0	10		1	1901	
P1.8.13	Number of tries after O/P Contactor interlock fault	0	10		1	1902	
P1.8.14	Number of tries after slot fault	0	10		1	1905	
P1.8.15	F53 auto reset enable	0	10		1	1904	Resets F53 fault after comms re-established

Fieldbus parameters (control keypad: menu M1 → G1.9)

Table 6-26. Fieldbus parameters — G1.9

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.9.1	Fieldbus min scale	0.00	320.00	Hz	0.00	850.00	
P1.9.2	Fieldbus max scale	0.00	320.00	Hz	0.00	851.00	
P1.9.3	Fieldbus data out 1 selection	0	10000		1	852	Choose monitoring data with parameter ID
P1.9.4	Fieldbus data out 2 selection	0	10000		2	853	Choose monitoring data with parameter ID
P1.9.5	Fieldbus data out 3 selection	0	10000		3	854	Choose monitoring data with parameter ID
P1.9.6	Fieldbus data out 4 selection	0	10000		4	855	Choose monitoring data with parameter ID
P1.9.7	Fieldbus data out 5 selection	0	10000		5	856	Choose monitoring data with parameter ID
P1.9.8	Fieldbus data out 6 selection	0	10000		6	857	Choose monitoring data with parameter ID
P1.9.9	Fieldbus data out 7 selection	0	10000		7	858	Choose monitoring data with parameter ID
P1.9.10	Fieldbus data out 8 selection	0	10000		37	859	Choose monitoring data with parameter ID
P1.9.11	FB Data In1 sel	0	2000		0	876	Writes to drive ID only on a change
P1.9.12	FB Data In2 sel	0	2000		0	877	Writes to drive ID only on a change

Torque control parameters (control keypad: menu M1 → G1.10)

Table 6-27. Torque control parameters — G1.10

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.10.1	Torque limit	0.0	400.0	%	300.0	609	
P1.10.2	Torque limit control P-gain	0	32000		3000	610	
P1.10.3	Torque limit control I-gain	0	32000		200	611	
P1.10.4	Torque reference selection	0	8		0	641	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = AI1 joystick 6 = AI2 joystick 7 = Torque reference from keypad, R2.4 8 = Fieldbus
P1.10.5	Torque reference max.	-300.0	300.0	%	100.0	642	
P1.10.6	Torque reference min.	-300.0	300.0	%	0.00	643	
P1.10.7	Torque speed limit	0	2		1	644	0 = Max frequency 1 = Selected freq. reference 2 = Preset speed 7
P1.10.8	Minimum frequency for open loop torque control	0.00	par.1.1.1	Hz	3.00	636	
P1.10.9	Torque controller P gain	0	32000		150	639	
P1.10.10	Torque controller I gain	0	32000		10	640	

Cold weather parameters (control keypad: menu M1 → G1.11)

Table 6-28. Cold weather parameters — G1.11

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.11.1	Cold weather enable	0.00	1.00		0.00	1490	0 = Disable 1 = Enable
P1.11.2	Cold weather voltage	0.00	20.00	%	2.00	1491	
P1.11.3	Cold weather timeout	0.00	10.00	min	0.00	1492	

Keypad control (control keypad: menu M2)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the 9000X AF Drives User Manual.

Table 6-28. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	3		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O Select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
P2.4	Stop button	0	1		1	114	0 = No 1 = Yes
R2.5	Torque reference	0.0	100.0	%	0.0		
P2.6	Hide operate M	0	1		0	1707	0 = No 1 = Yes

System menu (control keypad: menu M5)

For parameters and functions related to the general use of the drive, such as application and language selection, customized parameter sets or information about the hardware and software, see Chapter 5 in the 9000X AF Drives User Manual.

Expander boards (control keypad: menu M6)

The M6 menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 5 in the 9000X AF Drives User Manual.

Chapter 7 — Pump and fan control application

Introduction

Select the Pump and Fan Control Application in menu M5. See Chapter 5 of the 9000X AF Drives User Manual.

The Pump and Fan Control Application can be used to control one variable speed drive and up to four auxiliary drives. The PID controller of the frequency converter controls the speed of the variable speed drive and gives control signals to start and stop the auxiliary drives to control the total flow. In addition to the eight parameter groups provided as standard, a parameter group for multi-pump and fan control functions is available.

The application has two control places on the I/O terminal. Place A is the pump and fan control and place B is the direct frequency reference. The control place is selected with input DIN6.

As already its name tells, the Pump and Fan Control Application is used to control the operation of pumps and fans. It can be used, for example, to decrease the delivery pressure in booster stations if the measured input pressure falls below a limit specified by the user.

The application utilizes external contactors for switching between the motors connected to the frequency converter. The autochange feature provides the capability of changing the starting order of the auxiliary drives. Autochange between 2 drives (main drive + 1 auxiliary drive) is set as default. See **Page 73**.

- All inputs and outputs are freely programmable

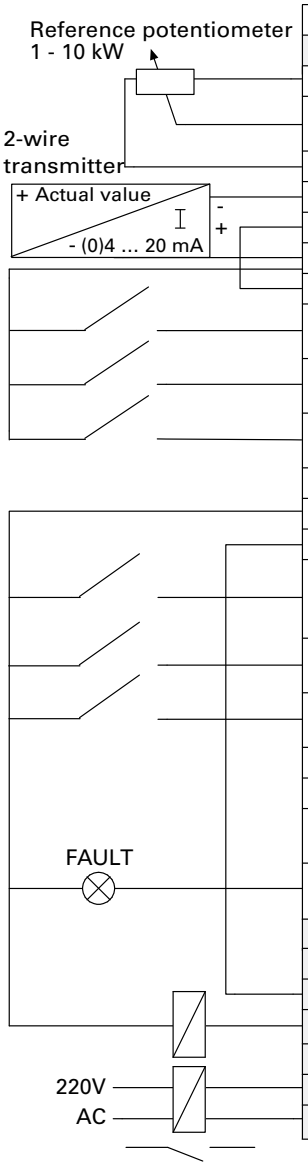
Additional functions:

- Analog input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three skip frequency areas
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sleep function

The parameters of the Basic Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Control I/O

Table 7-1. Pump and fan control application default I/O configuration and connection example (with 2-wire transmitter)



Terminal		Signal	Description
OPTA1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0 - 10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range 0 - 20mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start/Stop; Control place A (PID controller) (programm.)	Contact closed = start
9	DIN2	Interlock 1 (programmable)	Contact closed = Interlock used Contact open = Interlock not used
10	DIN3	Interlock 2 (programmable)	Contact closed = Interlock used Contact open = Interlock not used
11	CMA	Common for DIN1 - DIN3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Start/Stop Control place B (Direct frequency reference) (programmable)	Contact closed = Start
15	DIN5	Jogging speed selection (programmable)	Contact closed = Jogging speed active
16	DIN6	Control place A/B selection (programmable)	Contact open = Control place A is active Contact closed = Control place B is active
17	CMB	Common for DIN4 - DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable; See **Tables 7-12**, **7-13** and **7-14** Range 0 - 20 mA/R$_L$, max. 500W
19	AO1- (GND)	Analog output	
20	DO1	Digital output FAULT	Programmable Open collector, I ≤ 50 mA, V ≤ 48V DC
OPTA2			
21	RO1	Relay output 1 RUN	Programmable, see **Table 7-10**
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable, see **Table 7-10**
25	RO2		
26	RO2		

Note: For more information on jumper selections, see the 9000X AF Drives User Manual, Chapter 4.

Jumper Block X3: CMA and CMB Grounding

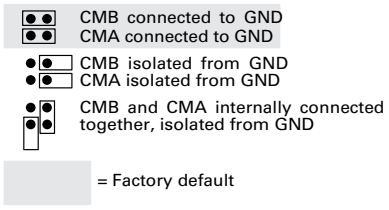


Figure 7.1. 2-Pump autochange system principal control diagram

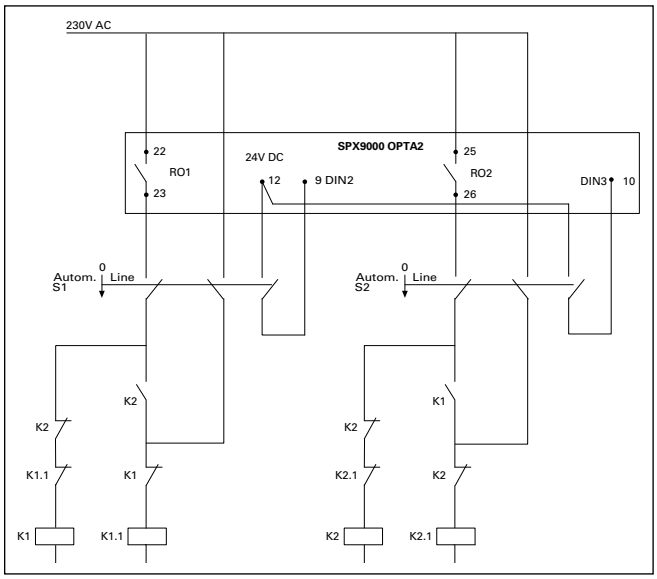
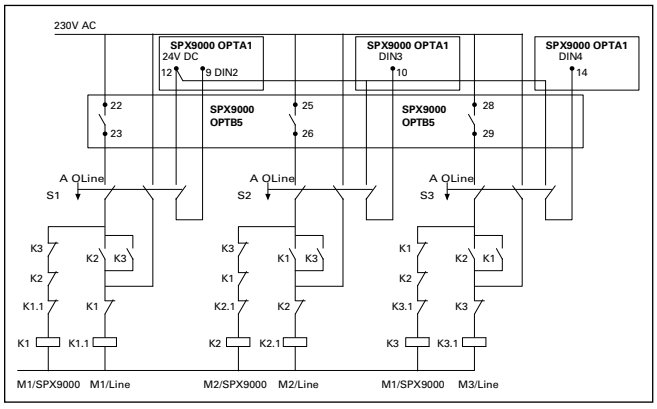


Figure 7.2. 3-Pump autochange system principal control diagram



Short description of function and essential parameters

Automatic changing between drives (Autochange, P1.9.24)

The Autochange function allows the starting and stopping order of drives controlled by the pump and fan automatics to be changed at desired intervals. The drive controlled by frequency converter can also be included in the automatic changing and locking sequence (par. 1.9.25). The Autochange function makes it possible to equalize the run times of the motors and to prevent e.g. pump stalls due to too long running breaks.

- Apply the Autochange function with parameter 1.9.24, Autochange.
- The autochange takes place when the time set with parameter 1.9.26, Autochange interval, has expired and the capacity used is below the level defined with parameter 1.9.28, Autochange frequency limit.
- The running drives are stopped and re-started according to the new order.
- External contactors controlled through the relay outputs of the frequency converter connect the drives to the frequency converter or to the mains. If the motor controlled by the frequency converter is included in the autochange sequence, it is always controlled through the relay output activated first. The other relays activated later control the auxiliary drives (See **Figure 7.4** and **Figure 7.5**).

Parameter 1.9.24 — Autochange

0 Autochange not used

1 Autochange used

The automatic change of starting and stopping order is activated and applied to either the auxiliary drives only or the auxiliary drives and the drive controlled by the frequency converter, depending on the setting of parameter 1.9.25, Automatics selection. By default, the Autochange is activated for 2 drives. See Figure 7.1 and Figure 7.4.

Parameter 1.9.25 — Autochange/interlockings automatics selection

0 Automatics (autochange/interlockings) applied to auxiliary drives only

The drive controlled by the frequency converter remains the same. Therefore, mains contactor is needed for one auxiliary drive only.

1 All drives included in the autochange/ interlockings sequence

The drive controlled by the frequency converter is included in the automatics and a contactor is needed for each drive to connect it to either the mains or the frequency converter.

Parameter 1.9.26 — Autochange interval

After the expiry of the time defined with this parameter, the autochange function takes place if the capacity used lies below the level defined with parameters 1.9.28 (Autochange frequency limit) and 1.9.27 (Maximum number of auxiliary drives). Should the capacity exceed the value of P1.9.28, the autochange will not take place before the capacity goes below this limit.

- The time count is activated only if the Start/Stop request is active at control place A.
- The time count is reset after the autochange has taken place or on removal of Start request at control place A.

Parameters 1.9.27 — Maximum number of auxiliary drives and 1.9.28 — Autochange frequency limit

These parameters define the level below which the capacity used must remain so that the autochange can take place.

This level is defined as follows:

- If the number of running auxiliary drives is smaller than the value of parameter 1.9.27 the autochange function can take place
- If the number of running auxiliary drives is equal to the value of parameter 1.9.27 and the frequency of the controlled drive is below the value of parameter 1.9.28 the autochange can take place
- If the value of parameter 1.9.28 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of parameter 1.9.27

Interlock selection (P1.9.23)

This parameter is used to activate the interlock inputs. The interlocking signals come from the motor switches. The signals (functions) are connected to digital inputs which are programmed as interlock inputs using the corresponding parameters. The pump and fan control automatics only control the motors with active interlock data.

- The interlock data can be used even when the Autochange function is not activated
- If the interlock of an auxiliary drive is inactivated and another unused auxiliary drive available, the latter will be put to use without stopping the frequency converter
- If the interlock of the controlled drive is inactivated. all motors will be stopped and re-started with the new setup
- If the interlock is re-activated in Run status, the automatics functions according to parameter 1.9.23, *Interlock selection*:

  0 Not used
  1 Update in stop

Interlocks are used. The new drive will be placed last in the autochange line without stopping the system. However, if the autochange order now becomes, for example, [P1 → P3 → P4 → P2], it will be updated in the next Stop (autochange, sleep, stop, etc.).

Example:

[P1 → P3 → P4] → [P2 LOCKED] → [P1 → P3 → P4 → P2] → [SLEEP] → [P1 → P2 → P3 → P4]

2 Stop & Update

Interlockings are used. The automatics will stop all motors immediately and re-start with a new setup.

Example:

[P1 → P2 → P4] → [P3 LOCKED] → [STOP] → [P1 → P2 → P3 → P4]

See **Page 74** Examples.

Example:

Pump and fan automatics with interlocks and no autochange

Situation: One controlled drive and three auxiliary drives.

Parameter settings: 1.9.1 = 3, 1.9.25 = 0

Interlock feedback signals used, autochange not used. Parameter settings: 1.9.23 = 1, 1.9.24 = 0

The interlock feedback signals come from the digital inputs selected with parameters 1.2.6.18 to 1.2.6.21.

The Auxiliary drive 1 control (par. 1.3.1.27) is enabled through Interlock 1 (par. 1.2.6.18), the Auxiliary drive 2 control (par. 1.3.1.28) through Interlock 2 (par. 1.2.6.19) etc.

Phases:

1. The system and the motor controlled by the frequency converter are started
2. The Auxiliary drive 1 starts when the main drive reaches the starting frequency set (par. 1.9.2)
3. The main drive decreases speed down to Auxiliary drive 1 Stop frequency (par. 1.9.3) and starts to rise toward the Start frequency of Auxiliary drive 2, if needed
4. The Auxiliary drive 2 starts when the main drive has reached the starting frequency set (par. 1.9.4)
5. The Interlock feedback is removed from Aux. drive 2. Because the Aux. drive 3 is unused, it will be started to replace the removed Aux. drive 2
6. The main drive increases speed to maximum because no more auxiliary drives are available
7. The removed Aux. drive 2 is reconnected and placed last in the auxiliary drive start order which now is 1-3-2. The main drive decreases speed to the set Stop frequency. The auxiliary drive start order will be updated either immediately or in the next Stop (autochange, sleep, stop, etc.) according to par. 1.9.23
8. If still more power is needed, the main drive speed rises up to the maximum frequency placing 100% of the output power in the system's disposal

   When the need of power decreases, the auxiliary drives turn off in the opposite order (2-3-1; after the update 3-2-1).

Pump and fan automatics with interlocks and autochange

The above is also applicable if the autochange function is used. In addition to the changed and updated start order, also the change order of main drives depends on parameter 1.9.23.

Figure 7.3. Example of the function of the PFC application with three aux. Drives

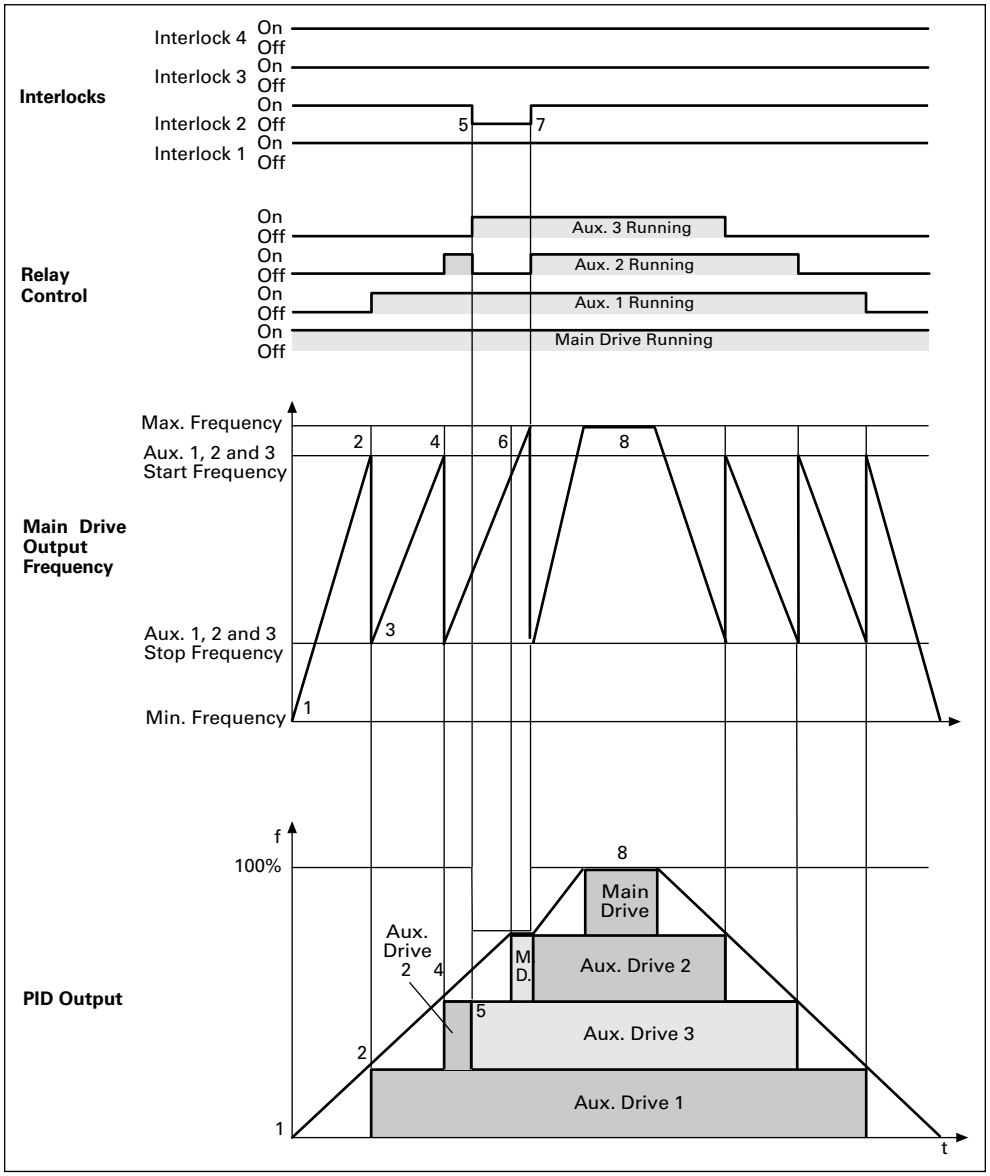


Figure 7.4. Example of 2-pump autochange, main diagram

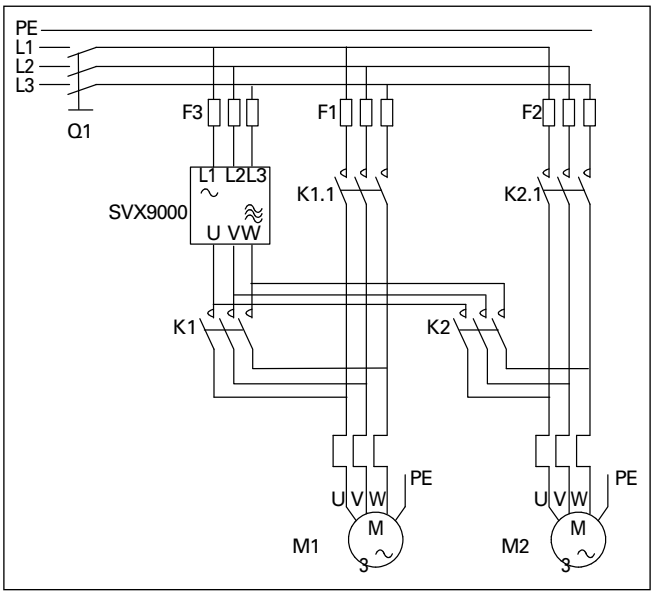
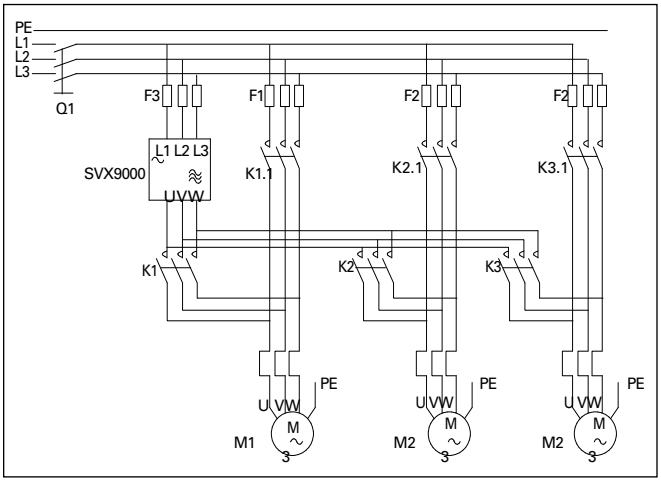


Figure 7.5. Example of 3-pump autochange, main diagram



Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in Chapter 8.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min.	=	Minimum value of parameter
Max.	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
ID	=	ID number of the parameter
①	=	Parameter value can only be changed after the drive has been stopped
②	=	Use TTF method to program these parameters. See **Page 55**.

Monitoring values (control keypad: menu M8)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

See 9000X AF Drives User Manual, Chapter 5 for more information. Note that the monitoring values V7.18 to V7.23 are available in the PFC control application only.

Table 7-2. Monitoring values

Code	Parameter	Unit	ID	Description
V7.1	Output frequency	Hz	1	Output frequency to motor
V7.2	Frequency reference	Hz	25	Frequency reference to motor control
V7.3	Motor speed rpm	rpm	2	Motor speed in rpm
V7.4	Motor current	A	3	
V7.5	Motor torque	%	4	In % of nominal torque
V7.6	Motor power	%	5	Motor shaft power in %
V7.7	Motor voltage	V	6	
V7.8	DC-bus voltage	V	7	
V7.9	Unit temperature	C°	8	Heatsink temperature
V7.10	Motortemperature	%	9	Calculated motor temperature
V7.11	Analog input 1	Varies	13	AI1 (Default V)
V7.12	Analog input 2	Varies	14	AI2 (Default mA)
V7.13	DIN1, DIN2, DIN3		15	Digital input status
V7.14	DIN4, DIN5, DIN6		16	Digital input status
V7.15	Analog Iout	mA	26	AO1
V7.16	Analog input 3		27	AI3
V7.17	Analog input 4		27	AI4
V7.18	PID reference	Varies	20	
V7.19	PID actual value	Varies	21	
V7.20	PID error	Varies	22	
V7.21	PID output	%	23	
V7.22	Running auxillary drives		30	Number of running auxillary drives
V7.23	Special display for actual value		29	See Parameters 1.9.29 to 1.9.31
V7.24	PT-100 tempurature	°C		Highest tempurature of used inputs
G7.25	Multimonitor			Displays three selectable monitor values

Table 7-3. Basic parameters — G1.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.1.1	Min frequency	0.00	Par. 1.1.2.0	Hz	0.00	101	
P1.1.2	Max frequency	Par. 1.1.1.0	320.00	Hz	60	102	**Note:** If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P1.1.3	Acceleration time 1	0.10	3000.0	s	3.0	103	
P1.1.4	Deceleration time 1	0.10	3000.0	s	3.0	104	
P1.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L	107	I_H is the nominal current rating of the 9000X inverter.
P1.1.6	Nominal voltage of the motor	180	690	V	2: 230V 4: 480V 5: 575V	110	Motor nameplate value.
P1.1.7	Nominal frequency of the motor	0.00	320.0	Hz	60.00	111	Motor nameplate value.
P1.1.8	Nominal speed of the motor	0	65000	rpm	1720	112	Motor nameplate value.
P1.1.9	Nominal current of the motor	0.1 x IH	2 x IH	A	IH	113	Check the rating plate of the motor.
P1.1.10	Power factor	0.30	1.0		0.85	120	Check the rating plate of the motor.
P1.1.11	Local control source	1	3		2	171	1 = I/O Terminal 2 = Keypad 3 = Fieldbus

Table 7-3. Basic parameters — G1.1 (continued)

P1.1.12	Remote control 1 source	1	3		1	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.1.13	Local reference	0	7		4	173	0 =AI1 1 = AI2 2 = AI3 3 = AI4 4 = Keypad Reference 5 = Fieldbus Reference 6 = Motor Potentiometer 7 = PID COntroller
P1.1.14	Remote reference	0	7		0	174	See par. 1.1.13
P1.1.15	PID Controller reference signal (Place A)	0	6		4	332	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = Keypad 5 = Fieldbus process data in 1 6 = Motor potentiometer
P1.1.16	PID Controller gain	0.0	1000.0	%	100.0	118	
P1.1.17	PID Controller I-time	0.00	320.00	s	1.0	119	
P1.1.18	PID Controller D-time	0.00	10.00	s	0.00	132	
P1.1.19	Sleep frequency	Par. 1.1.1	Par. 1.1.2	Hz	10.00	1016	
P1.1.20	Sleep delay	0	3600	s	30	1016	
P1.1.21	Wake up level	P1.2.27	P1.2.28	P1.2.43	25.00	1018	
P1.1.22	Wake up function	0	3		0	1019	0 = Wake-up when below wake up level (P1.1.21) 1 = Wake-up at when above wake up level (P1.1.21) 2 = Wake-up when below wake up level (PID ref.) 3 = Wake-up when above wake up level (PID ref.)
P1.1.23	Jogging speed	0.00	Par. 1.1.2	Hz	0.00	124	

Input signals

Basic settings (control keypad: menu M1 → G1.2.1)

Table 7-4. Input signals, basic settings — G1.2.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1.1	PID reference 2	0	7		7	371	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = PID reference 1 from keypad 5 = Fieldbus process data in 3 6 = Motor potentiometer 7 = PID reference 2 from keypad
P1.2.1.2	Error value inversion	0	1		0	340	0 = Normal 1 = Inverted
P1.2.1.3	PID reference rise time	0.0	100.0	s	5.0	341	
P1.2.1.4	PID reference fall time	0.0	100.0	s	5.0	341	
P1.2.1.5	Actual value selection	0	7		0	333	0 = Actual value 1 1 = Actual 1 + Actual 2 2 = Actual 1 - Actual 2 3 = Actual 1 * Actual 2 4 = Max (Actual 1. Actual 2) 5 = Min (Actual 1. Actual 2) 6 = Mean (Actual 1. Actual 2) 7 = Sqrt (Act1) + Sqrt (Act 2)

Table 7-4. Input signals, basic settings — G1.2.1 (continued)

P1.2.1.6	Actual value 1 selection	0	5		2	334	0 = Not used 1 = AI1 signal (c-board) 2 = AI2 signal (c-board) 3 = AI3 4 = AI4 5 = Fieldbus (processDataIN2)
P1.2.1.7	Actual value 2 selection	0	5		0	335	0 = Not used 1 = AI1 signal (c-board) 2 = AI2 signal (c-board) 3 = AI3 4 = AI4 5 = Fieldbus (processDataIN2)
P1.2.1.8	Actual 1 minimum scale	-1600.0	1600.0	%	0.00	336	0 = No minumum scaling
P1.2.1.9	Actual 1 maximum scale	-1600.0	1600.0	%	100.00	337	100 = No maximum scaling
P1.2.1.10	Actual 2 minimum scale	-1600.0	1600.0	%	0.00	338	0 = No minumum scaling
P1.2.1.11	Actual 2 maximum scale	-1600.0	1600.0	%	100.00	339	100 = No maximum scaling
P1.2.1.12	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0	331	

Analog input 1 (control keypad: menu M1 → G1.2.2)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.1.13	Motor potentiometer frequency reference memory reset	0	2		1	367	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P1.2.1.14	Motor potentiometer PID Reference memory reset	0	2		1	370	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P1.2.1.15	Reference scaling minimum place B	0.00	P1.2.1.16	Hz	0.00	344	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.1.16	Reference scaling maximum place B	P1.2.1.15	P1.1.2	Hz	0.00	345	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P1.2.1.17	Start delay	0.00	300.00	s	0.00	1494	

Table 7-5. Input signals, analog input 1 — G1.2.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.2.1	AI1 signal selection	AnIN:0.1	AnIN:E.10		A.1	377	TTF programming. See chapter 6.3
P1.2.2.2	AI1 filter time	0.00	10.00	s	0.10	324	0 = No filtering
P1.2.2.3	AI1 signal range	0	3		0	320	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.2.4	AI1 custom minimum setting	-160.00	160.00	%	0.00	321	
P1.2.2.5	AI1 custom maximum setting	-160.00	160.00	%	100.0	322	
P1.2.2.6	AI1 signal inversion	0	1		0	323	0 = Not inverted 1 = Inverted

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Analog input 2 (control keypad: menu M1 → G1.2.3)

Table 7-6. Input signals, analog input 2 — G1.2.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.3.1	AI2 signal selection	AnIN:0.1	AnIN:E.10		A.2	388	TTF programming. See chapter 6.3
P1.2.3.2	AI2 filter time	0.00	10.00	s	0.10	329	0 = No filtering
P1.2.3.3	AI2 signal range	0	3		1	325	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.3.4	AI2 custom minimum setting	-160.00	160.00	%	0.00	326	
P1.2.3.5	AI2 custom maximum setting	-160.00	160.00	%	100.0	327	

P1.2.3.6	AI2 signal inversion	0	1		0	328	0 = Not inverted 1 = Inverted

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Analog input 3 (control keypad: menu M1 → G1.2.4)

Table 7-7. Input signals, analog input 3 — G1.2.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.4.1	AI3 signal selection	AnIN:0.1	AnIN:E.10		0.1	141	TTF programming. See chapter 6
P1.2.4.2	AI3 filter time	0.00	10.00	s	0.10	142	0 = No filtering
P1.2.4.3	AI3 signal range	0	3		1	143	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.4.4	AI3 custom minimum setting	-160.00	160.00	%	0.0	144	
P1.2.4.5	AI3 custom maximum setting	-160.00	160.00	%	100.00	145	
P1.2.4.6	AI3 signal inversion	0	1		0	151	0 = Not inverted 1 = Inverted

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Analog input 4. (control keypad: menu M1 → G1.2.5)

Table 7-8. Input signals, analog input 4 — G1.2.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.2.5.1	AI4 signal selection	AnIN:0.1	AnIN:E.10		0.1	152	
P1.2.5.2	AI4 filter time	0.0	10.0	s	0.10	153	0 = No filtering
P1.2.5.3	AI4 signal range	0	3		1	154	0 = 0-100% 1 = 4mA/20%-100% 2 = -10V...+10V 3 = Custom range
P1.2.5.4	AI4 custom minimum setting	-160.00	160.00	%	0.0	155	
P1.2.5.5	AI4 custom maximum setting	-160.00	160.00	%	100.0	156	
P1.2.5.6	AI4 signal inversion	0	1		0	162	0 = Not inverted 1 = Inverted

Remember to place jumpers of block X2 accordingly. See 9000X AF Drives User Manual, Chapter 4.

Digital inputs (control keypad: menu M1 → G1.2.6)

Table 7-9. Input signals, digital inputs — G1.2.6

Code	Parameter	Min.	Max.	Default	ID	Note
P1.2.6.1	Start A signal	DigIN:0.1	DigIN:E.10	DigIN:A.1	423	
P1.2.6.2	Start B signal	DigIN:0.1	DigIN:E.10	DigIN:A.4	424	
P1.2.6.3	Control place A/B selection	DigIN:0.1	DigIN:E.10	DigIN:A.6	425	Control place A (OC) Control place B (CC)
P1.2.6.4	External fault (close)	DigIN:0.1	DigIN:E.10	DigIN:0.1	405	Ext. fault (F51) displayed (CC)
P1.2.6.5	External fault (open)	DigIN:0.1	DigIN:E.10	DigIN:0.2	406	Ext. fault (F51) displayed (OC)
P1.2.6.6	Run enable	DigIN:0.1	DigIN:E.10	DigIN:0.2	407	Motor start enabled (CC)
P1.2.6.7	Acc/Dec time sel	DigIN:0.1	DigIN:E.10	DigIN:0.1	408	Acc/Dec time 1 (OC) Acc/Dec time 2 (CC)
P1.2.6.8	Force remote	DigIN:0.1	DigIN:E.10	DigIN:A.6	411	Force control place to Remote (CC)
P1.2.6.9	Reverse	DigIN:0.1	DigIN:E.10	DigIN:0.1	412	Direction forward (OC) Direction Reverse (CC)
P1.2.6.10	Jogging speed	DigIN:0.1	DigIN:E.10	DigIN:A.5	413	Jogging speed selected for frequency reference (CC)
P1.2.6.11	Fault reset	DigIN:0.1	DigIN:E.10	DigIN:0.1	414	All faults reset (CC)

Table 7-9. Input Signals. Digital Inputs — G1.2.6 (continued)

Code	Parameter	Min.	Max.	Default	ID	Note
P1.2.6.12	Acc/Dec prohibit	DigIN:0.1	DigIN:E.10	DigIN:0.1	415	Acc/Dec prohibited (CC)
P1.2.6.13	DC Brake command	DigIN:0.1	DigIN:E.10	DigIN:0.1	416	DC braking active (CC)
P1.2.6.14	Mot pot down	DigIN:0.1	DigIN:E.10	DigIN:0.1	417	Mot.pot. reference decreases (CC)
P1.2.6.15	Mot pot up	DigIN:0.1	DigIN:E.10	DigIN:0.1	418	Mot.pot. reference increases (CC)
P1.2.6.16	Autochange 1 interlock	DigIN:0.1	DigIN:E.10	DigIN:A.2	426	Activated when closed
cc = closing contact; oc = opening contact.						
P1.2.6.17	Autochange 2 interlock	DigIN:0.1	DigIN:E.10	DigIN:A.3	427	Activated when closed
P1.2.6.18	Autochange 3 interlock	DigIN:0.1	DigIN:E.10	DigIN:0.1	428	Activated when closed
P1.2.6.19	Autochange 4 interlock	DigIN:0.1	DigIN:E.10	DigIN:0.1	429	Activated when closed
P1.2.6.20	Autochange 5 interlock	DigIN:0.1	DigIN:E.10	DigIN:0.1	430	Activated when closed
P1.2.6.21	PID reference 2	DigIN:0.1	DigIN:E.10	DigIN:0.1	431	Selected with P1.1.15 (OC) Selected with P1.2.1.1 (CC)
P1.2.6.22	Force local	DigIN:0.1	DigIN:E.10	DigIN:0.1	1497	Force control place to remote (CC)
P1.2.6.23	O/P contactor interlock	DigIN:0.1	DigIN:E.10	DigIN:0.1	1547	Output contactor interlock input
P1.2.6.24	CPX temp open	DigIN:0.1	DigIN:E.10	DigIN:0.2	1686	CPX temperature fault

cc = closing contact; oc = opening contact.

Output signals

Digital output signals (control keypad: menu M1 → G1.3.1)

Table 7-10. Output signals, digital outputs — G1.3.1

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1.1	Ready	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	432	Ready to run
P1.3.1.2	Run	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	433	Running
P1.3.1.3	Fault	DigOUT:0.1	DigOUT:E.10		DigOUT:A.1	434	Drive in fault state
P1.3.1.4	Inverted fault	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	435	Drive not in fault state
P1.3.1.5	Warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	436	Warning active
P1.3.1.6	External fault	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	437	External fault active
P1.3.1.7	Reference fault/warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	438	4 mA fault active
P1.3.1.8	Overtemperature warning	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	439	Drive overtemperature active
P1.3.1.9	Reverse	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	440	Output frequency < 0 Hz
P1.3.1.10	Unrequested direction	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	441	Reference <> Output frequency
P1.3.1.11	At speed	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	442	Reference = Output frequency
P1.3.1.12	Jogging speed	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	443	Jogging or preset speed command active
P1.3.1.13	Remote control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	444	IO control active
P1.3.1.14	External brake control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	445	See explanations on **Page 116**
P1.3.1.15	External brake control inverted	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	446	See explanations on **Page 116**
P1.3.1.16	Output frequency limit 1 supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	447	See ID315
P1.3.1.17	Output frequency limit 2 supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	448	See ID346
P1.3.1.18	Reference limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	449	See ID350
P1.3.1.19	Temperature limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	450	See ID354
P1.3.1.20	Torque limit supervision	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	451	See ID348
P1.3.1.21	Motor thermal protection	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	452	
P1.3.1.22	Analog input supervision limit	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	463	See ID356
P1.3.1.23	Motor regulator activation	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	454	
P1.3.1.24	Fieldbus input data 1	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	455	FB CW B11
P1.3.1.25	Fieldbus input data 2	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	456	FB CW B12
P1.3.1.26	Fieldbus input data 3	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	457	FB CW B13
P1.3.1.27	Autochange 1/ Aux 1 Control	DigOUT:0.1	DigOUT:E.10		DigOUT:B.1	458	
P1.3.1.28	Autochange 2/ Aux 2 Control	DigOUT:0.1	DigOUT:E.10		DigOUT:B.2	459	

Table 7-10. Output signals, digital outputs — G1.3.1 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.1.29	Autochange 3/ Aux 3 Control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	460	
P1.3.1.30	Autochange 4/ Aux 4 Control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	461	
P1.3.1.31	Autochange 5/ Aux 5 Control	DigOUT:0.1	DigOUT:E.10		DigOUT:0.1	462	

Limit settings (control keypad: menu M1 → G1.3.2)

Table 7-11. Output signals, limit settings — G1.3.2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.2.1	Output frequency limit 1 supervision	0	2		0	315	0 = No (no limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.2.2	Output frequency limit 1; supervised value	0.00	Par. 1.1.2	Hz	0.00	316	
P1.3.2.3	Output frequency limit 2 supervision	0	2		0	346	0 = No (no limit) 1 = Low limit supervision 2 = High limit supervision
P1.3.2.4	Output frequency limit 2; supervised value	0.00	Par. 1.1.2	Hz	0.00	347	
P1.3.2.5	Torque limit supervision	0	2		0	348	0 = No (not used) 1 = Low limit supervision 2 = High limit supervision
P1.3.2.6	Torque limit supervision value	-1000.0	1000.0	%	100.0	349	
P1.3.2.7	Reference limit supervision	0	2		0	350	0 = No (not used) 1 = Low limit 2 = High limit
P1.3.2.8	Reference limit supervision value	0.0	Par. 1.1.2	%	0.0	351	
P1.3.2.9	External brake-off delay	0.0	100.0	s	0.50	352	
P1.3.2.10	External brake-on delay	0.0	100.0	s	1.50	353	
P1.3.2.11	FC temperature supervision	0	2		0	354	0 = No (not used) 1 = Low limit 2 = High limit
P1.3.2.12	FC temperature supervised value	-10	75	°C	0	355	
P1.3.2.13	Analog input supervision limit	0	1		0	372	0 = AI1 1 = AI2
P1.3.2.14	Analog input supervision limit	0.0	2	%	0	373	0 = No (not used) 1 = Low limit 2 = High limit
P1.3.2.15	Analog input supervision limit	0.00	100.00	%	0.00	374	

Analog output 1 (control keypad: menu M1 → G1.3.3)

Table 7-12. Output signals, analog output 1 — G1.3.3

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.3.1	Analog output 1 signal selection	AnOUT:0.1	AnOUT:E.10		A.1	464	
P1.3.3.2	Analog output 1 function	0	14		1	307	0 = Not used 1 = Output freq. (0 - fmax) 2 = Freq. reference (0 - fmax) 3 = Motor speed (0 - Motor nominal speed) 4 = Motor current (0 - InMotor) 5 = Motor torque (0 - TnMotor) 6 = Motor power (0 - PnMotor) 7 = Motor voltage (0 - UnMotor) 8 = DC-Bus volt (0 - 1000V) 9 = PID Controller reference value 10 = PID Controller actual value 1 11 = PID Controller actual value 2 12 = PID Controller error value 13 =PID Controller output 14 = PT100 temperature
P1.3.3.3	Analog output 1 filter time	0.00	10.00	s	1.00	308	0 = No filtering

P1.3.3.4	Analog output 1 inversion	0	1		0	309	0 = Not inverted 1 = Inverted
P1.3.3.5	Analog output 1 minimum	0	1		0	310	0 = 0 mA 1 = 4mA
P1.3.3.6	Analog output 1 scale	10	1000	%	100	311	
P1.3.3.7	Analog output 1 offset	-100.00	100.00	%	0.00	375	

Analog output 2 (control keypad: menu M1 → G1.3.4)

Table 7-13. Output signals, analog output 2 — G1.3.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.4.1	Analog output 2 signal selection	AnOUT:0.1	AnOUT:E.10		0.1	471	
P1.3.4.2	Analog output 2 function	0	14		4	472	See par. 1.3.3.2
P1.3.4.3	Analog output 2 filter time	0.00	10.00	s	1.00	473	0 = No filtering
P1.3.4.4	Analog output 2 inversion	0	1		0	474	0 = Not inverted 1 = Inverted
P1.3.4.5	Analog output 2 minimum	0	1		0	475	0 = 0 mA 1 = 4mA
P1.3.4.6	Analog output 2 scale	10	1000	%	100	476	
P1.3.4.7	Analog output 2 offset	-100.00	100.00	%	0.00	477	

Analog output 3 (control keypad: menu M1 → G1.3.5)

Table 7-14. Output signals, analog output 3 — G1.3.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.3.5.1	Analog output 3 signal selection	AnOUT:0.1	AnOUT:E.10		0.1	478	
P1.3.5.2	Analog output 3 function	0	14		5	479	See par. 1.3.3.2
P1.3.5.3	Analog output 3 filter time	0.00	10.00	s	1.00	480	0 = No filtering
P1.3.5.4	Analog output 3 inversion	0	1		0	481	0 = Not inverted 1 = Inverted
P1.3.5.5	Analog output 3 minimum	0	1		0	482	0 = 0 mA 1 = 4mA
P1.3.5.6	Analog output 3 scale	10	1000	%	100	483	
P1.3.5.7	Analog output 3 offset	-100.00	100.00	%	0.00	484	

Drive control parameters (control keypad: menu M1 → G1.4)

Table 7-15. Drive control parameters — G1.4

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.4.1	Ramp 1 shape	0.0	10.0	s	0.0	500	0 = Linear >0 = S-curve ramp time
P1.4.2	Ramp 2 shape	0.0	10.0	s	0.0	501	0 = Linear >0 = S-curve Ramp Time
P1.4.3	Acceleration time 2	0.1	3000.0	s	10.0	502	
P1.4.4	Deceleration time 2	0.1	3000.0	s	10.0	503	
P1.4.5	Brake chopper	0	4		0	504	0 = Not used 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = Used when running (no testing)
P1.4.6	Start function	0	1		0	505	0 = Ramp 1 = Flying start
P1.4.7	Stop function	0	3		1	506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P1.4.8	DC braking current	0.00	I_L	A	0.7 x I_H	507	
P1.4.9	DC braking time at stop	0.00	600.00	s	0.00	508	0 = DC brake is off at stop

P1.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50	515	
P1.4.11	DC braking time at start	0.00	600.00	s	0.00	516	0 = DC brake is off at start
P1.4.12	Flux brake	0	1		0	520	0 = Off 1 = On
P1.4.13	Flux braking current	0	I_L	A	I_H	519	

Skip frequencies (control keypad: menu M1 → G1.5)

Table 7-16. Skip frequencies— G1.5

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.5.1	Skip frequency range 1 low limit	0.00	Par. 1.5.20	Hz	0.00	509	
P1.5.2	Skip frequency range 1 high limit	0.00	Par. 1.1.20	Hz	0.00	510	0 = Skip frequency range 1 not used
P1.5.3	Skip frequency range 2 low limit	0.00	Par. 1.5.40	Hz	0.00	511	
P1.5.4	Skip frequency range 2 high limit	0.00	Par. 1.1.20	Hz	0.00	512	0 = Skip frequency range 2 not used
P1.5.5	Skip frequency range 3 low limit	0.00	Par. 1.5.60	Hz	0.00	513	
P1.5.6	Skip frequency range 3 high limit	0.00	Par. 1.1.20	Hz	0.00	514	0 = Skip frequency range 3 not used
P1.5.7	Skip frequency acc./dec. ramp	0.1	10	Times	1.0	518	

Motor control parameters (control keypad: menu M1 → G1.6)

Table 7-17. Motor control parameters — G1.6

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.6.1	Motor control mode	0	1		0	600	**SVX:** 0 = Frequency Control 1 = Speed Control
P1.6.2	V/Hz Boost	0	1		0	109	0 = Not used 1 = Automatic Torque Boost
P1.6.3	V/Hz Ratio select	0	3		0	108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P1.6.4	Field weakening point	8.00	320.00	Hz	60.00	602	
P1.6.5	Voltage at field weakening point	10.00	200.00	%	100.00	603	n% x Unmot
P1.6.6	V/Hz curve midpoint frequency	0.00	P1.6.4	Hz	60.00	604	
P1.6.7	V/Hz curve midpoint voltage	0.00	100.00	%	100.00	605	n% x Unmot
P1.6.8	Output voltage at zero frequency	0	40	%	Varies	606	n% x Unmot
P1.6.9	Switching frequency	1.0	Varies	kHz	Varies	601	
P1.6.10	Overvoltage controller	0	2		1	607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping)
P1.6.11	Undervoltage controller	0	1		1	608	0 = Off 1 = On

Protections (control keypad: menu M1 → G1.7)

Table 7-18. Protections — G1.7

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.1	Ref Fault Resp	0	5		0	700	0 = None 1 = Warning 2 = Warning+Previous freq. 3 = Wrng+PresetFreq 1.7.2 4 = Fault.stop acc. to 1.4.7 5 = Fault.stop by coasting
P1.7.2	Ref Fault Freq.	0.00	Par. 1.1.2	Hz	0.00	728	

Table 7-18. Protections — G1.7 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.3	Response to external fault	0	3		2	701	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.4	Input phase supervision	0	3		3	730	
P1.7.5	Response to undervoltage fault	1	3		0	727	
P1.7.6	Output phase supervision	0	3		2	702	
P1.7.7	Earth fault protection	0	3		2	703	
P1.7.8	Thermal protection of the motor	0	3		2	704	
P1.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0	705	
P1.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0	706	
P1.7.11	Motor thermal time constant	1	200	min	45	707	
P1.7.12	Motor duty cycle	0	100	%	100	708	
P1.7.13	Stall protection	0	3		0	709	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.14	Stall current	Varies	I_H	A	I_L	710	
P1.7.15	Stall time limit	1.00	120.00	s	15.00	711	
P1.7.16	Stall frequency limit	1.0	Par. 1.1.2	Hz	25.0	712	
P1.7.17	Underload protection	0	3		0	713	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.18	Field weakening area load	10.0	150.0	%	50.0	714	
P1.7.19	Zero frequency load	5.0	150.0	%	10.0	715	
P1.7.20	Underload protection time limit	2.00	600.00	s	20.00	716	
P1.7.21	Response to thermistor fault	0	3		2	732	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.22	Response to fieldbus fault	0	3		2	733	See P1.7.21
P1.7.23	Response to slot fault	0	3		2	734	See P1.7.21
P1.7.24	No. of PT100 inputs	0	3		0	739	
P1.7.25	Response to PT100 fault	0	3		0	740	0 = No action 1 = Warning 2 = Fault.stop acc. to 1.4.7 3 = Fault.stop by coasting
P1.7.26	PT100 warning limit	-30.0	200.0	°C	120.0	741	
P1.7.27	PT100 fault limit	-30.0	200.0	°C	130.0	742	
P1.7.28	FCW monitor bit	0	2		0	771	0 = No action 1 = Fault low 2 = Fault high
P1.7.29	Earth fault currrent level	0.0	100.0		15%	1333	Sets the level of ground fault current for a fault
P1.7.30	OP Cont Intlk	0	3		0	1903	See external fault

Table 7-19. Motor regulator warnings — G1.7.31

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.7.31.1	Current Reg Resp	0	1		1	757	0 = No response 1 = Warning
P1.7.31.2	Overvolt Reg Resp	0	1		1	758	0 = No response 1 = Warning
P1.7.31.3	Undervolt Reg Resp	0	1		1	759	0 = No response 1 = Warning
P1.7.31.4	Torque Reg Resp	0	1		1	760	0 = No response 1 = Warning

Autorestart parameters (control keypad: menu M1 → G1.8)

Table 7-19. Autorestart parameters — G1.8

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.8.1	Wait time	0.10	10.00	s	0.50	717	
P1.8.2	Trial time	0.00	60.00	s	30.00	718	
P1.8.3	Start mode	0	2		0	719	0 = Ramp 1 = Flying start 2 = Start per P1.4.6
P1.8.4	Start delay mode	0	1		0	1495	0 = Normal 1 = Auto restart
P1.8.5	Number of tries after undervoltage trip	0	10		0	720	
P1.8.6	Number of tries after overvoltage trip	0	10		0	721	
P1.8.7	Number of tries after overcurrent trip	0	3		0	722	
P1.8.8	Number of tries after reference trip	0	10		0	723	
P1.8.9	Number of tries after motor temperature fault trip	0	10		0	726	
P1.8.10	Number of tries after external fault trip	0	10		0	725	
P1.8.11	Number of tries after underload fault trip	0	10		1	738	
P1.8.12	Number of tries after CPX Temp Open	0	10		1	1901	
P1.8.13	Number of tries after O/P Contactor interlock fault	0	10		1	1902	

Pump and fan control parameters (control keypad: menu M1 → G1.9)

Table 7-20. Pump and fan control parameters — G1.9

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.9.1	Number of auxillary drives	0	4		0	1001	
P1.9.2	Start frequency auxillary drive 1	P1.9.3	320.00	Hz	61.00	1002	
P1.9.3	Stop frequency auxillary drive 1	P1.1.1	P1.9.2	Hz	10.00	1003	
P1.9.4	Start frequency auxillary drive 2	P1.9.5	320.00	Hz	61.00	1004	
P1.9.5	Stop frequency auxillary drive 2	P1.1.1	P1.9.4	Hz	10.00	1005	
P1.9.6	Start frequency auxillary drive 3	P1.9.7	320.00	Hz	61.00	1006	
P1.9.7	Stop frequency auxillary drive 3	P1.1.1	P1.9.6	Hz	10.00	1007	
P1.9.8	Start frequency auxillary drive 4	P1.9.9	320.00	Hz	61.00	1008	
P1.9.9	Stop frequency auxillary drive 4	P1.1.1	P1.9.8	Hz	10.00	1009	
P1.9.10	Start delay auxillary drives	0.0	300.0	s	4.0	1010	
P1.9.11	Stop delay auxillary drives	0.0	300.0	s	2.0	1011	
P1.9.12	Reference step auxillary drive 1	0.0	100.0	%	0.0	1012.0	
P1.9.13	Reference step auxillary drive 2	0.0	100.0	%	0.0	1013	
P1.9.14	Reference step auxillary drive 3	0.0	100.0	%	0.0	1014	
P1.9.15	Reference step auxillary drive 4	0.0	100.0	%	0.0	1015	
P1.9.16	PID controller bypass	0	1		0	1020	1 = PID controller bypassed
P1.9.17	Analog input for input pressure measurement	0	5		0	1021	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Fieldbus
P1.9.18	Input pressure high limit	0.0	100.0	%	30.0	1022	
P1.9.19	Input pressure low limit	0.0	100.0	%	20.0	1023	
P1.9.20	Output pressure drop	0.0	100.0	%	30.0	1024	
P1.9.21	Frequency drop delay	0.0	300.0	s	0.0	1025	0 = No delay 300 = No frequency drop
P1.9.22	Frequency increase delay	0.0	300.0	s	0.0	1026	0 = No delay 300 = No frequency drop

Table 7-20: Pump and fan control parameters — G1.9 (continued)

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P1.9.23	Interlock selection	0	2		0	1032	0 = Interlocks not used 1 = Set new interlock last; P1.9.26 or stop state 2 = Stop and update order immediately
P1.9.24	Autochange	0	1		0	1027	0 = Not used 1 = Autochange used
P1.9.25	Autochange and interlock automatic selection	0	1		0	1028	0 = Auxillary drives only 1 = All drives
P1.9.26	Autochange interval	0.0	3000.0	h	48.0	1029	0.0 = TEST = 40 s
P1.9.27	Autochange maximum number of auxillary drives	0	4		1	1030	
P1.9.28	Autochange frequency limit	0.00	P1.1.2	Hz	30.00	1031	
P1.9.29	Actual value special display minimum	0.0	3000.0		0.0	1033	
P1.9.30	Actual value special display maximim	0.0	3000.0		10.0	1034	
P1.9.31	Actual value special display decimals	0	4		1	1035	

Keypad control (control keypad: menu M2)

This menu provides the parameters for the setting of the keypad frequency reference, the selection of motor direction when in keypad operation, and when the STOP button is active.

Table 7-21. Keypad control parameters — M2

Code	Parameter	Min.	Max.	Unit	Default	ID	Note
P2.1	Control place	1	6		0	1685	0 = Keypad L/R 1 = Local 2 = Remote 3 = I/O Select
R2.2	Keypad reference	Par. 1.1.1	Par. 1.1.2	Hz			
P2.3	Direction (on keypad)	0	1		0	123	0 = Forward 1 = Reverse
R2.4	PID Reference	Par. 1.2.27	Par. 1.2.28	Par. 1.2.43	50		
R2.5	PID Reference 2	Par. 1.2.27	Par. 1.2.28	Par. 1.2.43	0		
P2.6	Stop button	0	1		1	114	0 = No 1 = Yes
P2.7	Hide operate M	0	1		0	1707	0 = No 1 = Yes

Menus – M3 to M6

Menus M3 to M6 provide information on the Active Faults, Fault History, System Menu settings and the Expander Board setup. These menu items are explained in detail in Chapter 5 of the 9000X AF Drives User Manual.

Monitoring menu – M7

The monitored items are the actual values of parameters and signals as well as the status and measurements of other elements. Monitored items cannot be edited.

See the 9000X AF Drives User Manual, Chapter 5 — Menu information item M7, for more information.

Note: Local control is always frequency control mode unless PID is selected for the local reference. In remote, frequency mode is selected with DIN6 unless PID is selected for the remote reference. PC Control is always frequency mode.

Chapter 8 — Description of parameters

Introduction

On the following pages you will find the parameter descriptions arranged according to the individual ID number of the parameter. A parameter ID number with a footnote (e.g. 418 Motor potentiometer UP) indicates that the TTF programming method shall be applied to this parameter (See **Page 55**).

<table>
<tr><th>Code</th><th>ID</th><th>Parameter</th><th>Notes</th></tr>
<tr><td>(P1.1, P1.1.1)</td><td>101</td><td>Minimum frequency</td><td></td></tr>
<tr><td>(P1.2, P1.1.2)</td><td>102</td><td>Maximum frequency
(Defines the frequency limits of the frequency converter. The maximum value for these parameters is 320 Hz. The software will automatically check the values of ID105, ID106, ID315 and ID728.)</td><td></td></tr>
<tr><td>(P1.3, P1.1.3)</td><td>103</td><td>Acceleration time 1</td><td></td></tr>
<tr><td>(P1.4, P1.1.4)</td><td>104</td><td>Deceleration time 1
These limits correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (ID102).</td><td></td></tr>
<tr><td>(P1.10, P1.1.17, P1.1.18)</td><td>105</td><td>Preset speed 1</td><td></td></tr>
<tr><td>(P1.11, P1.1.18, P1.1.19)</td><td>106</td><td>Preset speed 2
Parameter values are automatically limited between the minimum and maximum frequencies (ID101, ID102).
Table 8-1. Preset speed
<table>
<tr><th>Speed</th><th>Multi-step speed select 1 (DIN4)</th><th>Multi-step speed select 2 (DIN5)</th></tr>
<tr><td>Basic speed</td><td>0</td><td>0</td></tr>
<tr><td>ID105</td><td>1</td><td>0</td></tr>
<tr><td>ID106</td><td>0</td><td>1</td></tr>
</table></td><td>the use of the TTF-programming method in the Multi-Purpose Control Application. See ID419, ID420 and ID421.</td></tr>
<tr><td>(P1.5, P1.1.5)</td><td>107</td><td>Current limit
This parameter determines the maximum motor current from the frequency converter. The parameter value range differs from size to size.</td><td></td></tr>
<tr><td>(P1.6.3)</td><td>108</td><td>V/Hz ratio selection
Linear:
0. The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. A linear V/Hz ratio should be used in constant torque applications. This default setting should be used if there is no special need for another setting.</td><td></td></tr>
</table>

Code	ID	Parameter	Notes
(P1.6.3)	108	**Squared:**	

1. The voltage of the motor changes following a squared curve form with the frequency in the area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. The motor runs under magnetized below the field weakening point and produces less torque and electromechanical noise. A squared V/Hz ratio can be used in applications where the torque demand of the load is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

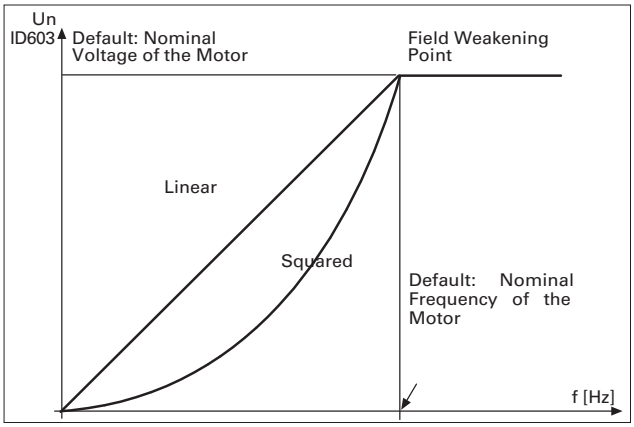


Figure 8.1. Linear and squared change of motor voltage

Programmable V/Hz curve:

2. The V/Hz curve can be programmed with three different points. A programmable V/Hz curve can be used if the other settings do not satisfy the needs of the application.

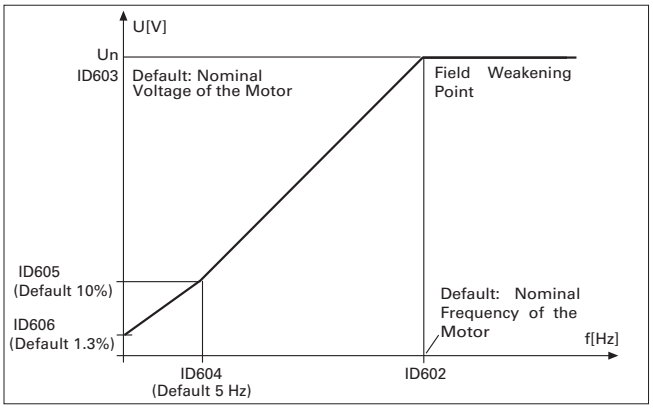


Figure 8.2. Programmable V/Hz curve

Linear with flux optimization:

3. The frequency converter starts to search for the minimum motor current in order to save energy, lower the disturbance level and the noise. This function can be used in applications with constant motor load, such as fans, pumps, etc.

Code	ID	Parameter	Notes
(P1.1.16, P1.6.2)	109	**V/Hz optimization** **Automatic torque boost** The voltage to the motor changes automatically which makes the motor produce sufficient torque to start and run at low frequencies. The voltage increase depends on the motor type and power. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors. Example: What changes are required to start the load from 0 Hz? • First set the motor nominal values (Parameter group 1.1). Option 1: Activate the Automatic torque boost. Option 2: Programmable V/Hz curve. To obtain the required torque, the zero point voltage and midpoint voltage/frequency (in parameter group 1.6) need to be set, so that the motor can draw enough current at the low frequencies. First set parameter ID108 to Programmable V/Hz curve (value 2). Increase the zero point voltage (ID606) to get enough current at zero speed. Then set the midpoint voltage (ID605) to 1.4142*ID606 and the midpoint frequency (ID604) to value ID606/100%*ID111	In high torque — low speed applications — it is likely that the motor will overheat. If the motor has to run a prolonged time under these conditions, special attention must be paid to cooling the motor. Use external cooling for the motor if the temperature tends to rise too high.
(P1.6, P1.1.6)	110	**Nominal voltage of the motor** Find this value V_n on the rating plate of the motor. This parameter sets the voltage at the field weakening point (ID603) to 100%* V_nMotor.	
(P1.7, P1.1.7)	111	**Nominal frequency of the motor** Find this value f_n on the rating plate of the motor. This parameter sets the field weakening point (ID602) to the same value.	
(P1.8, P1.1.8)	112	**Nominal speed of the motor** Find this value n_n on the rating plate of the motor.	
(P1.9, P1.1.9)	113	**Nominal current of the motor** Find this value I_n on the rating plate of the motor.	
(P1.1.16)	118	**PID controller gain** This parameter defines the gain of the PID controller. If the value of the parameter is set to 100% a change of 10% in the error value causes the controller output to change by 10%. If the parameter value is set to 0 the PID controller operates as ID-controller. See the examples on **Page 91.**	
(P1.1.19, P1.1.17)	119	**PID controller I-time** ID119 defines the integration time of the PID controller. If this parameter is set to 1.00 second, a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00 s the PID controller will operate as PD controller. See the examples on **Page 91.**	
(P1.1.10)	120	**Motor power factor** Find this value "Power Factor" on the rating plate of the motor.	
(P1.1.17, P1.1.25, P1.1.23)	124	**Jogging speed reference** Defines the jogging speed selected with the DIN3 digital input which can be programmed for Jogging speed. See parameter ID301. This parameter's value is automatically limited between minimum and maximum frequency (ID101 and ID102)	
(P1.1.20)	127	**Preset speed 3**	
(P1.1.21)	124	**Preset speed 4**	
(P1.1.22)	128	**Preset speed 5**	
(P1.1.23)	129	**Preset speed 6**	
(P1.1.24)	130	**Preset speed 7** These parameter values define the Multi-step speeds selected with the DIN3, DIN4, DIN5 and DIN6 digital inputs. See also parameters ID105 and ID106. These parameter values are automatically limited between minimum and maximum frequency (ID101 and ID102).	

Code	Id	Descriptions	Notes

(P1.1.24) **130**

Table 8-2. Preset speeds 3 to 7

Speed	Multi-step speed select 1 (DIN4)	Multi-step speed select 2 (DIN5)	Multi-step speed select 3 (DIN6)	Multi-step speed select 4 (DIN3)
Basic speed	0	0	0	0
P1.1.20 (3)	1	1	0	0
P1.1.21 (4)	0	0	1	0
P1.1.22 (5)	1	0	1	0
P1.1.23 (6)	0	1	1	0
P1.1.24 (7)	1	1	1	0

(P1.1.20, P1.1.18) **132**

PID controller D-time

ID132 defines the derivative time of the PID controller. If this parameter is set to 1.00 second a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%. If the parameter value is set to 0.00 s the PID controller will operate as PI controller. See examples below.

Example 1:

In order to reduce the error value to zero, with the given values, the frequency converter output behaves as follows:

Given values:

ID 118, P = 0%

ID 119, I-time = 1.00 s

ID 132, D-time = 0.00 s

Min freq. = 0 Hz

Error value (setpoint - process value) = 10.00%

Max freq. = 60 Hz

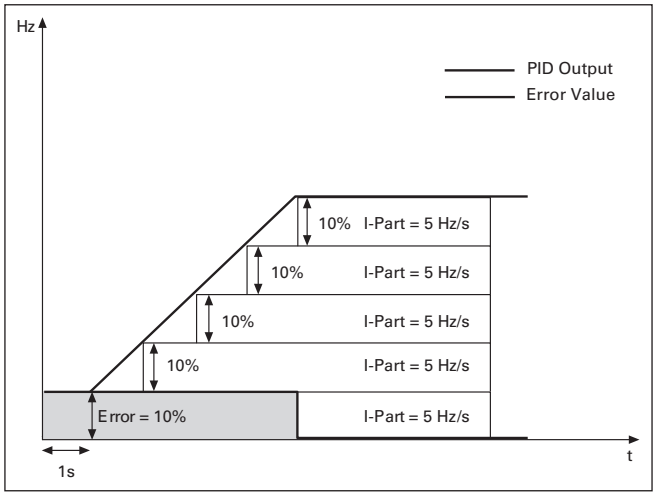


Figure 8.3. PID controller function as I-Controller

Code	Id	Descriptions	Notes
(P1.1.20, P1.1.18)	132	***Example 2:*** Given values: ID 118, P = 100% ID 119, I-time = 1.00 s ID 132, D-time = 1.00 s Min freq. = 0 Hz Error value (setpoint - process value) = ±10% Max freq. = 60 Hz As the power is switched on, the system detects the difference between the setpoint and the actual process value and starts to either raise or decrease (in case the error value is negative) the PID output according to the I-time. Once the difference between the setpoint and the process value has been reduced to 0, the output is reduced by the amount corresponding to the value of ID 119. In case the error value is negative, the frequency converter reacts reducing the output correspondingly. See **Figure 8.4.**	

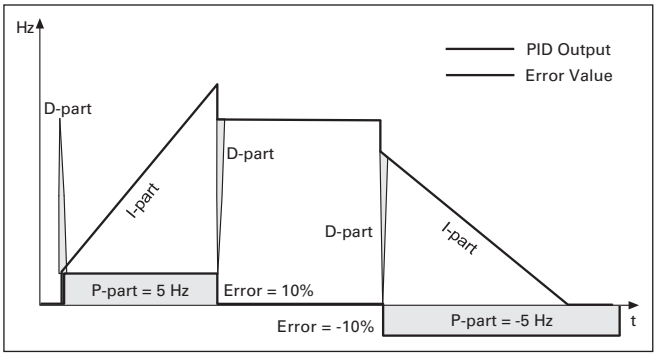


Figure 8.4. PID output curve with the values of example 2

Example 3:

Given values:
ID 118, P = 100%
ID 119, I-time = 0.00 s
ID 132, D-time = 1.00 s
Min freq. = 0 Hz
Error value (setpoint - process value) = ±10%/s
Max freq. = 60 Hz
As the error value increases, the PID output also increases according to the set values (D-time = 1.00s)

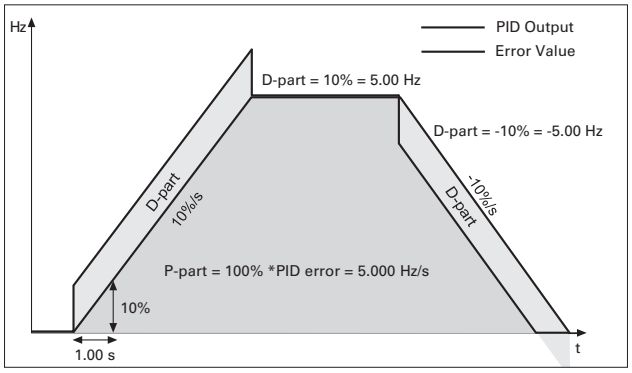


Figure 8.5. Pid output curve with the values of example 3

Code	Id	Descriptions	Notes
(P1.1.25)	133	**Preset speed 8**	
(P1.1.26)	134	**Preset speed 9**	
(P1.1.27)	135	**Preset speed 10**	
(P1.1.28)	136	**Preset speed 11**	
(P1.1.29)	137	**Preset speed 12**	
(P1.1.30)	138	**Preset speed 13**	
(P1.1.31)	139	**Preset speed 14**	
(P1.1.32)	140	**Preset speed 15**	

Table 8-3. Preset speed Multi-step speed selections with digital inputs DIN3, DIN4, DIN5 and DIN6

Speed	Multi-step speed select 1 (DIN4)	Multi-step speed select 2 (DIN5)	Multi-step speed select 3 (DIN6)	Multi-step speed select 4 (DIN3)
P1.1.25 (8)	0	0	0	1
P1.1.26 (9)	1	0	0	1
P1.1.27 (10)	0	1	0	1
P1.1.28 (11)	1	1	0	1
P1.1.29 (12)	0	0	1	1
P1.1.30 (13)	1	0	1	1
P1.1.31 (14)	0	1	1	1
P1.1.32 (15)	1	1	1	1

(P1.2.34, P1.2.4.1)	141	**AI3 signal selection** Connect the AI3 signal to the analog input of your choice with this parameter. For more information, See **Page 55**, "Terminal to Function" (TTF) programming principle.	
(P1.2.37, P1.2.4.2)	142	**AI3 signal filter time** When this parameter is given a value greater than 0, the function that filters out disturbances from the incoming analog signal is activated. A long filtering time makes the regulation response slower. See ID324.	
(P1.2.35, P1.2.4.3)	143	**AI3 signal range** With this parameter you can select the AI3 signal range.	

Table 8-4. Selections for ID143

Application			
Select	**5**	**6**	**7**
0	0 – 100%	0 – 100%	0 – 100%
1	20 – 100%	20 – 100%	20 – 100%
2	–	-10 – +10V	Customized
3	–	Customized	

(P1.2.4.4)	144	**AI3 custom setting minimum**	
(P1.2.4.5)	145	**AI3 custom setting maximum** Set the custom minimum and maximum levels for the AI3 signal from 0 to 100%.	
(P1.2.36, P1.2.4.6)	151	**AI3 signal inversion** 0 = No inversion 1 = Signal inverted	
(P1.2.38, P1.2.5.1)	152	**AI4 signal selection** See ID13641.	
(P1.2.41, P1.2.5.2)	153	**AI4 filter time** See ID142.	
(P1.2.5.3)	154	**AI4 filter time** See ID143.	

Code	Id	Descriptions	Notes
(P1.2.5.4)	155	**AI4 custom setting minimum**	
(P1.2.5.5)	156	**AI4 custom setting maximum** See ID144 and ID145.	
(P1.2.40, P1.2.5.6)	162	**AI4 signal inversion** See ID151.	
(P1.2.7.20)	164	**Motor control mode 1/2** Contact is open = Motor control mode 1 is selected. Contact is closed = Motor control mode 2 is selected. See ID600 and ID521.	
(P1.2.2.11)	165	**AI1 joystick offset** Define the frequency zero point as follows: With this parameter being displayed, place the potentiometer at the assumed zero point and press ENTER on the keypad.	This will not change the reference scaling. Press the RESET button to change the parameter value back to 0.00%.
(P1.2.3.11)	166	**AI2 joystick offset** See ID165.	
(P1.3.3.27)	169	**Fieldbus input data (FBFixedControlWord, bit 6)**	
(P1.3.3.28)	170	**Fieldbus input data 5 (FBFixedControlWord, bit 7)** The data from the fieldbus (FBFixedControlWord) can be led to the digital outputs of the frequency converter.	
	171 & 172	**Local & remote control place** The active control place can be changed by pressing the LOC/REM button on the keypad. There are two different places which the frequency converter can be controlled from, Local and Remote. For each control place the actual control source is selected with this parameter, a different symbol will appear on the alphanumeric display.	

Table 8-5. Selections for ID171 and ID172

Control source	Symbol
I/O terminals	
Keypad (panel)	
Fieldbus	

Code	Id	Descriptions	Notes
	173 & 174	**Local & remote reference & selection** Defines which frequency reference source is selected when controlled from the keypad.	

Table 8-6. Selections for ID173, ID174 and ID175

Application				
Select	**2 - 4**	**5**	**6**	**7**
0	Analog voltage ref. Terminals 2 - 3	Analog voltage ref. Terminals 2 - 3	Analog voltage ref. Terminals 2 - 3	Analog voltage ref. Terminals 2 - 3
1	Analog current ref. Terminals 4 - 5	Analog current ref. Terminals 4 - 5	Analog current ref. Terminals 4 - 5	Analog current ref. Terminals 4 - 5
2	Keypad reference (Menu M2)	AI3	AI1+AI2	AI3
3	Fieldbus reference	AI4	AI1 - AI2	AI4
4	Motor potentiometer (App #3 only)	Keypad reference (Menu M2)	AI2 - AI1	Keypad reference (Menu M2)
5	–	Fieldbus reference	AI1 x AI2	Fieldbus reference
6	–	Potentiometer ref.	AI1 joystick	Potentiometer ref.
7	–	PID controller ref.	AI2 joystick	PID controller ref.
8	–	–	Keypad reference (Menu M2)	–
9	–	–	Fieldbus reference	–
10	–	–	Potentiometer reference; controlled with DIN5 (TRUE = increase) and DIN6 (TRUE = decrease)	–
11	–	–	AI1 or AI2, whichever is lower	–
12	–	–	AI1 or AI2, whichever is greater	–
13	–	–	Max. frequency (recommended in torque control only)	–
14	–	–	AI1/AI2 selection	–
FB Speed reference				

(P1.2.1, P1.2.1.1)	**300**	**Start/Stop logic selection** 0 DIN1: closed contact = start forward DIN2: closed contact = start reverse	

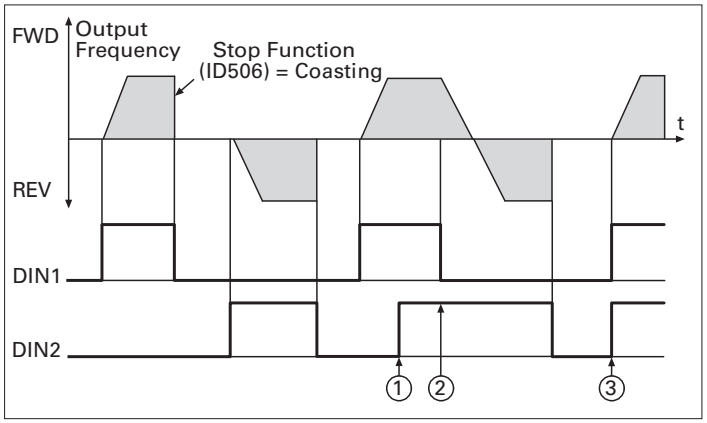


Figure 8.6. Start forward/start reverse

Code	Id	Descriptions	Notes
(P1.2.1, P1.2.1.1)	**300**	The first selected direction has the highest priority. When the DIN1 contact opens the direction of rotation starts to change. If Start forward (DIN1) and Start reverse (DIN2) signals are active simultaneously the Start forward signal (DIN1) has priority. 1. DIN1: closed contact = start — open contact = stop DIN2: closed contact = reverse — open contact = forward, see **Figure 8.7.**	

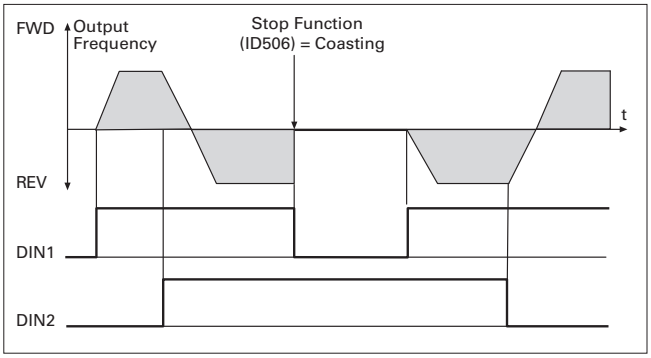


Figure 8.7. Start, stop and reverse

2. DIN1: closed contact = start — open contact = stop
   DIN2: closed contact = start enabled — open contact = start disabled and drive stopped if running, see **Figure 8.8.**
3. 3-wire connection (pulse control):
   DIN1: closed contact = start pulse
   DIN2: open contact = stop pulse
   (DIN3 can be programmed for reverse command), see **Figure 8.8.**

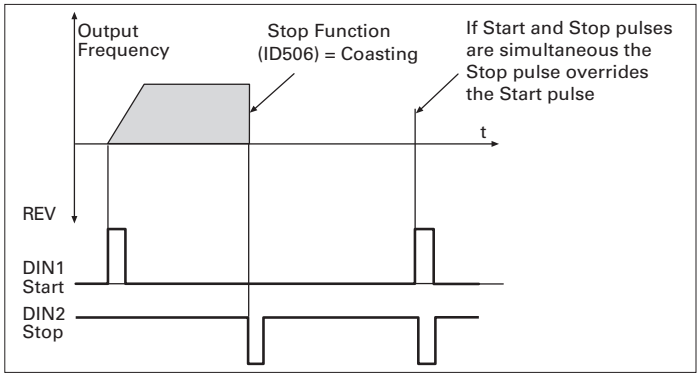


Figure 8.8. Start pulse/stop pulse

The selections including the text **"Rising edge required to start"** shall be used to exclude the possibility of an unintentional start when, for example, power is connected, re-connected after a power failure, after a fault reset, after the drive is stopped by Run Enable (Run Enable = False) or when the control place is changed. The Start/Stop contact must be opened before the motor can be started.

Applications 2 and 4:

4 DIN1: closed contact = start forward (Rising edge required to start)
DIN2: closed contact = start reverse (Rising edge required to start)

5 DIN1: closed contact = start (Rising edge required to start) open contact = stop
DIN2: closed contact = reverse — open contact = forward

6 DIN1: closed contact = start (Rising edge required to start) open contact = stop
DIN2: closed contact = start enabled — open contact = start disabled and drive stopped if running

Code	Id	Descriptions	Notes
(P1.2.1, P1.2.1.1)	300	The selections including the text "Rising edge required to start" shall be used to exclude the possibility of an unintentional start when, for example, power is connected, re-connected after a power failure, after a fault reset, after the drive is stopped by Run Enable (Run Enable = False) or when the control place is changed. The Start/Stop contact must be opened before the motor can be started. **Applications 2 and 4:** 4 DIN1: closed contact = start forward (Rising edge required to start) DIN2: closed contact = start reverse (Rising edge required to start) 5 DIN1: closed contact = start (Rising edge required to start) open contact = stop DIN2: closed contact = reverse — open contact = forward 6 DIN1: closed contact = start (Rising edge required to start) open contact = stop DIN2: closed contact = start enabled — open contact = start disabled and drive stopped if running **Application 3 and 6:** 4 DIN1: closed contact = start forward DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if ID174 is set to 3 or 4). 5 DIN1: closed contact` = start forward (Rising edge required to start) DIN2: closed contact = start reverse (Rising edge required to start) 6 DIN1: closed contact = start (Rising edge required to start) open contact = stop DIN2: closed contact = reverse — open contact = forward 7 DIN1: closed contact = start (Rising edge required to start) open contact = stop DIN2: closed contact = start enabled — open contact = start disabled and drive stopped if running **Application 3:** 8 DIN1: closed contact = start forward (Rising edge required to start) DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if ID174 is set to 3 or 4).	
(P1.2.2)	301	**DIN3 function** 0 Not used 1 External fault, closing contact = Fault is shown and motor is stopped when the input is active 2 External fault, opening contact = Fault is shown and motor is stopped when the input is not active 3 Run enable: contact open = Motor start disabled and the motor is stopped contact closed = Motor start enabled **Applications 2 to 5:** 4 Acc./Dec. time select: contact open = Acceleration/deceleration time 1 selected contact closed = Acceleration/deceleration time 2 selected 5 Closing contact: Force control place to I/O terminal 6 Closing contact: Force control place to keypad 7 Closing contact: Force control place to fieldbus When the control place is forced to change, the values of Start/Stop, Direction and Reference valid in the respective control place are used (reference according to parameters ID173 and ID174). **Applications 2 to 5:** 8 Reverse: Contact open = Forward Contact closed = Reverse	The value of ID125 keypad control place does not change. When DIN3 opens the control place is selected according to parameter 3.1. Can be used for reversing if ID300 has a value of 3.

Code	Id	Descriptions	Notes
(P1.2.2)	301	**Applications 3 to 5:** 9 Jogging speed, contact closed = Jogging speed selected for frequency reference 10 Fault reset, contact closed = Resets all faults 11 Acc./dec. operation prohibited, contact closed = Stops acceleration or deceleration until the contact is opened 12 DC-braking command, contact closed = In Stop mode, the DC-braking operates until the contact is opened, see **Figure 8.9.** **Applications 3 and 5:** 13 Motor potentiometer down, contact closed = Reference decreases until the contact is opened **Application 4:** 13 Preset speed	

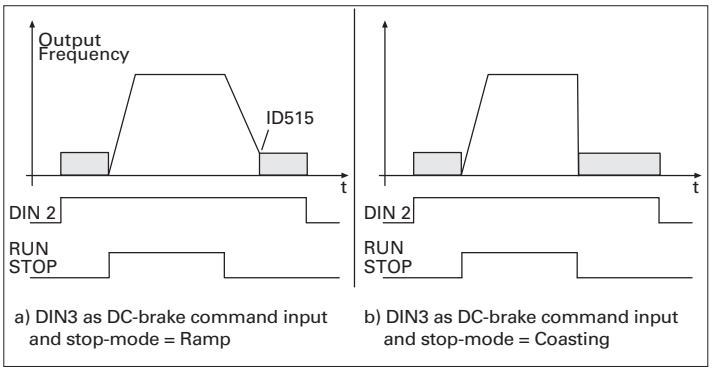


Figure 8.9. DIN3 as DC-brake command input
a) Stop mode = ramp, b) Stop mode = coasting

(P1.2.3)	302	**Reference offset for current input** 0 No offset: 0 - 20 mA 1 Offset: 4 mA ("living zero") provides supervision of zero level signal. In the Standard Application, the response to reference fault can be programmed with ID700.	
(P1.2.4, P1.2.13, P1.2.2.6)	303	**Reference scaling, minimum value**	
(P1.2.5,P1.2.14,P1.2.2.7)	304	**Reference scaling, maximum value** Setting value limits: 0 ≤ ID303 ≤ ID304 ≤ ID102. If ID303 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.	

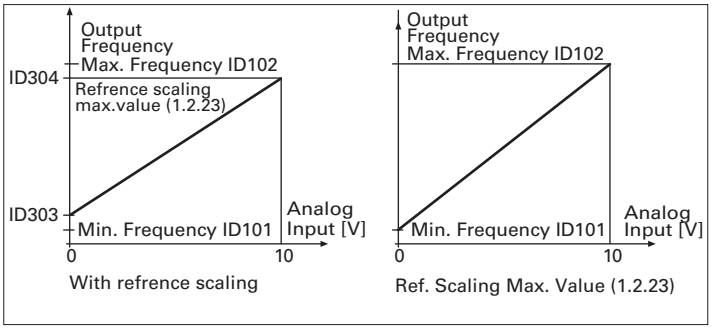


Figure 8.10. With and without reference scaling
Left: Reference scaling, Right: No scaling used (ID303 = 0)

Code	Id	Descriptions	Notes
(P1.2.6)	305	**Reference inversion** Inverts reference signal: Max. ref. signal = Min. set freq. Min. ref. signal = Max. set freq. 0 No inversion 1 Reference inverted	

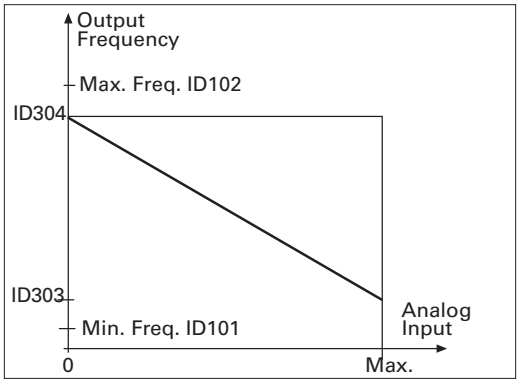


Figure 8.11. Reference inversion

(P1.2.7)	306	**Reference filter time** Filters out disturbances from the incoming analog V_{in} signal. A long filtering time makes regulation response slower.	

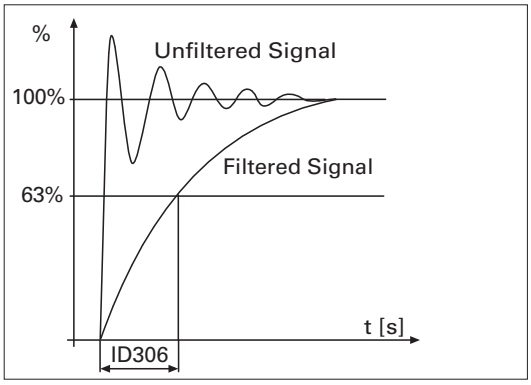


Figure 8.12. Reference filtering

(P1.3.2, P1.3.5.2, P1.3.3.2)	307	**Analog output function** This parameter selects the desired function for the analog output signal. See the specific parameters for the values available in each respective application.	
(P1.3.3, P1.3.5.3, P1.3.3.3)	308	**Analog output filter time** Defines the filtering time for the analog output signal. Setting this parameter value to 0.00 will deactivate filtering.	

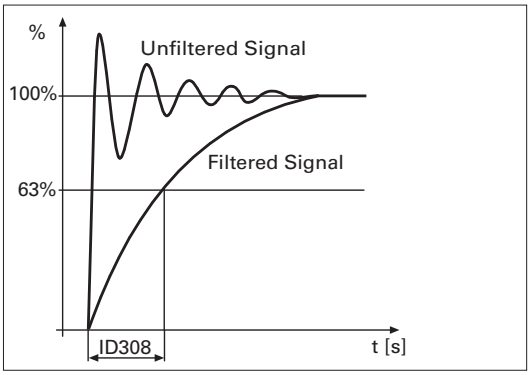


Figure 8.13. Analog output filtering

Code	Id	Descriptions	Notes
(P1.3.4, P1.3.5.4, P1.3.3.4)	309	**Analog output inversion** Inverts the analog output signal: Maximum output signal = Minimum set value Minimum output signal = Maximum set value See ID311 in **Figure 8.14.**	

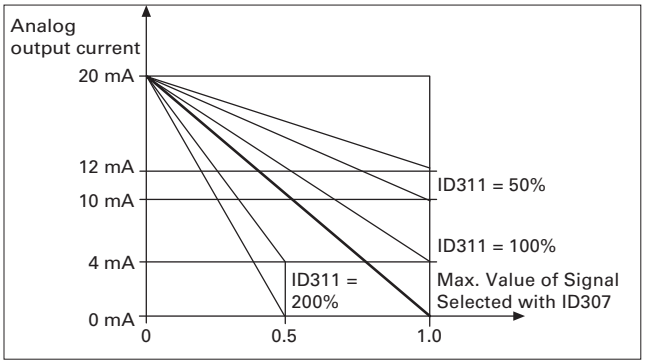


Figure 8.14. Analog output invert

(P1.3.5, P1.3.5.5, P1.3.3.5)	310	**Analog output minimum** Defines the signal minimum to be either 0 mA or 4 mA ("living zero"). 0 Set minimum value to 0 mA 1 Set minimum value to 4 mA	The difference in analog output scaling in ID311 **Figure 8.15.**
(P1.3.6, P1.3.5.6, P1.3.3.6)	311	**Analog output scale** Scaling factor for analog output.	

Table 8.7: Analog output scaling

Signal	Max. value of the signal
Output frequency	Max frequency (ID102)
Freq. Reference	Max frequency (ID102)
Motor speed	Motor nom. speed 1xnmMotor
Output current	Motor nom. current 1xInMotor
Motor torque	Motor nom. torque 1xTnMotor
Motor power	Motor nom. power 1xPnMotor
Motor voltage	100% x VnMotor
DC-link voltage	1000 V
PI-ref. value	100% x ref. value max.
PI act. value 1	100% x actual value max.
PI act. value 2	100% x actual value max.
PI error value	100% x error value max.
PI output	100% x output max.

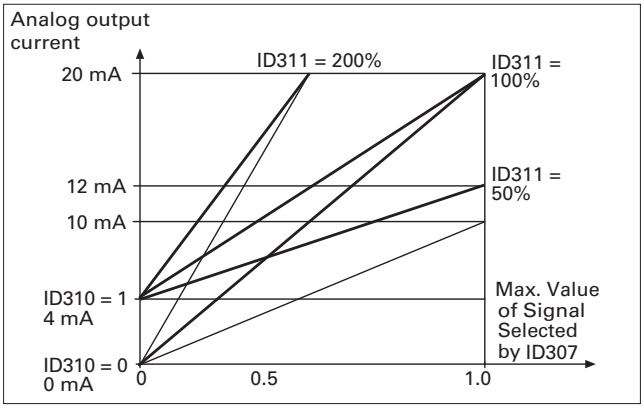
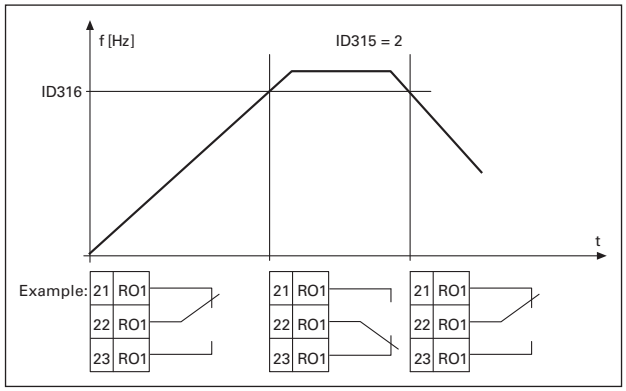


Figure 8.15. Analog output scaling

Code	Id	Descriptions	Notes
(P1.3.7, P1.3.1.2)	**312**	**Digital output function**	
(P1.3.8)	**313**	**Relay output 1 function**	
(P1.3.9)	**314**	**Relay output 2 function**	

Table 8.8: Output signals via DO1 and output relays RO1 and RO2

Setting value	Signal content
0 = Not used	Out of operation
Digital output DO1 sinks current and programmable relay (RO1, RO2) is activated when:	
1 = Ready	The frequency converter is ready to operate
2 = Run	The frequency converter is operating (motor is running)
3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip not occurred
5 = Overheat warning	The heat-sink temperature exceeds +70°C
6 = External fault or warning	Fault or warning depending on ID701
7 = Reference fault or warning	Fault or warning depending on ID700 • If analog reference is 4 - 20 mA and signal is <4 mA
8 = Warning	Always if a warning exists
9 = Reversed	The reverse command has been selected
10 = Preset speed 1 (Application **2**) 10 = Jogging speed (Applications **3456**)	The preset speed has been selected with digital input The jogging speed has been selected with digital input
11 = At speed	The output frequency has reached the set reference
12 = Motor regulator activated	Overvoltage or overcurrent regulator was activated
13 = Output frequency limit supervision	The output frequency is outside the set supervision low limit/high limit (ID315 and ID316)
14 = Control from I/O terminals (Application **2**) 14 = Output frequency limit 2 supervision (Applications **3456**)	I/O control mode selected (in menu **M2**) The output frequency goes outside the set supervision low limit/ high limit (ID346 and ID347)
15 = Thermistor fault or warning (Application **2**) 15 = Torque limit supervision (Applications **3456**)	The thermistor input of option board indicates overtemperature. Fault or warning depending on ID732. The motor torque is beyond the set supervision low limit/ high limit (ID348 and ID349).
16 = Fieldbus input data (Application **2**) 16 = Reference limit supervision (Applications **3456**)	Fieldbus input data (FBFixedControlWord) to DO/RO. Active reference goes beyond the set supervision low limit/ high limit (ID350 and ID351)
17 = External brake control (Applications **3456**)	External brake ON/OFF control with programmable delay (ID352 and ID353)
18 = Control from I/O terminals (Applications **3456**)	External control mode (Menu **M2**; ID125)
19 = Frequency converter temperature limit supervision (Applications **3456**)	Frequency converter heatsink temperature goes beyond the set supervision limits (ID354 and ID355).
20 = Unrequested rotation direction (Applications **3456**) 20 = Reference inverted (Application **6**)	Rotation direction is different from the requested one.
21 = External brake control inverted (Applications **3456**)	External brake ON/OFF control (ID352 and ID353); Output active when brake control is OFF
22 = Thermistor fault or warning (Applications **3456**)	The thermistor input of option board indicates overtemperature. Fault or warning depending on ID732.
23 = Fieldbus input data (Application **5**) 23 = On/Off control (Application 6)	Fieldbus input data (FBFixedControlWord) to DO/RO. Selects the analog input to be monitored. (ID356, ID357, ID358 and ID463)
24 = Fieldbus input data 1 (Application **6**)	Fieldbus data (FBFixedControlWord) to DO/RO
25 = Fieldbus input data 2 (Application **6**)	Fieldbus data (FBFixedControlWord) to DO/RO
26 = Fieldbus input data 3 (Application **6**)	Fieldbus data (FBFixedControlWord) to DO/RO

Code	Id	Descriptions	Notes
(P1.3.10, P1.3.4.1, P1.3.2.1)	315	**Output frequency limit supervision function** 0 No supervision 1 Low limit supervision 2 High limit supervision 3 Brake-on control (Application **6** only, See **Page 145**.) If the output frequency goes under/over the set limit (ID316) this function generates a warning message via the digital output DO1 or via the relay outputs RO1 or RO2 depending on the settings of ID312 to ID314.	
(P1.3.11, P1.3.4.2, P1.3.2.2)	316	**Output frequency limit supervision value** Selects the frequency value supervised by ID315. See **Figure 8.16**  **Figure 8.16. Output frequesncy supervision**	
(P1.2.1)	319	**DIN2 function 5** This parameter has 14 selections. If digital input DIN2 is not used, set this value to 0. 0 Not used 1 External fault: Contact closed = Fault is displayed and the motor stopped when the input is active 2 External fault: Contact open = Fault is displayed and the motor stopped when the input is not active 3 Run enable: 4 Acceleration or deceleration time selection: Contact open = Acceleration/Deceleration time 1 selected Contact closed = Acceleration/Deceleration time 2 selected 5 Closing contact: Force control place to I/O terminal 6 Closing contact: Force control place to keypad 7 Closing contact: Force control place to fieldbus When the control place is forced to change, the values of Start/Stop,Direction and the Reference valid in the respective control place, are used (reference according to ID343, ID121 and ID122). 8 Reverse: Contact open = Forward Contact closed = Reverse 9 Jog speed (see ID124) Contact closed = Jogging speed selected for frequency reference 10 Fault reset Contact closed = All faults reset 11 Acceleration/Deceleration prohibited: Contact closed = No acceleration or deceleration possible until the contact is opened 12 DC braking command: Contact closed = In Stop mode, the DC braking operates until the contact is opened. **See Figure 8.17.**	The value of ID125 (Keypad Control Place) does not change. When DIN2 opens the control place is selected according to keypad control place selection. If several inputs are programmed to reverse, one active contact is enough to set the direction to reverse.

Code	Id	Descriptions	Notes
(P1.2.1)	319	13 Motor potentiometer UP: Contact closed = Reference increases until the contact is opened.	

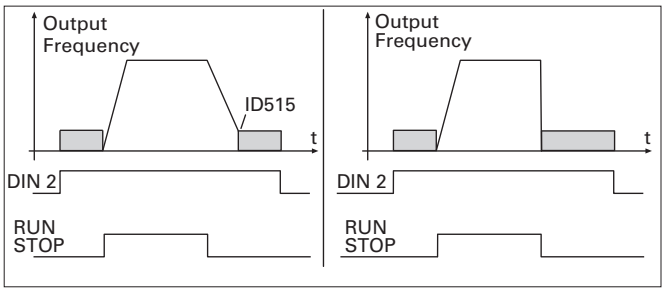


Figure 8.17. DC braking command (selection 12) selected for DIN2
Left: stop mode = ramp, right: stop mode = coasting

(P1.2.13, P1.2.2.3)	320	**AI1 signal range**	

Table 8.9. Selections for ID320

Application

Select	3, 4, 5	6	7
0	0 - 100%	0 - 100%	0 - 100%
1	20 - 100%	20 - 100%	20 - 100%
2	Customized	-10 - +10V	Customized
3	–	Customized	–

For selection "Customized", see ID321 and ID322.

(P1.2.14, P1.2.2.4)	321	**AI1 custom setting minimum**	
(P1.2.15, P1.2.2.5)	322	**AI1 custom setting maximum** These parameters set the analog input signal for any input signal span within 0 - 100%.	
(P1.2.4, P1.2.16, P1.2.2.6)	323	**AI1 signal inversion** If this parameter = 0 no inversion of analog V_{in} signal takes place.	In Application 3, AI1 is place B frequency reference if parameter ID131 = 0 (default).

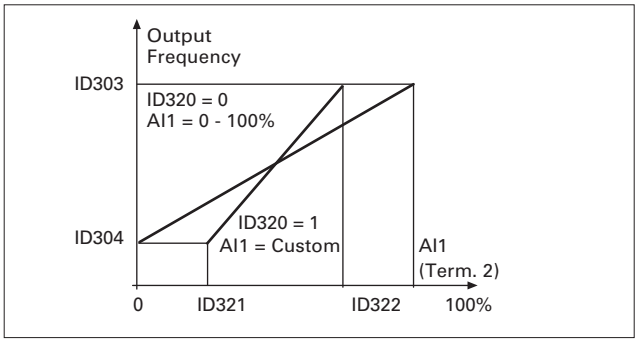


Figure 8.18. AI1 no signal inversion

Code	Id	Descriptions	Notes
(P1.2.4, P1.2.16, P1.2.2.6)	323	**AI1 signal inversion** If this parameter = 1 inversion of analog signal takes place max. AI1 signal = minimum set speed min. AI1 signal = maximum set speed	In Application 3, AI1 is place B frequency reference if parameter ID131 = 0 (default).

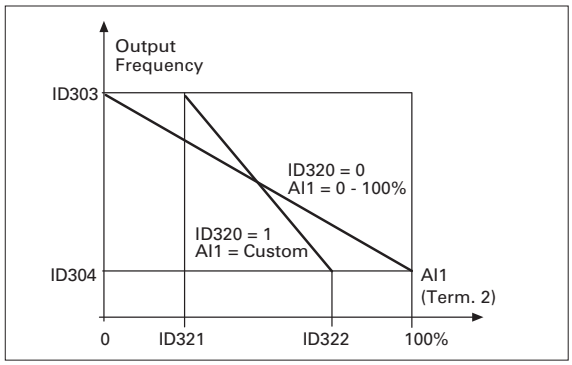


Figure 8.19. AI1 signal inversion

(P1.2.5, P1.2.17, P1.2.2.2)	324	**AI1 signal filter time** When this parameter is given a value greater than 0, the function that filters out disturbances from the incoming analog signal is activated. A long filtering time makes the regulation response slower. See **Figure 8.20.**	

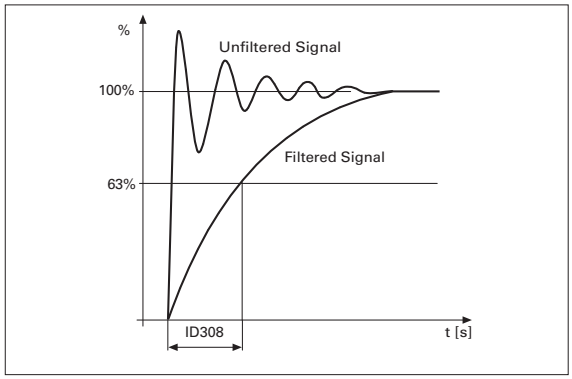


Figure 8.20. AI1 signal filtering

(P1.2.7, P1.2.19, P1.2.3.3)	325	**Analog input AI2 signal range**	

Table 8.10: Selections for Parameter ID325

Application				
Select	**3, 4**	**5**	**6**	**7**
0	0 - 20 mA	0 - 20 mA	0 - 100%	0 - 100%
1	4 - 20 mA	4 mA/ 20 - 100%	20 - 100%	20 - 100%
2	Customized	Customized	-10 - +10V	Customized
3	–	–	Customized	–

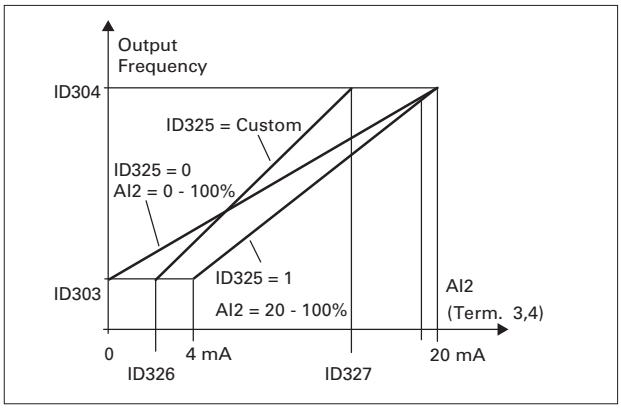
Code	Id	Descriptions	Notes
(P1.2.7, P1.2.19, P1.2.3.3)	325	 **Figure 8.21. Analog input AI2 scaling**	
(P1.2.8, P1.2.20, P1.2.3.4)	326	**Analog input AI2 custom setting min**	
(P1.2.9, P1.2.21, P1.2.3.5)	327	**Analog input AI2 custom setting max.** These parameters set AI2 for any input signal span within 0 - 100%	
(P1.2.10, P1.2.22, P1.2.3.6)	328	**Analog input AI2 inversion** See ID323.	In Application 3, AI2 is the place A frequency reference, if ID117 = 1 (default)
(P1.2.11, P1.2.23, P1.2.3.2)	329	**Analog input AI2 (I_{in}) filter time** See ID324.	
(P1.2.3)	330	**DIN5 function** The digital input DIN5 has 14 possible functions. If it is not used, set the value to 0. The selections are the same as in ID319 except: **13** Enable PID reference 2: Contact open = PID controller reference selected with ID332 Contact closed = PID controller keypad reference 2 selected with parameter R2.5	
(P1.2.15, P1.2.24, P1.2.1.2, P1.2.1.12)	331	**Motor potentiometer ramp time** Defines the speed of change of the motor potentiometer value.	
(P1.1.17, P1.1.15)	332	**PID controller reference signal (Place A)** Defines which frequency reference place is selected for the PID controller.	

Table 8.11. Selections for ID332

Application		
Select	**5**	**7**
0	AI1; terminals 2 - 3	AI1; terminals 2 - 3
1	AI2; terminals 4 - 5	AI2; terminals 4 - 5
2	PID ref. from menu M2, parameter R24	AI3
3	Fieldbus reference (FBProcessDataIN1)	AI4
4	Motor potentiometer reference	PID ref. from menu M2, parameter R24
5	–	Fieldbus reference (FBProcessDataIN1)
6	–	Motor potentiometer reference

Code	Id	Descriptions	Notes
(P1.2.5, P1.2.1.5)	**333**	**PID controller actual value selection** This parameter selects the PID controller actual value. 0 Actual value 1 1 Actual value 1 + Actual value 2 2 Actual value 1 - Actual value 2 3 Actual value 1 * Actual value 2 4 Greater one of Actual value 1 and Actual value 2 5 Smaller one of Actual value 1 and Actual value 2 6 Mean value of Actual value 1 and Actual value 2 7 Square root of Actual value 1 + Square root of Actual value 2	
(P1.2.6, P1.2.1.6)	**334**	**Actual value 1 selection**	
(P1.2.7, P1.2.1.7)	**335**	**Actual value 2 selection** 0 Not used 1 AI1 (control board) 2 AI2 (control board) 3 AI3 4 AI4 5 Fieldbus (Actual value 1: FBProcessDataIN2; Actual value 2: FBProcessDataIN3) **Application 5:** 6 Motor torque 7 Motor speed 8 Motor current 9 Motor power 10 Encoder frequency (for Actual value 1 only)	
(P1.2.8, P1.2.1.8)	**336**	**Actual value 1 minimum scale** Sets the minimum scaling point for Actual value 1. See **Figure 8.22.**	
(P1.2.9, P1.2.1.9)	**337**	**Actual value 1 maximum scale** Sets the maximum scaling point for Actual value 1. See **Figure 8.22**	
(P1.2.10, P1.2.1.10)	**338**	**Actual value 2 minimum scale** Sets the minimum scaling point for Actual value 2. See **Figure 8.22**.	
(P1.2.11, P1.2.1.11)	**339**	**Actual value 2 maximum scale** Sets the maximum scaling point for Actual value 2. See **Figure 8.22.**	
(P1.2.29, P1.2.1.2)	**340**	**PID error value inversion** This parameter allows you to invert the error value of the PID controller (and thus the operation of the PID controller). 0 No inversion 1 Inverted	

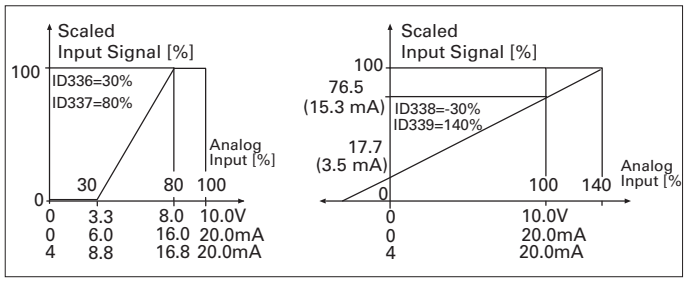


Figure 8.22. Examples of actual value signal scaling

Code	Id	Descriptions	Notes
(P1.2.33, P1.2.1.3)	341	**PID reference rise time** Defines the time during which the PID controller reference rises from 0% to 100%.	
(P1.2.31, P1.2.1.4)	342	**PID reference fall time** Defines the time during which the PID controller reference falls from 100% to 0%.	
(P1.2.32, P1.2.1.15)	344	**Reference scaling minimum value, place B**	
(P1.2.33, P1.2.1.16)	345	**Reference scaling maximum value, place B** You can choose a scaling range for the frequency reference from control place B between the Minimum and Maximum frequency. If no scaling is desired set the parameter value to 0.0. In **Figure 8.23**, input AI1 with signal range 0 - 100% is selected for Place B reference.	

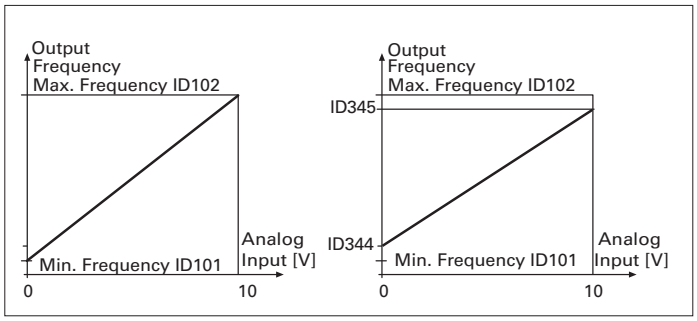


Figure 8.23. Control place B with and without reference scaling
Left: ID344 = 0 (No reference scaling), Right: reference scaling

(P1.3.12, P1.3.4.3, P1.3.2.3)	346	**Output freq. limit 2 supervision function** 0 No supervision 1 Low limit supervision 2 High limit supervision 3 Brake-on control (Application 6 only, See **Page 145**.) 4 Brake-on/off control (Application 6 only, See **Page 145**.) If the output frequency goes under/over the set limit (ID347) this function generates a warning message via the digital output DO1 or relay outputs RO1 or RO2 depending on: 1. The settings of ID312 to ID314 (Applications 3, 4, 5) or … 2. To which output the supervision signals (ID447 and ID448) are connected (Applications 6 and 7).	
(P1.3.13, P1.3.4.4, P1.3.2.4)	347	**Output frequency limit 2 supervision value** Selects the frequency value supervised by ID346. See **Figure 8.16**	
(P1.3.14, P1.3.4.5, P1.3.2.5)	348	**Torque limit, supervision function** 0 No supervision 1 Low limit supervision 2 High limit supervision 3 Brake-off control (Application 6 only, See **Page 145**.) If the calculated torque value falls below or exceeds the set limit (ID349) this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2 depending on: 1. The settings of ID312 to ID314 (Applications 3, 4, 5) or … 2. To which output the supervision signal (ID451) is connected (Applications 6 and 7).	
(P1.3.15, P1.3.4.6, P1.3.2.6)	349	**Torque limit, supervision value** Set here the torque value to be supervised by ID348. **Applications 3 and 4:** The torque supervision value can be reduced below the setpoint with the external free analog input signal, see ID361 and ID362.	

Code	Id	Descriptions	Notes
(P1.3.16, P1.3.4.7, P1.3.2.7)	**350**	**Reference limit, supervision function** 0 No supervision 1 Low limit supervision 2 High limit supervision If the reference value falls below or exceeds the set limit (ID351), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2 depending on: 1. The settings of ID312 to ID314 (Applications 3, 4, 5) or … 2. To which output the supervision signal (ID451) is connected (Applications 6 and 7). The supervised reference is the current active reference. It can be place A or B reference depending on DIN6 input, or panel reference if the panel is the active control place.	
(P1.3.17, P1.3.4.8, P1.3.2.8)	**351**	**Reference limit, supervision value** The frequency value to be supervised by ID350.	
(P1.3.18, P1.3.4.9, P1.3.2.9)	**352**	**External brake-off delay**	
(P1.3.19, P1.3.4.10, P1.3.2.10)	**353**	**External brake-on delay** The function of the external brake can be timed to the start and stop control signals with these parameters. See **Figure 8-24** and **Page 145.** The brake control signal can be programmed via digital output DO1 or via one of the relay outputs RO1 and RO2, see ID312 to ID314 (Applications 3, 4, 5) or ID445 (Applications 6 and 7).	
(P1.3.20, P1.3.4.11, P1.3.2.11)	**354**	**Frequency converter temperature limit supervision** 0 No supervision 1 Low limit supervision 2 High limit supervision If the temperature of the frequency converter unit falls below or exceeds the set limit (ID355), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2 depending on: 1. The settings of ID312 to ID314 (Applications 3, 4, 5) or … 2. To which output the supervision signal (ID451) is connected (Applications 6 and 7).	
(P1.3.21, P1.3.4.12, P1.3.2.12)	**355**	**Frequency converter temperature limit value** This temperature value is supervised by ID354.	
(P1.3.4.13)	**356**	**Analog input supervision input** With this parameter, you can select the analog input to be monitored. 0 Not used 1 AI1 2 AI2 3 AI3 4 AI4	

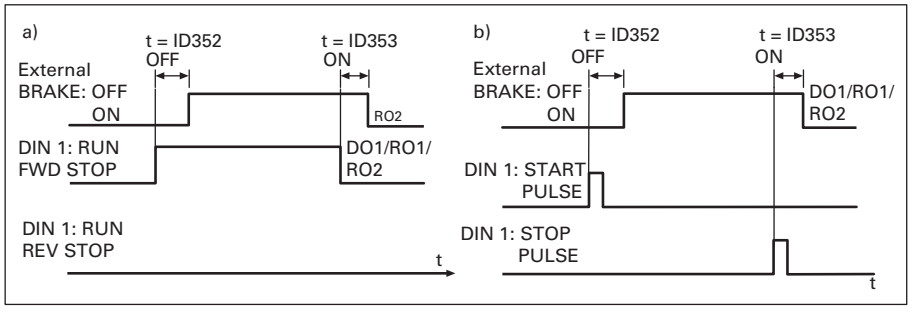


Figure 8.24. External brake control
a) Start/stop logic selection, ID300 = 0, 1 or 2
b) Start/stop logic selection, ID300 = 3

Code	Id	Descriptions	Notes
(P1.3.4.14)	**357**	**Analog input supervision low limit**	
(P1.3.4.15)	**358**	**Analog input supervision high limit** These parameters set the low and high limits of the signal selected with ID356. See **Figure 8.25.**	

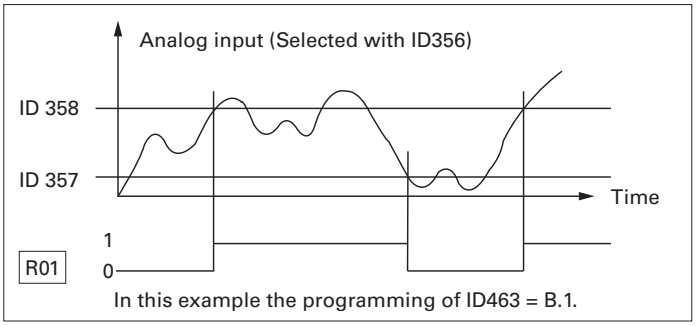


Figure 8.25. An Example of On/Off-control

(P1.2.27)	**359**	**PID controller minimum limit**	
(P1.2.28)	**360**	**PID controller maximum limit** With these parameters, you can set the minimum and maximum limits for the PID controller output. Limit setting: -1000.0% (of f_{max}) < ID359 < ID360 < 1000.0% (of f_{max}). These Limits should equal the limits of the Input signal and will be in engineering units. Example a 0 to 250 PSI transducer is wired to the VFD the min and max limits should be set to 0 and 250 PSi	
(P1.2.12)	**363**	**Start/Stop logic selection, place B** 0 DIN4: closed contact = start forward DIN5: closed contact = start reverse	

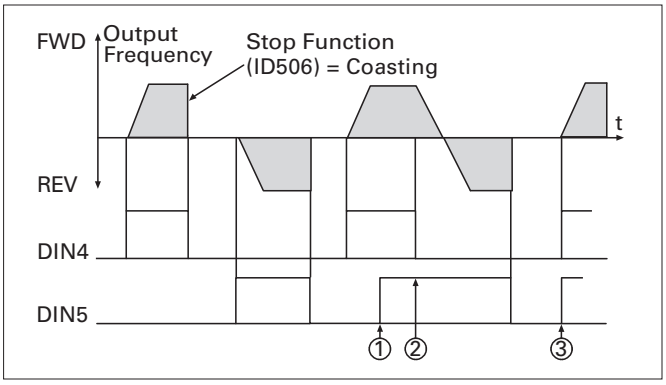


Figure 8.26. Place B start forward/start reverse

Code	Id	Descriptions	Notes
(P1.2.12)	**363**	The first selected direction has the highest priority. When the DIN4 contact opens the direction of rotation starts to change. If Start forward (DIN4) and Start reverse (DIN5) signals are active simultaneously, the Start forward signal (DIN4) has priority. 1 DIN4: closed contact = start — open contact = stop DIN5: closed contact = reverse — open contact = forward see **Figure 8.27.**	

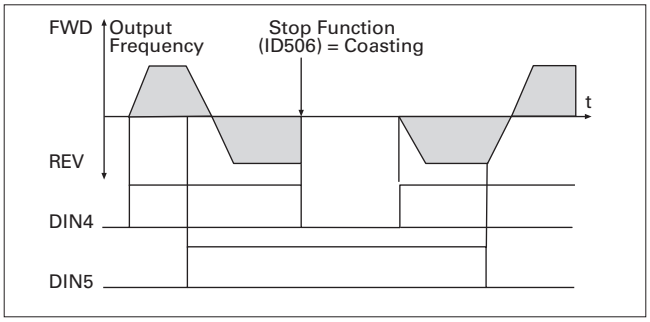


Figure 8.27. Place B start, stop, reverse

2 DIN4: closed contact = start — open contact = stop
DIN5: closed contact = start enabled — open contact = start disabled and drive stopped if running
3 3-wire connection (pulse control):
DIN4: closed contact = start pulse
DIN5: open contact = stop pulse
(DIN3 can be programmed for reverse command) See **Figure 8.28.**

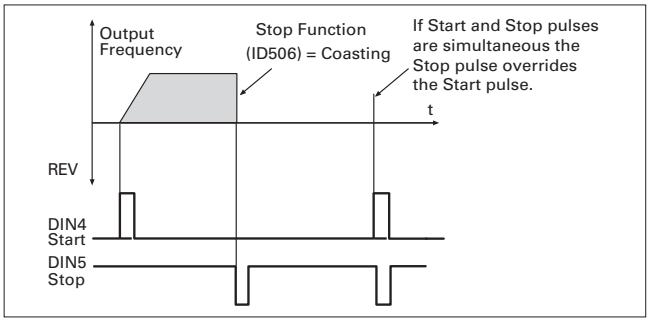


Figure 8.28. Place B start, stop pulse

Selections 4 to 6 are used to exclude the possibility of an unintentional start when, for example, power is connected, re-connected after a power failure, after a fault reset, after the drive is stopped by Run Enable (Run Enable = False) or when the control place is changed. The Start/Stop contact must be opened before the motorcan be started.

4 DIN4: closed contact = start forward **(Rising edge required to start)**
DIN5: closed contact = start reverse **(Rising edge required to start)**
5 DIN4: closed contact = start(Rising edge required to start) —
open contact = stop
DIN5: closed contact = reverse — open contact = forward
6 DIN4: closed contact = start **(Rising edge required to start)** —
open contact = stop
DIN5: closed contact = start enabled — open contact = start disabled and drive stopped if running

(P1.2.16, P1.2.25, P1.2.1.3, P1.2.1.13)	**367**	**Motor potentiometer memory reset (Frequency reference)** 0 No reset 1 Memory reset in stop and power down 2 Memory reset in power down	

Code	Id	Descriptions	Notes
(P1.2.26, P1.2.1.14)	370	**Motor potentiometer memory reset (PID reference)** 0 No reset 1 Memory reset in stop and power down 2 Memory reset in power down	
(P1.2.1.1)	371	**PID reference 2 (Place A additional reference)** If the PID reference 2 enable input function ID330 = TRUE, this parameter defines which reference place is selected as PID controller reference. 0 AI1 reference (terminals 2 and 3, e.g. potentiometer) 1 AI2 reference (terminals 5 and 6, e.g. transducer) 2 AI3 reference 3 AI4 reference 4 PID reference 1 from keypad 5 Reference from Fieldbus (FBProcessDataIN3) 6 Motor potentiometer 7 PID reference 2 from keypad If value 6 is selected for this parameter, the functions Motor potentiometer DOWN and Motor potentiometer UP must be connected to digital inputs (ID417 and ID418).	
(P1.3.5.7, P1.3.3.7)	375	**Analog output offset** Add -100.0 to 100.0% to the analog output.	
(P1.2.4)	376	**PID sum point reference (Place A direct reference)** Defines which reference source is added to PID controller output if PID controller is used. 0 No additional reference (Direct PID output value) 1 PID output + AI1 reference from terminals 2 and 3 (e.g. potentiometer) 2 PID output + AI2 reference from terminals 4 and 5 (e.g. transducer) 3 PID output + PID keypad reference 4 PID output + Fieldbus reference (FBSpeedReference) 5 PID output + Motor potentiometer reference If value 5 is selected for this parameter, the values of ID319 and ID301 are automatically set to 13. See **Figure 8.29.**	The maximum and minimum limits illustrated in the picture limit only the PID output, no other outputs are affected.
(P1.2.3, P1.2.8, P1.2.2.1)	377	**AI1 signal selection** Connect the AI1 signal to the analog input of your choice with this parameter. For more information about the TTF programming method, See **Page 55.**	
(P1.2.2.8)	384	**AI1 joystick hysteresis** This parameter defines the joystick hysteresis between 0 and 20%. When the joystick or potentiometer control is turned from reverse to forward, the output frequency falls linearly to the selected minimum frequency (joystick/potentiometer in middle position) and stays there until the joystick/potentiometer is turned towards the forward command. How much the joystick/potentiometer must be turned to start the increase of the frequency towards the selected maximum frequency, is dependent on the amount of joystick hysteresis defined with this parameter. If the value of this parameter is 0, the frequency starts to increase linearly immediately when the joystick/potentiometer is turned towards the forward command from the middle position. When the control is changed from forward to reverse, the frequency follows the same pattern the other way round. See **Figure 8.30.**	

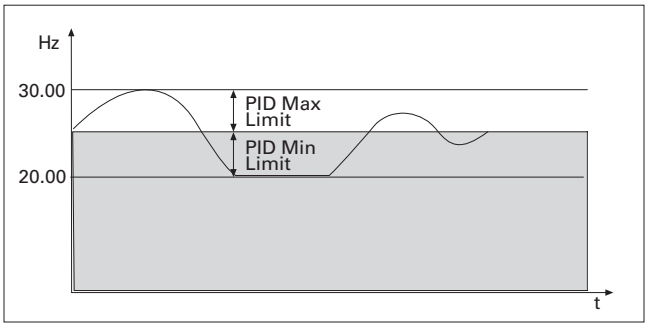


Figure 8.29. PID sum point reference

Code	Id	Descriptions	Notes
(P1.2.2.8)	384	**AI1 joystick hysteresis** This parameter defines the joystick hysteresis between 0 and 20%. When the joystick or potentiometer control is turned from reverse to forward, the output frequency falls linearly to the selected minimum frequency (joystick/potentiometer in middle position) and stays there until the joystick/potentiometer is turned towards the forward command. How much the joystick/potentiometer must be turned to start the increase of the frequency towards the selected maximum frequency, is dependent on the amount of joystick hysteresis defined with this parameter. If the value of this parameter is 0, the frequency starts to increase linearly immediately when the joystick/potentiometer is turned towards the forward command from the middle position. When the control is changed from forward to reverse, the frequency follows the same pattern the other way round. See **Figure 8.30.**	

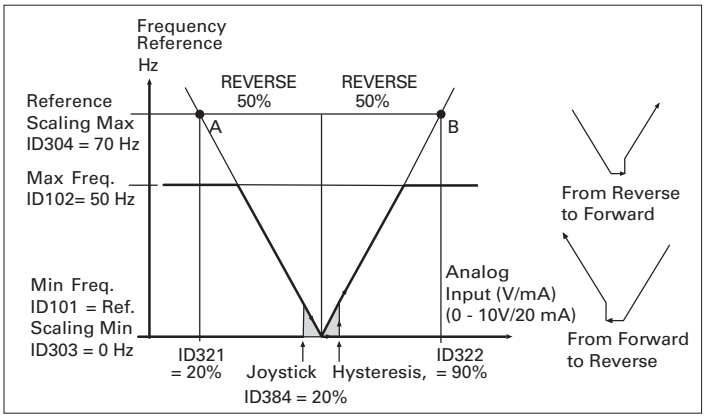


Figure 8.30. An example of joystick hysteresis
In this example, the value of ID385 (Sleep limit) = 0

(P1.2.2.9)	385	**AI1 sleep limit** The frequency converter is automatically stopped if the AI signal level falls below the Sleep limit defined with this parameter. See **Figure 8.31.**	

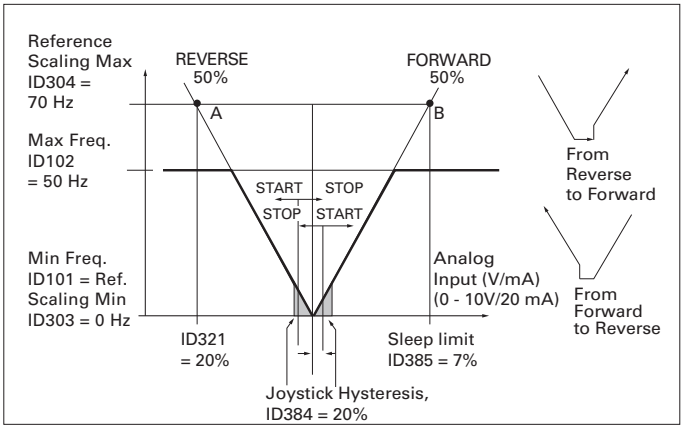
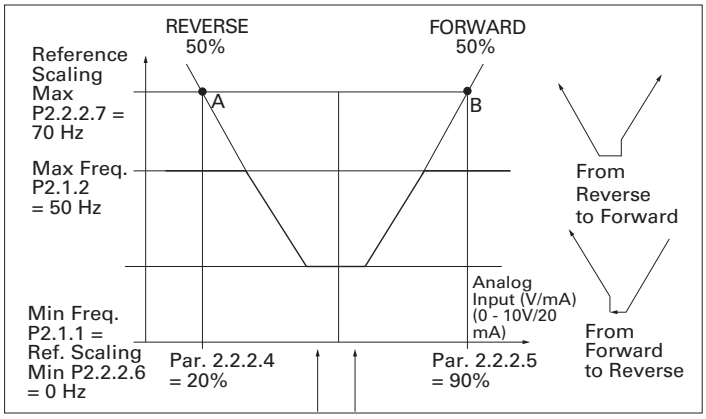
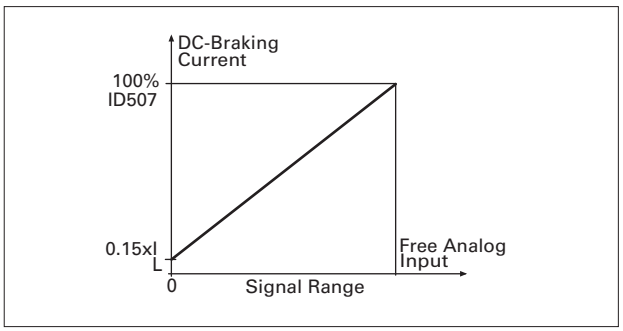


Figure 8.31. Example of sleep limit function

Code	Id	Descriptions	Notes
(P1.2.2.9)	385		
		Figure 8.32. Joystick hysteresis with minimum frequency at 35 Hz	
(P1.2.2.10)	386	**AI1 sleep delay** This parameter defines the time the analog input signal has to stay under the Sleep limit determined with parameter ID385 in order to stop the frequency converter.	
(P1.2.9, P1.2.3, P1.2.12, P1.2.3.1)	388	**AI2 signal selection** Connect the AI2 signal to the analog input of your choice with this parameter Formore information about the TTF programming method, See **Page 55.**	
(P1.2.3.6)	393	**AI2 reference scaling, minimum value**	
(P1.2.3.7)	394	**AI2 reference scaling, maximum value** See ID303 and ID304.	
(P1.2.3.8)	395	**AI2 joystick hysteresis** See ID384.	
(P1.2.3.9)	396	**AI2 sleep limit** See ID385.	
(P1.2.3.10)	397	**AI2 sleep delay** See ID386.	
(P1.2.6.1)	399	**Scaling of current limit** 0 Not used 1 AI1 2 AI2 3 AI3 4 AI4 5 Fieldbus (FBProcessDataIN2) This signal will adjust the maximum motor current between 0 and max. limit set with ID107.	
(P1.2.6.2)	400	**Scaling of DC-braking current** See ID399 for the selections. DC-braking current can be reduced with the free analog input signal between current 0.4 x I_H and the current set with ID507. See **Figure 8.33.**	
			
		Figure 8.33. Scaling of DC-Braking current	

Code	Id	Descriptions	Notes
(P1.2.6.3)	401	**Reducing of acceleration and deceleration times** See ID399. Acceleration and deceleration times can be reduced with the free analog input signal according to the following formulas: Reduced time = set acc./deceler. time (ID103, ID104; ID502, ID503) divided by the factor R from **Figure 8.34**	

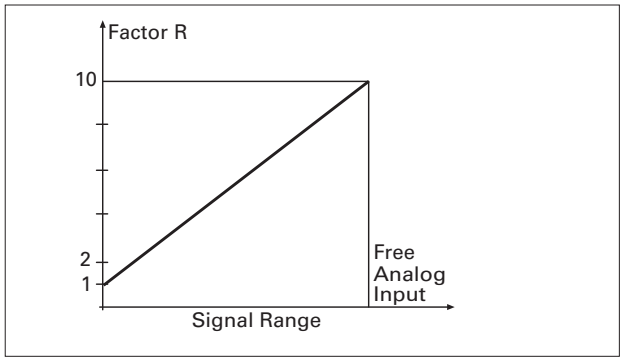


Figure 8.34. : Reducing acceleration and deceleration times

(P1.2.6.4)	402	**Reducing of torque supervision limit** See ID399. The set torque supervision limit can be reduced with the free analog input signal between 0 and the set supervision limit, ID349. See **Figure 8.35.**	

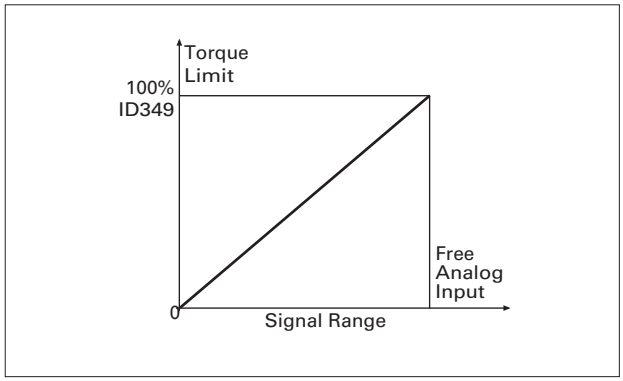


Figure 8.35. Reducing torque supervision limit

(P1.2.7.1)	403	**Start signal 1** Signal selection 1 for the start/stop logic. Default programming A.1.	
(P1.2.7.2)	404	**Start signal 2** Signal selection 2 for the start/stop logic. Default programming A.2.	
(P1.2.7.11, P1.2.6.4)	405	**External fault (close)** Contact closed: Fault is displayed and motor stopped	
(P1.2.7.12, P1.2.6.5)	406	**External fault (open)** Contact open: Fault is displayed and motor stopped	
(P1.2.7.3, P1.2.6.6)	407	**Run enable** Contact open: Start of motor disabled Contact closed: Start of motor enabled	
(P1.2.7.13, P1.2.6.7)	408	**Acceleration/Deceleration time selection** Contact open: Acceleration/Deceleration time 1 selected Contact closed: Acceleration/Deceleration time 2 selected Set Acceleration/Deceleration times with ID103 and ID104.	
(P1.2.7.18, P1.2.6.8)	409	**Control from I/O terminal** Contact closed: Force control place to I/O terminal	

Code	Id	Descriptions	Notes
(P1.2.7.4, P1.2.6.9)	412	**Reverse** Contact open: Direction forward Contact closed: Direction reverse	
(P1.2.7.16, P1.2.6.10)	413	**Jogging speed** Contact closed: Jog speed selected for frequency reference See parameter ID124. Default programming: A.4.	
(P1.2.7.10, P1.2.6.11)	414	**Fault reset** Contact closed: All faults are reset.	
(P1.2.7.14, P1.2.6.12)	415	**Acceleration/Deceleration prohibited** Contact closed: No acceleration or deceleration possible until the contact is opened.	
(P1.2.7.15, P1.2.6.13)	416	**DC-braking** Contact closed: In STOP mode, the DC braking operates until the contact is opened.	
(P1.2.7.8, P1.2.6.14)	417	**Motor potentiometer DOWN** Contact closed: Motor potentiometer reference DECREASES until the contact is opened.	
(P1.2.7.9, P1.2.6.15)	418	**Motor potentiometer UP** Contact closed: Motor potentiometer reference INCREASES until the contact is opened.	
(P1.2.7.5)	419	**Preset speed 1**	
(P1.2.7.6)	420	**Preset speed 2**	
(P1.2.7.7)	421	**Preset speed 3** Parameter values are automatically limited between the minimum and maximum frequencies (ID101 and ID102).	
(P1.2.7.17)	422	**AI1/AI2 selection** This parameter is used to select either AI1 or AI2 signal as the frequency reference.	
(P1.2.6.1)	423	**Start A signal** Start command from control place A. Default programming: A.1	
(P1.2.6.2)	424	**Start B signal** Start command from control place B. Default programming: A.4	
(P1.2.6.3)	425	**Control place A/B selection** Contact open: Control place A Contact closed: Control place B Default programming: A.6	
(P1.2.6.16)	426	**Autochange 1 interlock** Contact closed: Interlock of autochange drive 1 or auxiliary drive 1 activated. Default programming: A.2.	
(P1.2.6.17)	427	**Autochange 2 interlock** Contact closed: Interlock of autochange drive 2 or auxiliary drive 2 activated. Default programming: A.3.	
(P1.2.6.18)	428	**Autochange 3 interlock** Contact closed: Interlock of autochange Autochange 3 interlock drive 3 or auxiliary drive 3 activated.	
(P1.2.6.19)	429	**Autochange 4 interlock** Contact closed: Interlock of autochange drive 4 or auxiliary drive 4 activated.	
(P1.2.6.20)	430	**Autochange 5 interlock** Contact closed: Interlock of autochange drive 5 activated.	
(P1.2.6.21)	431	**PID reference 2** Contact open: PID controller reference selected with ID332. Contact closed: PID controller keypad reference 2 selected with ID371.	
(P1.3.3.1, P1.3.1.1)	432	**Ready** The frequency converter is ready to operate.	
(P1.3.3.2, P1.3.1.2)	433	**Run** The frequency converter is operating (the motor is running).	

Code	Id	Descriptions	Notes
(P1.3.3.3, P1.3.1.3)	**434**	**Fault** A fault trip has occurred. Default programming: A.1 for Application 7 and B.2 for Application 6.	
(P1.3.3.4, P1.3.1.4)	**435**	**Inverted fault** No fault trip has occurred.	
(P1.3.3.5, P1.3.1.5)	**436**	**Warning** General warning signal.	
(P1.3.3.6, P1.3.1.6)	**437**	**External fault or warning** Fault or warning depending on ID701.	
(P1.3.3.7, P1.3.1.7)	**438**	**Reference fault or warning** Fault or warning depending on ID700.	
(P1.3.3.8, P1.3.1.8)	**439**	**Overtemperature warning** The heatsink temperature exceeds +70°C	
(P1.3.3.9, P1.3.1.9)	**440**	**Reverse** The Reverse command has been selected.	
(P1.3.3.10, P1.3.1.10)	**441**	**Unrequested direction** Motor rotation direction is different from the requested one.	
(P1.3.3.11, P1.3.1.11)	**442**	**At speed** The output frequency has reached the set reference.	
(P1.3.3.12, P1.3.1.12)	**443**	**Jogging speed** Jogging speed selected.	
(P1.3.3.13, P1.3.1.13)	**444**	**External control place** Control from I/O terminal selected (Menu **M2**; ID125)	
(P1.3.3.14, P1.3.1.14)	**445**	**External brake control** External brake ON/OFF control with programmable delay.	
(P1.3.3.15, P1.3.1.15)	**446**	**External brake control, inverted** External brake ON/OFF control; Output active when brake control is OFF.	
(P1.3.3.16, P1.3.1.16)	**447**	**Output frequency limit 1 supervision** The output frequency is outside the set supervision low limit/high limit (see ID315 and ID316).	
(P1.3.3.17, P1.3.1.17)	**448**	**Output frequency limit 2 supervision** The output frequency is outside the set supervision low limit/high limit (see ID346 and ID347).	
(P1.3.3.18, P1.3.1.18)	**449**	**Reference limit supervision** Active reference is beyond the set supervision low limit/high limit (see ID350 and ID351).	
(P1.3.3.19, P1.3.1.19)	**450**	**Temperature limit supervision** The frequency converter heatsink temperature is beyond the set supervision limits (see ID354 and ID355).	
(P1.3.3.20, P1.3.1.20)	**451**	**Torque limit supervision** The motor torque is beyond the set supervision limits (see ID348 and ID349).	
(P1.3.3.21, P1.3.1.21)	**452**	**Motor thermal protection** Motor thermistor initiates an overtemperature signal which can be tied to a digital output.	This parameter will not work unless you have an OPTA3 or OPTB2 (thermistor relay board) connected.
(P1.3.3.23, P1.3.1.23)	**454**	**Motor regulator activation** Overvoltage or overcurrent regulator has been activated.	
(P1.3.3.24, P1.3.1.24)	**455**	**Fieldbus input data 1 (FBFixedControlWord, bit 3)**	
(P1.3.3.25, P1.3.1.25)	**456**	**Fieldbus input data 2 (FBFixedControlWord, bit 4)**	
(P1.3.3.26, P1.3.1.26)	**457**	**Fieldbus input data 3 (FBFixedControlWord, bit 5)** The data from the fieldbus **(FBFixedControlWord)** can be tied to frequency converter digital outputs.	

Code	Id	Descriptions	Notes
(P1.3.1.27)	458	**Autochange 1/Auxiliary drive 1 control** Control signal for autochange/auxiliary drive 1. Default programming: B.1	
(P1.3.1.28)	459	**Autochange 2/Auxiliary drive 2 control** Control signal for autochange/auxiliary drive 2. Default programming: B.2	
(P1.3.1.29)	460	**Autochange 3/Auxiliary drive 3 control** Control signal for autochange/auxiliary drive 3. If three (or more) auxiliary drives are used, we recommend the use of a relay output to connect drive 3. Since the OPTA2 board only has two relay outputs, it is advisable to purchase an I/O expander board with extra relay outputs (e.g. OPTB5)	
(P1.3.1.30)	461	**Autochange 4/Auxiliary drive 4 control** Control signal for autochange/auxiliary drive 4. If three (or more) auxiliary drives are used, we recommend the use of relay outputs, to connect drives 3 and 4. Since the OPTA2 board only has two relay outputs it is advisable to purchase an I/O expander board with extra relay outputs (e.g. OPTB5).	
(P1.3.1.31)	462	**Autochange 5 control** Control signal for autochange drive 5.	
(P1.3.3.22, P1.3.1.22	463	**Analog input supervision limit** The selected analog input signal is beyond the set supervision limits (see ID372, ID373 and ID374)	
(P1.3.1, P1.3.5.1, P1.3.3.1)	464	**Analog output 1 signal selection** Connect the AO1 signal to the analog output of your choice with this parameter. For more information about the TTF programming method, See **Page 55.**	
(P1.3.12, P1.3.22, P1.3.6.1, P1.3.4.1)	471	**Analog output 2 signal selection** Connect the AO2 signal to the analog output of your choice with this parameter. For more information about the TTF programming method, See **Page 55.**	
(P1.3.13, P1.3.23, P1.3.6.2, P1.3.4.2)	472	**Analog output 2 function**	
(P1.3.14, P1.3.24, P1.3.6.3, P1.3.4.3)	473	**Analog output 2 filter time**	
(P1.3.15, P1.3.25, P1.3.6.4, P1.3.4.4)	474	**Analog output 2 inversion**	
(P1.3.16, P1.3.26, P1.3.6.5, P1.3.4.5)	475	**Analog output 2 minimum**	
(P1.3.17, P1.3.27, P1.3.6.6, P1.3.4.6)	476	**Analog output 2 scaling** For more information on these five parameters, see the corresponding parameters for the analog output 1, ID307 to ID311.	
(P1.3.6.7, P1.3.4.7)	477	**Analog output 2 offset** Add -100.0 to 100.0% to the analog output.	
(P1.3.7.1, P1.3.5.1)	478	**Analog output 4, signal selection** See ID464.	
(P1.3.7.2, P1.3.5.2)	479	**Analog output 3, function** See ID307.	
(P1.3.7.3, P1.3.5.3)	480	**Analog output 3, filter time** See ID308.	
(P1.3.7.4, P1.3.5.4)	481	**Analog output 3 inversion** See ID309.	
(P1.3.7.5, P1.3.5.5)	482	**Analog output 3 minimum** See ID310.	
(P1.3.7.6, P1.3.5.6)	483	**Analog output 3 scaling** See ID311.	
(P1.3.7.7, P1.3.5.7)	484	**Analog output 3 offset** See ID375.	
(P1.2.6.5)	485	**Torque limit** See ID399 for the selections.	

Code	Id	Descriptions	Notes
(P1.3.1.1)	486	**Digital output 1 signal selection 6** Connect the delayed DO1 signal to the digital output of your choice with this parameter. For more information about the TTF programming method, See **Page 55**.	
P1.3.1.3)	487	**Digital output 1 on-delay**	
P1.3.1.4)	488	**Digital output 1 off-delay** With these parameters you can set on- and off-delays for digital outputs. **See Figure 8.36.**	
(P1.3.2.1)	489	**Digital output 2 signal selection 6** Digital output 2 signal selection 6	
(P1.3.2.2)	490	**Digital output 2 function 6** See ID487.	
(P1.3.1.3)	491	**Digital output 2 on-delay 6** See ID488.	
(P1.3.1.4)	492	**Digital output 2 off-delay** See ID488.	
(P1.2.1.4)	493	**Adjust input** With this parameter you can select the signal, according to which the frequency reference to the motor is fine adjusted. 0 Not used 1 Analog input 1 2 Analog input 2 3 Analog input 3 4 Analog input 4 5 Signal from fieldbus (FBProcessDataIN)	
(P1.2.1.5)	494	**Adjust minimum**	

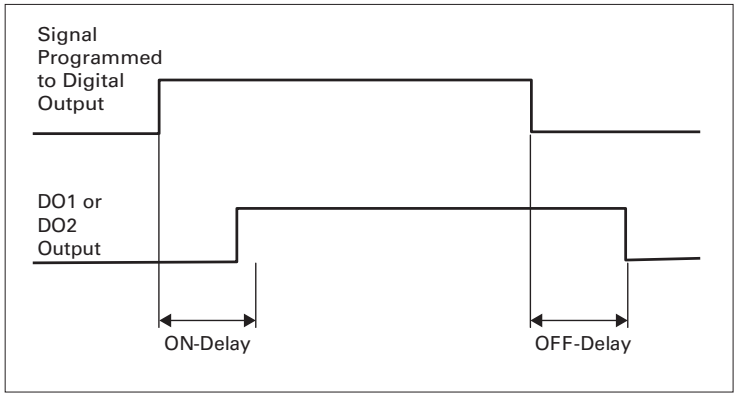


Figure 8.36. Digital outputs 1 and 2, on- and off-delays

Code	Id	Descriptions	Notes
(P1.2.1.6)	495	**Adjust maximum** These parameters define the minimum and maximum of adjusted signals. See **Figure 8.37.**	

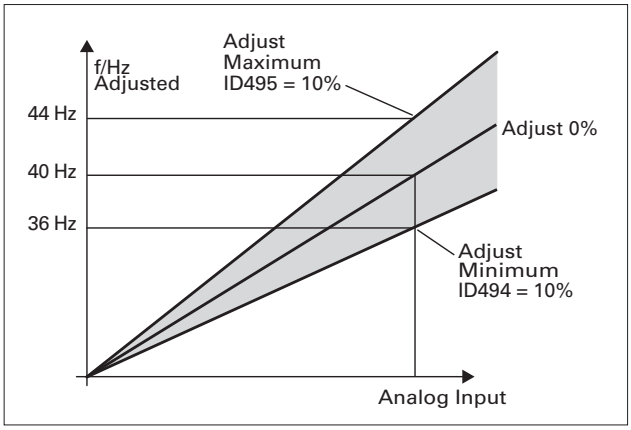


Figure 8.37. An example of adjust input

(P1.2.7.19)	496	**Parameter Set 1/Set 2 selection** With this parameter you can select between Parameter Set 1 and Set 2. The input for this function can be selected from any slot. The procedure of selecting between the sets is explained in the 9000X AF Drives User Manual, Chapter 5. Digital input = FALSE: • The active set is saved to set 2 • Set 1 is loaded as the active set Digital input = TRUE: • The active set is saved to set 1 • Set 2 is loaded as the active set	The parameter values can be changed in the active set only.
(P1.2.17)	498	**Start pulse memory** Giving a value to this parameter determines if the present RUN status is copied when the control place is changed from A to B or vice versa. 0 The RUN status is not copied 1 The RUN status is copied In order for this parameter to have effect, ID300 and ID363 must have been set the value 3.	
(P1.4.1)	500	**Acceleration/Deceleration ramp 1 shape**	
(P1.4.2)	501	**Acceleration/Deceleration ramp 2 shape** The start and end of the acceleration and deceleration ramps can be smoothed with these parameters. Setting a value of 0.0 gives a linear ramp shape which causes acceleration and deceleration to react immediately to the changes in the reference signal. Setting a value from 0.1 - 10 seconds for this parameter produces an S-shaped acceleration/deceleration. The acceleration time is determined with ID103 and ID104 (ID502 and ID503).	

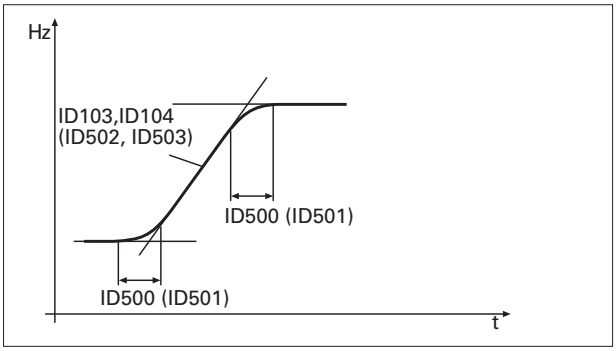


Figure 8.38. Acceleration/Deceleration (S-shaped)

Code	Id	Descriptions	Notes
(P1.4.3)	502	**Acceleration time 2**	
(P1.4.4)	503	**Deceleration time 2** These values correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (ID102). These parameters provide the possibility to set two different acceleration/deceleration time sets for one application. The active set can be selected with the programmable signal DIN3 (ID301).	
(P1.4.5)	504	**Brake chopper** 0 No brake chopper used 1 Brake chopper in use and tested when running. Can be tested also in READY state 2 External brake chopper (no testing) 3 Used and tested in READY state and when running 4 Used when running (no testing) When the frequency converter is decelerating the motor, the inertia of the motor and the load is fed into an external brake resistor. This enables the frequency converter to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected). See the separate Brake resistor installation manual.	
(P1.4.7)	506	**Stop Function** **Coasting:** 0 The motor coasts to a halt without any control from the frequency converter, after the Stop command. **Ramp:** 1 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters. If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration. **Normal stop: Ramp/Run Enable stop: coasting** 2 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters. However, when Run Enable is selected, the motor coasts to a halt without any control from the frequency converter. **Normal stop: Coasting/Run Enable stop: ramping** 3 The motor coasts to a halt without any control from the frequency converter. However, when Run Enable signal is selected, the speed of the motor is decelerated according to the set deceleration parameters. If the regenerated energy is high, it may be necessary to use an external braking resistor for faster deceleration.	
(P1.4.6)	505	**Start Function** **Ramp:** 0 The frequency converter starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time. (Load inertia or starting friction may cause prolonged acceleration times.) **Flying start:** 1 The frequency converter is able to start into a running motor by applying a small torque to motor and searching for the frequency corresponding to the speed the motor is running at. Searching starts from the maximum frequency towards the actual frequency until the correct value is detected. Thereafter, the output frequency will be increased/decreased to the set reference value according to the set acceleration/deceleration parameters. Use this mode if the motor is coasting when the start command is given, with the flying start it is possible to ride through short utility voltage interruptions.	
(P1.4.8)	507	**DC-braking current** Defines the current injected into the motor during DC-braking.	

Code	Id	Descriptions	Notes
(P1.4.9)	508	**DC-braking time at stop** Determines if braking is ON or OFF and the braking time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, ID506. 0.0 DC-brake is not used >0.0 DC-brake is in use and its function depends on the Stop function, (ID506). The DC-braking time is determined with this parameter. **Par. ID506 = 0; Stop function = Coasting:** After the stop command, the motor coasts to a stop without control of the frequency converter. With DC-injection, the motor can be electrically stopped in the shortest possible time, without using an optional external braking resistor. The braking time is scaled according to the frequency when the DC-braking starts. If the frequency is ≥ the nominal frequency of the motor, the set value of parameter ID508 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of ID508.	

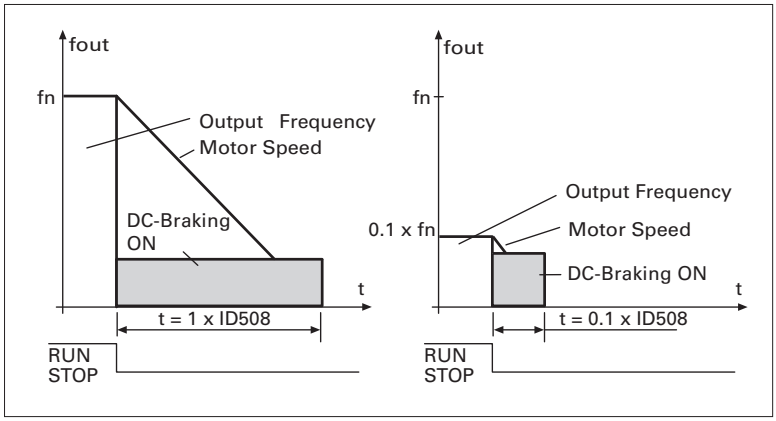


Figure 8.39. DC-Braking time when stop mode = Coasting

(P1.4.9)	508	**Par. ID506 = 1; Stop function = Ramp:** After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with ID515, where the DC-braking starts. The braking time is defined with ID508. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See **Figure 8.40.**	

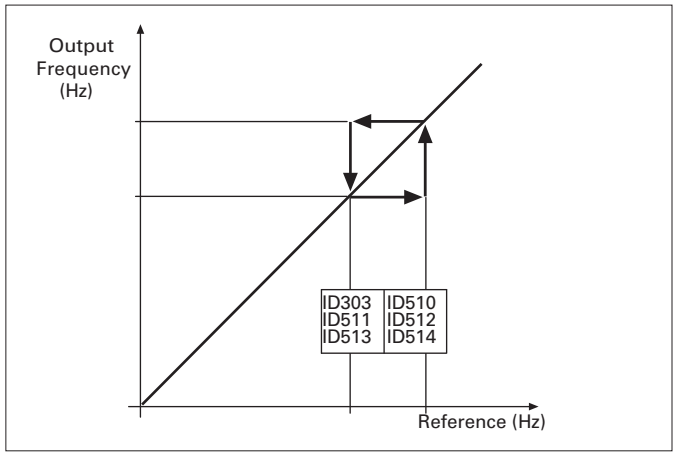


Figure 8.40. DC-braking time when stop mode = ramp

Code	Id	Descriptions	Notes
(P1.5.1)	509	**Skip frequency area 1; low limit**	
(P1.5.2)	510	**Skip frequency area 1;high limit**	
(P1.5.3)	511	**Skip frequency area 2; low limit**	
(P1.5.4)	512	**Skip frequency area 2; high limit**	
(P1.5.5)	513	**Skip frequency area 3; low limit**	
(P1.5.6)	514	**Skip frequency area 3; high limit** In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems. With these parameters limits are set for the "skip frequency" regions. See **Figure 8.41.**	

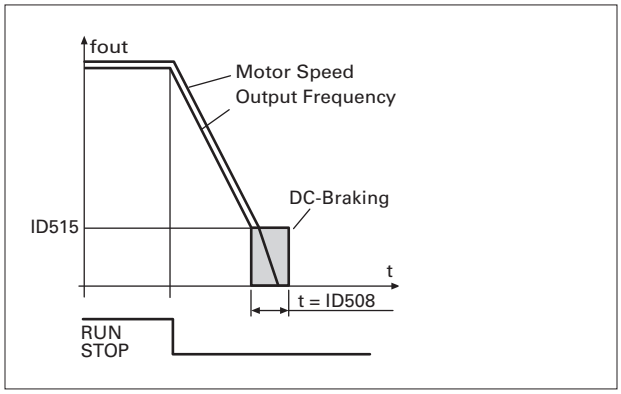


Figure 8.41. Example of skip frequency area setting

(P1.4.10)	515	**DC-braking frequency at stop** The output frequency at which the DC-braking is applied. See **Figure 8.41**.	
(P1.4.11)	516	**DC-braking time at start** DC-brake is activated when the start command is given. This parameter defines the time before the brake is released. After the brake is released, the output frequency increases according to the set start function by ID505.	
(P1.5.3, P1.5.7)	518	**Acceleration/deceleration ramp speed scaling ratio between skip frequency limits** Defines the acceleration/deceleration time when the output frequency is between the selected skip frequency range limits (ID509 and ID510). The ramping speed (selected acceleration/deceleration time 1 or 2) is multiplied with this factor. E.g. value 0.1 makes the acceleration time 10 times shorter than outside the skip frequency range limits.	

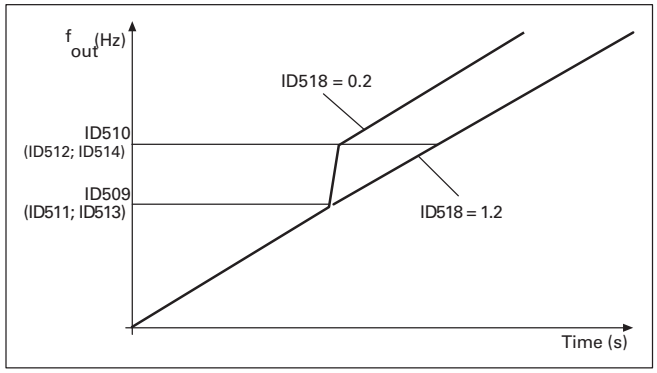


Figure 8.42. Ramp speed scaling between skip frequencies

(P1.4.13)	519	**Flux braking current** Defines the flux braking current value. This value can be set between $0.4*I_H$ and the current limit.	

Code	Id	Descriptions	Notes
(P1.4.12)	520	**Flux brake** Instead of DC braking, flux braking is a useful form of braking for motors ≤ 15 kW. When braking is needed, the frequency is reduced and the flux in the motor is increased, which in turn increases the motor's capability to brake. Unlike DC braking, the motor speed remains controlled during braking. The flux braking can be set ON or OFF. 0 Flux braking OFF 1 Flux braking ON	Flux braking converts the energy into heat in the motor, and should be used intermittently to avoid motor damage.
(P1.6.12)	521	**Motor control mode 2** With this parameter you can set another motor control mode. The mode which is used is determined by ID164. For the available selections, see ID600.	
(P1.6.1)	600	**Motor control mode** **SVX:** 0 Frequency control: The I/O terminal and keypad references are frequency references and the frequency converter controls the output frequency (output frequency resolution = 0.01 Hz) 1 Speed control: The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed compensating for motor slip (accuracy ± 0.5%). **SPX:** The following selections are available for SPX drives only, except for selection 2, which is available in the Multi-Purpose Control Application for SVX drives also. 2 Torque control: In torque control mode, the references are used to control the motor torque. 3 Speed control (closed loop): The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed very accurately comparing the actual speed received from the tachometer to the speed reference (accuracy ± 0.01%). 4 Torque control (closed loop): The I/O terminal and keypad references are torque references and the frequency converter controls the motor torque.	
(P1.6.9)	601	**Switching frequency** Motor noise can be minimized using a high switching frequency. Increasing the switching frequency reduces the capacity of the frequency converter unit. The range of this parameter depends on the size of the frequency converter:	
(P1.6.4)	602	**Field weakening point** The field weakening point is the output frequency at which the output voltage reaches the set (ID603) maximum value.	
(P1.6.5)	603	**Voltage at field weakening point** Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the V/Hz curve parameters. See ID109, ID108, ID604 and ID605. When the parameters ID110 and ID111 (nominal voltage and nominal frequency of the motor) are set, the parameters ID602 and ID603 are automatically set to the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting ID110 and ID111.	

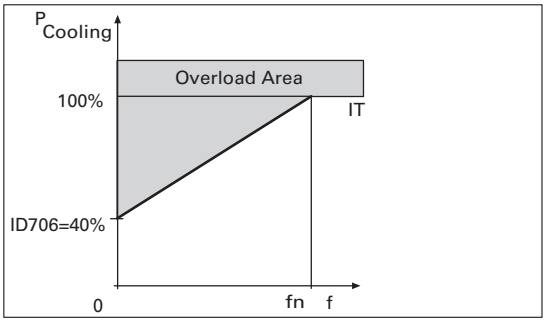
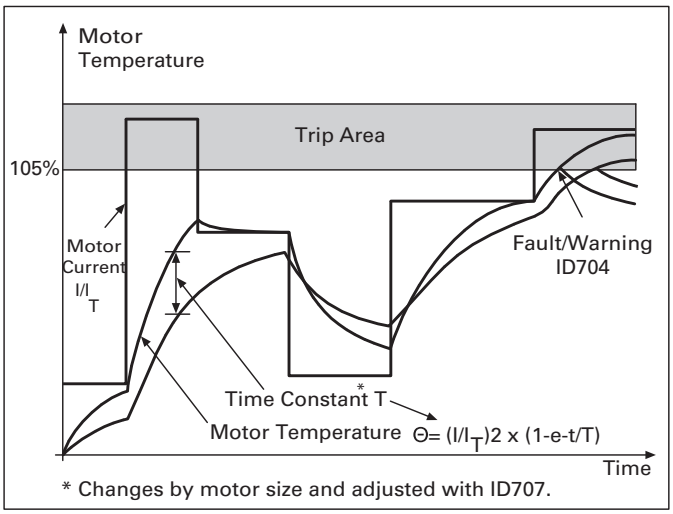
Table 8.12. Size-dependent switching frequencies

Voltage	Drive Rating HP (I_L)	Min. (kHz)	Max. (kHz)	Default (kHz)
230 (208 - 240) V:	1 - 20 HP	1.0	16.0	3.6
230 (208 - 240) V:	25 - 30 HP	1.0	10.0	3.6
480 (380 - 500) V:	1-1/2 - 40 HP	1.0	16.0	3.6
480 (380 - 500) V:	50 - 250 HP	1.0	6.0	3.6
575 (525 - 690) V:	All	1.0	6.0	1.5

Code	Id	Descriptions	Notes
(P1.6.6)	604	**V/Hz curve, middle point frequency** If the programmable V/Hz curve has been selected with ID108 this parameter defines the middle point frequency of the curve. See **Figure 8.2.**	
(P1.6.7)	605	**V/Hz curve, middle point voltage** If the programmable V/Hz curve has been selected with the ID108 this parameter defines the middle point voltage of the curve. See **Figure 8.2.**	
(P1.6.8)	606	**Output voltage at zero frequency** If the programmable V/Hz curve has been selected with the ID108 this parameter defines the zero frequency voltage of the curve. See **Figure 8.2.**	
(P1.6.10)	607	**Overvoltage controller** These parameters allow the under-/overvoltage controllers to be switched out of operation. This may be useful, for example, if the main supply voltage varies more than -15% to +10% and the application will not tolerate this over-/undervoltage. In this case, the regulator controls the output frequency taking the supply fluctuations into account. 0 Controller switched off 1 Controller switched on (no ramping) = Minor adjustments of OP frequency are made 2 Controller switched on (with ramping) = Controller adjusts OP freq. up to max. freq.	
(P1.6.11)	608	**Undervoltage controller** See ID607.	Over-/undervoltage trips may occur when the controllers are switched off. 0 Controller switched off 1 Controller switched on
(P1.10.1)	609	**Torque limit** With this parameter you can set the torque limit control between 0.0 - 400.0%.	
(P1.10.2)	610	**Torque limit control P-gain** This parameter defines the gain of the torque limit controller.	
(P1.10.2)	610	**Torque limit control P-gain** This parameter defines the gain of the torque limit controller.	
(P1.10.3)	611	**Torque limit control I-gain** This parameter determines the I-gain of the torque limit controller.	
(P1.6.14.1, P1.6.17.1)	612	**CL: Magnetizing current** Sets the motor magnetizing current (no-load current). See **Page 146.**	
(P1.6.14.2, P1.6.17.2)	613	**CL: Speed control P-gain** Sets the gain for the speed controller in % per Hz. See **Page 146.**	
(P1.6.14.3, P1.6.17.3)	614	**CL: Speed control I-time** Sets the integral time constant for the speed controller. Increasing the I-time increases stability but lengthens the speed response time. See **Page 146**.	
(P1.6.14.9, P1.6.17.9)	615	**CL: Zero speed time at start** After giving the start command the drive will remain at zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/ speed reference after this time has elapsed from the instant where the command is given. See **Page 146**.	
(P1.6.14.10, P1.6.17.10)	616	**CL: Zero speed time at stop** The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed when a stop command is given. This parameter has no effect if the selected stop function (ID506) is Coasting. See **Page 146.**	
(P1.6.14.17, P1.6.17.17)	617	**CL: Current control P-gain** Sets the gain for the current controller. This controller is active only in closed loop and advanced open loop modes. The controller generates the voltage vector reference to the modulator. See **Page 146.**	
(P1.6.14.15, P1.6.17.15)	618	**CL: Encoder filter time** Sets the filter time constant for speed measurement. The parameter can be used to eliminate encoder signal noise. Too high a filter time reduces speed control stability. See **Page 146**.	

Code	Id	Descriptions	Notes
P1.6.14.5, P1.6.17.5)	619	**CL: Slip adjust** The motor name plate speed is used to calculate the nominal slip. This value is used to adjust the voltage of motor when loaded. The name plate speed is sometimes a little inaccurate and this parameter can therefore be used to trim the slip. Reducing the slip adjust value increases the motor voltage when the motor is loaded. See **Page 146**	
(P1.6.12, P1.6.15)	620	**CL: Load drooping** The drooping function enables speed drop as a function of load. This parameter sets that amount corresponding to the nominal torque of the motor. See **Page 146.**	
(P1.6.14.11, P1.6.17.11)	621	**CL: Startup torque** Chooses the startup torque. Torque Memory is used in crane applications. Startup torque FWD/REV can be used in other applications to help the speed controller. See **Page 146**. 0 Not Used 1 TorqMemory 2 torque Ref 3 Torq.Fwd/Rev	
(P1.6.14.5, P1.6.17.5)	626	**CL: Acceleration compensation** Sets the inertia compensation to improve speed response during acceleration and deceleration. The time is defined as acceleration time to nominal speed with nominal torque. This parameter is also active in advanced open loop mode.	
(P1.6.14.7, P1.6.17.7)	627	**CL: Magnetizing current at start**	
(P1.6.14.8, P1.6.17.8)	628	**CL: Magnetizing time at start** Sets the rise time of magnetizing current.	
(P1.6.13, P1.6.16)	631	**Identification** With this parameter, the drive will identify the motor and adjust tuning parameters to improve starting torque and closed loop current control. See Chapter 6 of the 9000X User Manual. 0 No Action 1 OL V/F Ratio-ID No Run; the drive is run at zero speed to identify the stator motor parameters. 2 OL V/F + Boost; same as ID No Run and then turns on V/Hz Boost. 3 (MultiPurpose APP, SPX Only) ID With Run; performs an ID No Run, andthen runs the motor at 2/3 rated frequency to identify the motor no load current and motor saturation curve. Motor must be unloaded for an accurate ID Run.	
(P1.6.14.5, P1.6.17.5)	633	**CL: Start-up torque, forward** Sets the start-up torque for forward direction if selected with parameter P1.6.12.11.	
(P1.6.14.2, P1.6.17.2)	634	**CL: Start-up torque, reverse** Sets the start-up torque for reverse direction if selected with parameter P1.6.12.11.	
(P1.10.8)	636	**Minimum frequency for Open Loop torque control** Defines the frequency limit below which the frequency converter operates in the frequency control mode. Because of the nominal slip of the motor, the internal torque calculation is inaccurate at low speeds where it is recommended to use the frequency control mode.	
(P1.6.13)	637	**Speed controller P gain, Open Loop** Defines the P gain for the speed controlled in Open Loop control mode.	
(P1.6.14)	638	**Speed controller I gain, Open Loop** Defines the I gain for the speed controlled in Open Loop control mode.	
(P1.10.9)	639	**Torque controller P gain** Defines the P gain of the torque controller.	
(P1.10.10)	640	**Torque controller I gain** Defines the I gain of the torque controller.	

Code	Id	Descripions	Notes
(P1.10.4)	641	**Torque reference selection** Defines the source for torque reference. 0 Not used 1 Analog input 1 2 Analog input 2 3 Analog input 3 4 Analog input 4 5 Analog input 1 (joystick) 6 Analog input 2 (joystick) 7 From keypad, parameter R3.5 8 Fieldbus	
(P1.10.5)	642	**Torque reference scaling, maximum value**	
(P1.10.6)	643	**Torque reference scaling, minimum value** Scale the custom minimum and maximum levels for analog inputs within -300.0 - 300.0%.	
(P1.10.7)	644	**Torque speed limit** With this parameter the maximum frequency for the torque control can be selected. 0 Maximum frequency, ID102 1 Selected frequency reference 2 Preset speed 7, ID130	
(P1.7.1)	700	**Response to the reference fault** 0 No response 1 Warning 2 Warning, the frequency from 10 seconds back is set as reference 3 Warning, the Preset Frequency (ID728) is set as reference 4 Fault, stop mode after fault according to ID506 5 Fault, stop mode after fault always by coasting A warning or a fault action and message is generated if the 4 - 20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2	
(P1.7.3)	701	**Response to external fault** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting A warning or a fault action and message is generated from the external fault signal in the programmable digital inputs DIN3. The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.	
(P1.7.6)	702	**Output phase supervision** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting Output phase supervision of the motor ensures that the motor phases have approximately equal currents.	
(P1.7.7)	703	**Earth fault protection** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting Earth fault protection ensures that the sum of the motor phase currents is zero. The overcurrent protection is always working and protects the frequency converter from earth faults with high currents.	

Code	Id	Descripions	Notes
(P1.7.8)	704	**Motor thermal protection** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting If tripping is selected the drive will stop and activate the fault stage. Deactivating this protection, i.e. setting parameter to 0, will reset the thermal stage of the motor to 0%. See **Page 147.**	
(P1.7.9)	705	**Motor thermal protection: Motor ambient temp. factor** The factor can be set between -100.0% - 100.0%. See **Page 147**	
(P1.7.10)	706	**Motor thermal protectione: Motor cooling factor at zero peed** The current can be set between 0 - 150.0% x I_{nMotor}. This parameter sets the value for thermal current at zero frequency. See **Figure 8.43**. The default value is set assuming that there is no external fan cooling the motor. If an external fan is used this parameter can be set to 90% (or even higher).  **Figure 8.43. Motor thermal current I_T curve**	The value is set as a percentage of the motor nameplate data, ID113 (nominal current of the motor), not the drive's nominal output current. The motor's nominal current is the current that the motor can withstand in direct on-line use without being overheated. If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value. Setting this parameter does not affect the maximum output current of the drive which is determined by ID107 alone. See **Page 147**
(P1.7.11)	707	**Motor thermal protectione: Time constant** This time can be set between 1 and 200 minutes. This is the thermal time constant of the motor, the larger the motor, the longer the time constant. The time constant is the time within which the calculated thermal stage has reached 63% of its final value. The motor thermal time is specific to the motor design and it varies between different motor manufacturers. If the motor's t6 - time (t6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set based on it. As a rule of thumb, the motor thermal time constant in minutes is equal to 2xt6. If the drive is in stop stage the time constant is internally increased to three times the set parameter value. The cooling in the stop stage is based on convection and the time constant is increased. See **Figure 8.44**.  **Figure 8.44. Motor temperature calculation**	

Code	Id	Descripions	Notes
(P1.7.12)	708	**Motor thermal protectione: Motor duty cycle** Defines how much of the nominal motor load is applied. The value can be set to 0% - 100%. See **Page 147.**	
(P1.7.13)	709	**Stall protection** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting Setting the parameter to 0 will deactivate the protection and reset the stall timecounter. See **Page 147.**	
(P1.7.14)	710	**Stall current limit** The current can be set to 0.1 - I_{nMotor}*2. For a stall stage to occur, the current must have exceeded this limit. See **Figure 8.45**. The software does not allow entering a greater value than InMotor*2. If ID113, nominal motor current is changed, this parameter is automatically restored to the default value (IL). See **Page 147.**	

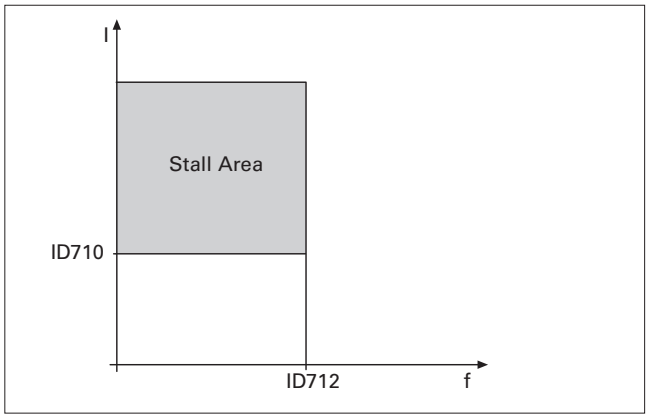


Figure 8.45. Stall characteristics settings

(P1.7.15)	711	**Stall time** This time can be set between 1.0 and 120.0s. This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/ down counter. If the stall time counter value goes above this limit the protection will cause a trip (see ID709). See **Page 147.**	

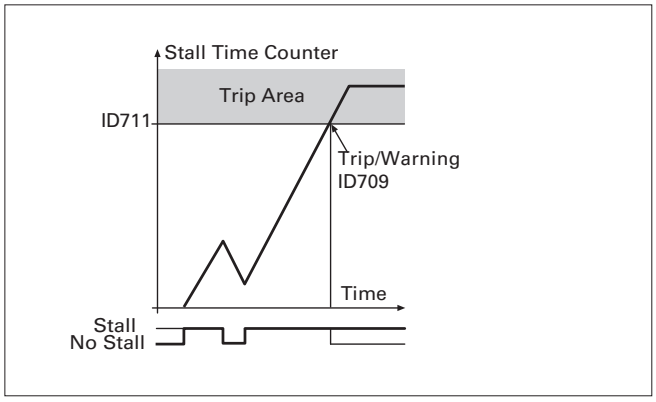


Figure 8.46. Stall time count

(P1.7.16)	712	**Stall frequency limit** The frequency can be set between 1 - f_{mAx} (ID102). For a stall state to occur, the output frequency must have remained below this limit. See **Page 147.**	

Code	Id	Descripions	Notes
(P1.7.17)	713	**Underload protection** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting If tripping is set active the drive will stop and activate the fault stage. Deactivating the protection by setting the parameter to 0 will reset the underload time counter to zero. See **Page 147.**	
(P1.7.18)	714	**Underload protection, field weakening area load** The torque limit can be set between 10.0 - 150.0 % x T_{nMotor}. This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point. See **Figure 8.47**. If you change ID113, nominal motor current, this parameter is automatically restored to the default value. See **Page 147.**	

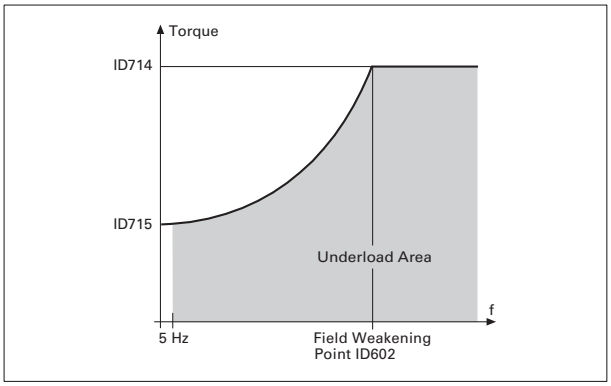


Figure 8.47. Setting of minimum load

(P1.7.19)	715	**Underload protection, zero frequency load** The torque limit can be set between 5.0 - 150.0 % x T_{nMotor}. This parameter gives value for the minimum torque allowed with zero frequency. See **Figure 8.47**. If you change the value of ID113, nominal motor current, this parameter is automatically restored to the default value. See **Page 147.**	
(P1.7.20)	716	**Underload time** This time can be set between 2.0 and 600.0s. This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to ID713. If the drive is stopped the underload counter is reset to zero. See **Figure 8.48** and **Page 147**	

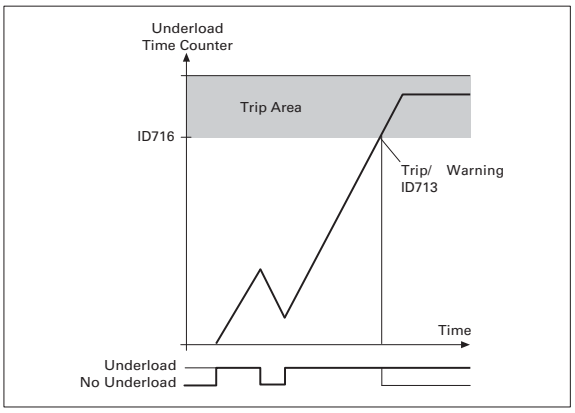
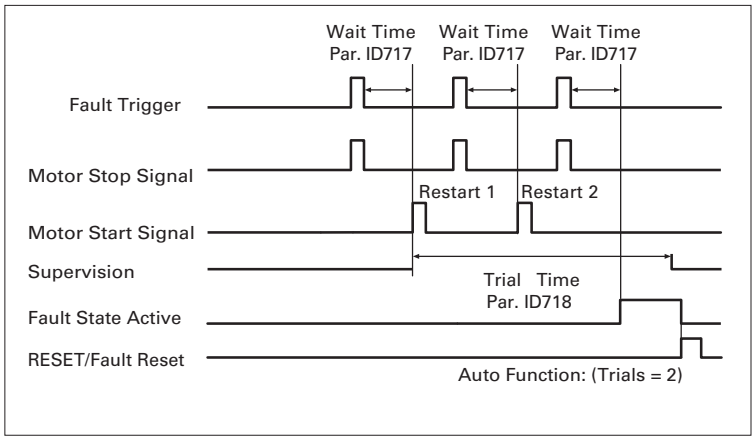


Figure 8.48. Underload time counter function

(P1.8.1)	717	**Automatic restart: Wait time** Defines the time before the frequency converter tries to automatically restart the motor after the fault has disappeared.	

Code	Id	Descripions	Notes
(P1.8.2)	718	**Automatic restart: Trial time** The Automatic restart function restarts the frequency converter when the fault selected with ID720 to ID725 have cleared and the waiting time has elapsed.  **Figure 8.49. Example of automatic restarts with two restarts** ID720 to ID725 determine the maximum number of automatic restarts during the trial time set by ID718. The time count starts from the first autorestart. If the number of faults occurring during the trial time exceeds the values of ID720 to ID725 the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault starts the trial time count again. If a single fault remains during the trial time, a fault state is true.	
(P1.8.3)	719	**Automatic restart: Start function** The Start function for Automatic restart is selected with this parameter. The parameter defines the start mode: 0 Start with ramp 1 Flying start 2 Start according to ID505	
(P1.8.5)	720	**Automatic restart: Number oftries after undervoltage fault trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718 after an undervoltage trip. 0 No automatic restart >0 Number of automatic restarts after undervoltage fault. The fault is reset and the drive is started automatically after the DC-link voltage hasreturned to the normal level.	
(P1.8.6)	721	**Automatic restart: Number of tries after overvoltage trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718 after an overvoltage trip. 0 No automatic restart after overvoltage fault trip >0 Number of automatic restarts after overvoltage fault trip. The fault is reset and the drive is started automatically after the DC-link voltage has returned to the normal level.	
(P1.8.7)	722	**Automatic restart: Number of tries after overcurrent trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718./h 0 No automatic restart after overcurrent fault trip >0 Number of automatic restarts after an overcurrent trip, saturation trip or IGBT temperature fault.	An IGBT temperature fault also included as part of this fault.
(P1.8.8)	723	**Automatic restart: Number of tries after reference trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after reference fault trip >0 Number of automatic restarts after the analog current signal (4 - 20 mA) has returned to the normal level (≥ 4 mA)	

Code	Id	Descripions	Notes
(P1.8.10)	725	**Automatic restart: Number of tries after external fault trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after External fault trip >0 Number of automatic restarts after External fault trip	
(P1.8.9)	726	**Automatic restarte: Number of tries after motor temperature fault trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after Motor temperature fault trip >0 Number of automatic restarts after the motor temperature has returned to its normal level	
(P1.7.5)	727	**Response to undervoltage fault** 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting For the undervoltage limits, see 9000X AF Drives User Manual, **Table 4-2**.	
(P1.7.2)	728	**Reference fault: preset frequency reference** If the value of parameter ID700 is set to 3 and the 4 mA fault occurs, then the frequency reference to the motor is the value of this parameter.	
(P1.12, P1.7.4)	730	**Input phase supervision** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting The input phase supervision ensures that the input phases of the frequency converter have approximately equal currents.	
P1.7.21)	732	**Response to thermistor fault** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting Setting the parameter to 0 will deactivate the protection.	
(P1.7.22)	733	**Response to fieldbus fault** This sets the response mode for the fieldbus fault when a fieldbus board is used. For more information, see the respective Fieldbus Board Manual. See ID732.	
(P1.7.23)	734	**Response to slot fault** This sets the response mode for a board slot fault caused by a missing or failed board. See ID732	
(P1.8.11)	738	**Automatic restarte: Number of tries after underload fault trip** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after an Underload fault trip >0 Number of automatic restarts after an Underload fault trip	
(P1.7.24)	739	**Number of PT100 inputs in use** If a PT100 input board is installed in the frequency converter, this sets the number of PT100 inputs in use. See the 9000X Option Board User Manual.	If the selected value is greater than the actual number of PT100 inputs being used, the display will read 200°C. If the input is short-circuited the displayed value is -30°C.
(P1.7.25)	740	**Response to PT100 fault** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting	

Code	Id	Descripions	Notes
(P1.7.26)	741	**PT100 warning limit** Set here the limit at which the PT100 warning will be activated.	
(P1.7.27)	742	**PT100 fault limit** Set here the limit at which the PT100 fault (F56) will be activated.	
(P1.7.28)	743	**PT100 numbers 2** See (P1.7.24)	
(P1.7.29)	744	**PT100 flt resp 2** See (P1.7.25)	
(P1.7.30)	745	**PT100 warn limit 2** See (P1.7.26)	
(P1.7.31)	746	**PT100 fault limit 2** See (P1.7.27)	
(P1.7.34)	755	**SafeDisable mode** With parameter, you set the mode of the Safe Disable.	
(P1.7.26.1, P1.7.30.1, P1.7.39.1, P1.7.31.1)	757	**Current regulator response** When set to Warning an A 90 Warning will appear if the drive is operating in the current limit region	
(P1.7.26.2, P1.7.30.2, P1.7.39.2, P1.7.31.2)	758	**Overvoltage regulator response** When set to Warning an A 91 Warning will appear if the drive is operating in the DC bus overvoltage region	
(P1.7.26.2, P1.7.30.2, P1.7.39.2, P1.7.31.2)	758	**Overvoltage regulator response** When set to Warning an A 91 Warning will appear if the drive is operating in the DC bus overvoltage region	
(P1.7.26.3, P1.7.30.2, P1.7.39.3, P1.7.31.3)	759	**Undervoltage regulator response** When set to Warning an A 92 Warning will appear if the drive is operating in the DC bus undervoltage region	
(P1.7.26.4, P1.7.30.2, P1.7.39.4, P1.7.31.4)	760	**Torque limit regulator response** When set to Warning an A 93 Warning will appear if the drive is operating in the Torque limit region	
(P1.7.35)	770	**Ref fault select** With this parameter, you select the reference source to monitor for a reference fault.	
(P1.7.24, P1.7.28, P1.7.33)	771	**FB MCW Bit 15** Bit 15 of the Fieldbus Main Control Word is used to indicate the status of the signal from the master controller. For example, the PROFIBUS board will set Bit 15 high if the drive is addressed correctly and communicating with the master. Bit 15 is set low and the red LED on the board is turned on if: • The cable is broken or incorrectly connected, • The wrong configuration is set in the master, or • The master is offline or shut down. Set Fault Low for this enhanced monitoring of the PROFIBUS. This bit can affect both the Communication Fault and Reference Fault. Other Fieldbus boards or master controllers may indicate a problem by setting Bit 15 high. In this case, select Fault High to respond to a Bit 15.	
(P1.7.34)	772	**FB monitor delay**	
(P1.9.1)	850	**Fieldbus reference minimum scaling**	
(P1.9.2)	851	**Fieldbus reference maximum scaling** Use these two parameters to scale the fieldbus reference signal. Setting value limits: 0 ≤ ID850 ≤ ID851 ≤ ID102. If ID851 = 0, custom scaling is not used and the minimum and maximum frequencies are used for scaling. The scaling functions as illustrated in **Figure 8.10**. See **Page 147.**	Using this custom scaling function also affects the scaling of the actual value.
(P1.9.3 to P1.9.10)	852 to 859	**Fieldbus data out selections 1 to 8** Using these parameters, you can observe any monitored item or parameter from the fieldbus. Enter the ID number of the item you wish to observe for its value. See **Page 147.**	

<table>
<tr><th>Code</th><th>Id</th><th>Descripions</th><th>Notes</th></tr>
<tr><td>(P1.9.3 to P1.9.10)</td><td>852 to 859</td><td>Some typical values:
Table 8.13. Typical monitored items
<table>
<tr><th>Item</th><th>Description</th><th>Item</th><th>Description</th></tr>
<tr><td>1</td><td>Output frequency</td><td>15</td><td>Digital inputs 1,2,3 status</td></tr>
<tr><td>2</td><td>Motor speed</td><td>16</td><td>Digital inputs 4,5,6 status</td></tr>
<tr><td>3</td><td>Motor current</td><td>17</td><td>Digital and relay output status</td></tr>
<tr><td>4</td><td>Motor torque</td><td>25</td><td>Frequency reference</td></tr>
<tr><td>5</td><td>Motor power</td><td>26</td><td>Analog output current</td></tr>
<tr><td>6</td><td>Motor voltage</td><td>27</td><td>AI3</td></tr>
<tr><td>7</td><td>DC link voltage</td><td>28</td><td>AI4</td></tr>
<tr><td>8</td><td>Unit temperature</td><td>31</td><td>AO1 (expander board)</td></tr>
<tr><td>9</td><td>Motor temperature</td><td>32</td><td>AO2 (expander board)</td></tr>
<tr><td>13</td><td>AI1</td><td>37</td><td>Active fault 1</td></tr>
<tr><td>14</td><td>AI2</td><td>–</td><td>–</td></tr>
</table></td><td></td></tr>
<tr><td>(P1.9.11)</td><td>876</td><td>FB data In1 sel
With this parameter, you select the ID of the parameter to write to with DB Data In1. The data is only sent to the drive on a change. This function is disabled if “Fieldbus” is selected in P1.10.4, Torq Ref Select</td><td></td></tr>
<tr><td>(P1.9.12)</td><td>877</td><td>FB data In2 sel
With this parameter, you select the ID of the parameter to write to with DB Data in2. The data is only sent to the drive on a change. This function is disabled if “Fieldbus” is selected by any parameter in Group 1.2.6, Free AI Select.</td><td></td></tr>
<tr><td>(P1.9.1)</td><td>1001</td><td>Number of auxiliary drives
With this parameter, the number of auxiliary drives in use will be defined. The functions controlling the auxiliary drives (ID458 to ID462) can be programmed to relay outputs or digital output. By default, one auxiliary drive is in use and it is programmed to relay output RO1 at B.1.</td><td></td></tr>
<tr><td>(P1.9.3)</td><td>1002</td><td>Start frequency, auxiliary drive 1
The frequency of the drive controlled by the frequency converter must exceed the limit defined with these parameters with 1 Hz before the auxiliary drive is started. The 1 Hz overdraft makes a hysteresis to avoid unnecessary starts and stops. See Figure 8.50. See also ID101 and ID102.</td><td></td></tr>
<tr><td>(P1.9.4)</td><td>1004</td><td>Start frequency, auxiliary drive 2</td><td></td></tr>
<tr><td>(P1.9.5)</td><td>1005</td><td>Stop frequency, auxiliary drive 2</td><td></td></tr>
<tr><td>(P1.9.6)</td><td>1006</td><td>Start frequency, auxiliary drive 3</td><td></td></tr>
<tr><td>(P1.9.7)</td><td>1007</td><td>Stop frequency, auxiliary drive 3</td><td></td></tr>
<tr><td>(P1.9.8)</td><td>1008</td><td>Start frequency, auxiliary drive 4</td><td></td></tr>
<tr><td>(P1.9.9)</td><td>1009</td><td>Stop frequency, auxiliary drive
See ID1002 and ID1003</td><td></td></tr>
<tr><td>(P1.9.10)</td><td>1010</td><td>Start delay of auxiliary drives
The frequency of the drive controlled by the frequency converter must remain above the start frequency of the auxiliary drive for the time defined with this parameter before the auxiliary drive is started. The delay defined applies to all auxiliary drives. This prevents unnecessary starts caused by the start limit being momentarily exceeded. See Figure 8.50.</td><td></td></tr>
</table>

Code	Id	Descripions	Notes
(P1.9.11)	1011	**Stop delay of auxiliary drives** The frequency of the drive controlled by the frequency converter must remain below the stop limit of the auxiliary drive for the time defined with this parameter before the auxiliary drive is stopped. The delay defined applies to all auxiliary drives. This prevents unnecessary stops caused by the stop limit frequency momentarily dropping below the limit. See **Figure 8.50**.	

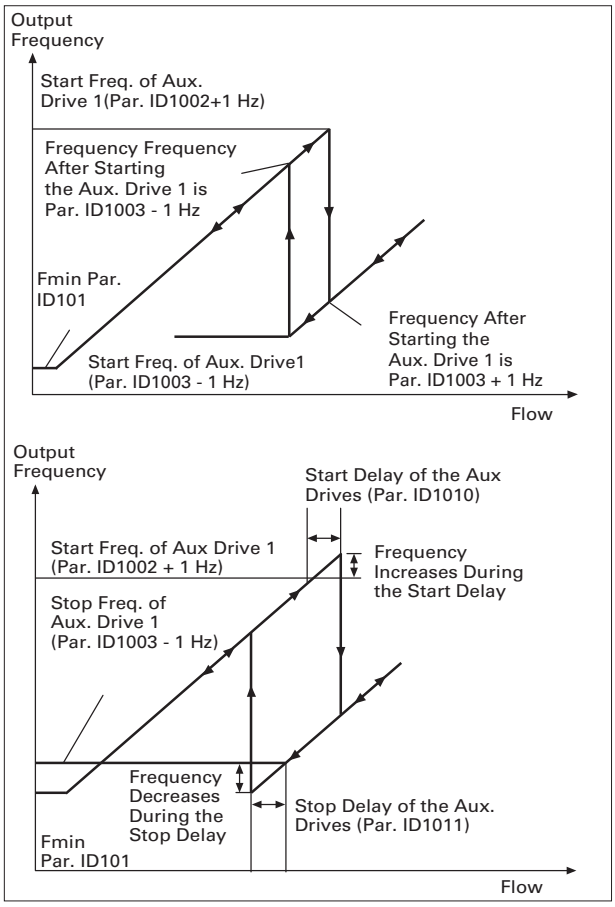


Figure 8.50. Example of parameter setting variable speed drive and one auxiliary drive

(P1.9.12)	1012	**Reference step after start of auxiliary drive 1**
(P1.9.13)	1013	**Reference step after start of auxiliary drive 2**
(P1.9.14)	1014	**Reference step after start of auxiliary drive 3**

Code	Id	Descripions	Notes
(P1.9.15)	1015	**Reference step after start of auxiliary drive 4** The reference step will always be automatically added to the reference value when the corresponding auxiliary drive is started. With the reference steps, e.g. the pressure loss in the piping caused by the increased flow can be compensated. See **Figure 8.51.**	
(P1.1.21, P 1.1.19)	1016	**Sleep frequency** The frequency converter is automatically stopped if the frequency of the drive falls below the Sleep level defined with this parameter for a time greater than that determined by ID1017. During the Stop state, the PID controller is operating switching the frequency converter back to the Run state when the actual value signal either falls below or exceeds (ID1019) the Wake-up level determined by ID1018. See **Figure 8.52**	
(P1.1.22, P1.1.20)	1017	**Sleep delay** The minimum amount of time the frequency has to remain below the Sleep level before the frequency converter is stopped. See **Figure 8.52**.	
(P1.1.23, P1.1.21)	1018	**Wake-up level** The wake-up level defines the level below which the actual value must fall or which has to be exceeded before the Run state of the frequency converter is restored. See **Figure 8.52**.	

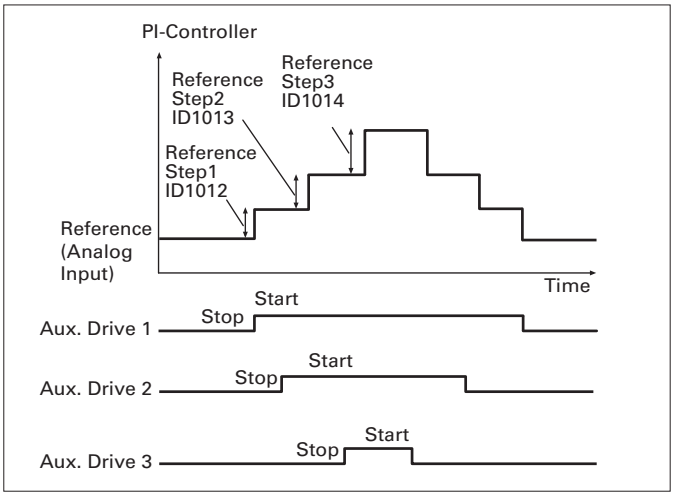


Figure 8.51. Reference steps after starting auxiliary drives

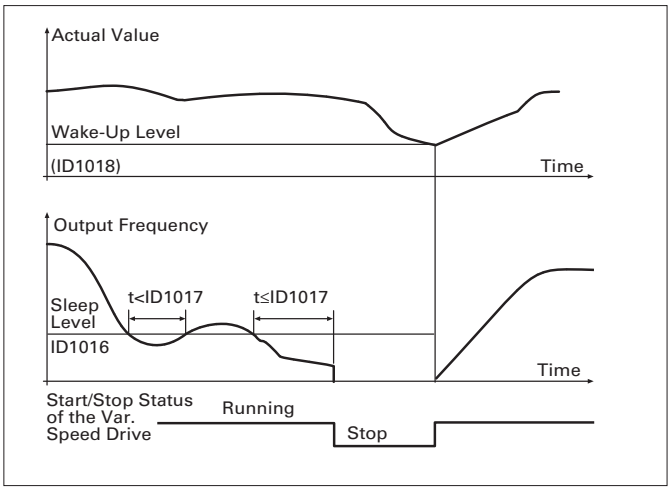
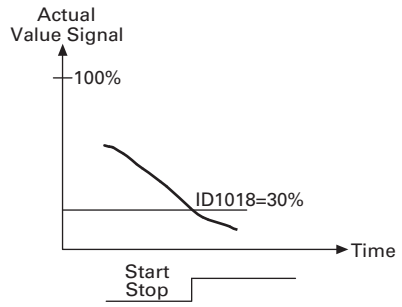
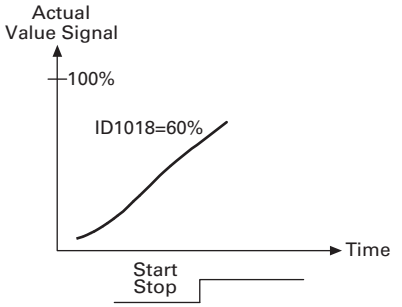
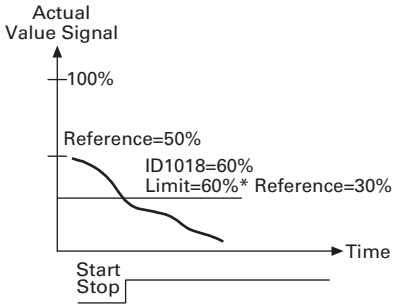
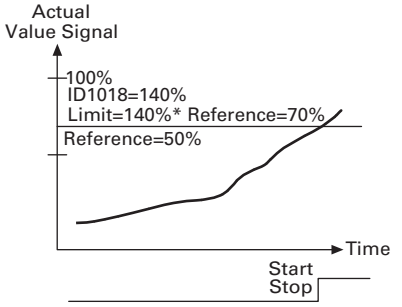


Figure 8.52. Frequency converter sleep function

Code	Id	Descripions	Notes
(P1.1.24, P 1.1.22)	**1019**	**Wake-up function** This parameter defines whether the restoration of the Run state occurs when the actual value signal falls below or exceeds the Wake-up level (ID1018). See **Figure 8.52** and **Table 8.14.** Application 5 has selections 0 - 1 and Application 7 selections 0 - 3 available.	

Table 8.14. Typical monitored items

Parameter Value	Function	Limit	Description
0	Wake-up happens when actual value goes below the limit	The limit defined with ID1018 is in percent of the maximum actual value	
1	Wake-up happens when actual value exceeds the limit	The limit defined with ID1018 is in percent of the maximum actual value	
2	Wake-up happens when actual value goes below the limit	The limit defined with ID1018 is in percent of the current value of the reference signal	
3	Wake-up happens when actual value exceeds the limit	The limit defined with ID1018 is in percent of the current value of the reference signal	

Code	Id	Descriptions	Notes
(P1.9.16)	1020	**PID controller bypass** With this parameter, the PID controller can be programmed to be bypassed. Then the frequency of the controlled drive and the starting points of the auxiliary drives are defined according to the actual value signal. See **Figure 8.53.**	

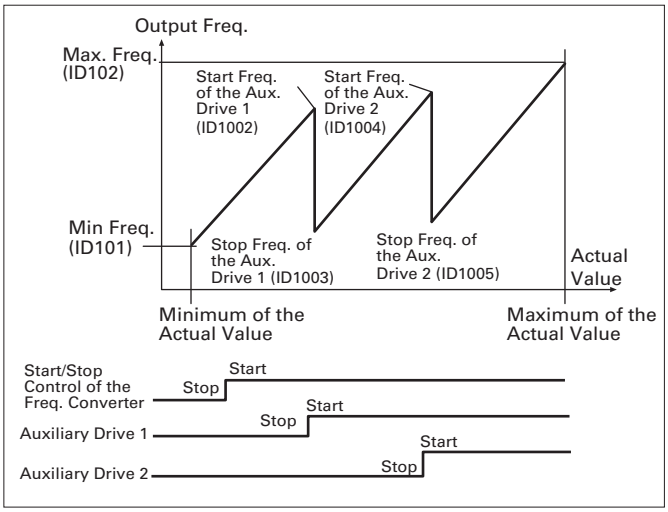


Figure 8.53. Example of adjustable frequency drive and two auxiliary drives with bypassed PID controller

(P1.9.17)	1021	**Analog input selection for input pressure measurement**	
(P1.9.18)	1022	**Input pressure high limit**	
(P1.9.19)	1023	**Input pressure low limit**	
(P1.9.20)	1024	**Output pressure drop value** In pressure increase stations there may be need for decreasing the output pressure if the input pressure decreases below a certain limit. The input pressure measurement which is needed is connected to the analog input selected with ID1021. See **Figure 8.54.**	

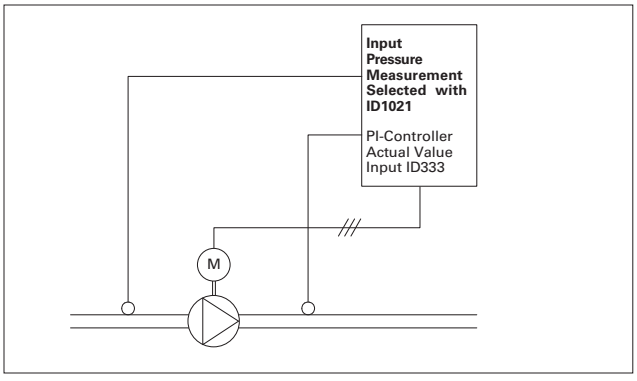


Figure 8.54. Input and output pressure measuring

Code	Id	Descriptions	Notes
(P1.9.20)	**1024**	D1022 and ID1023 are used to select the limits for the area of the input pressure, where the output pressure is decreased. The values are in percent of the input pressure measurement maximum value. With ID1024 the value for the output pressure decrease within this area can be set. The value is in percent of the reference value maximum. See **Figure 8.55.**	

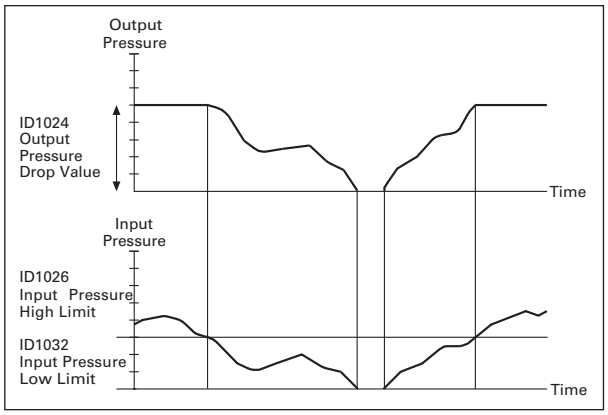


Figure 8.55. Output pressure behavior depending on input pressure and parameter settings

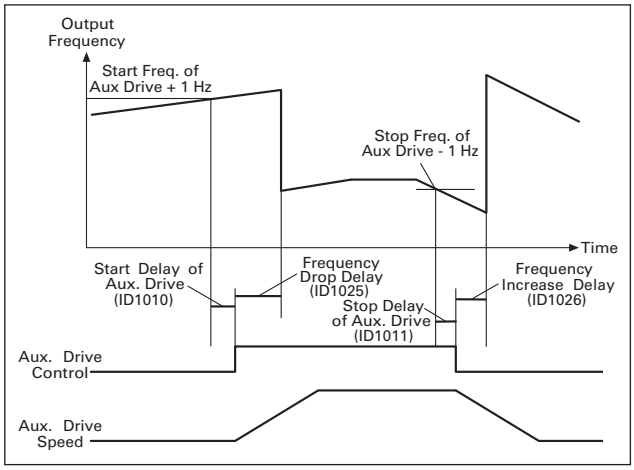
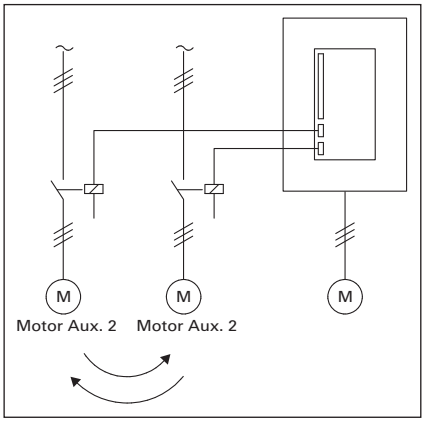
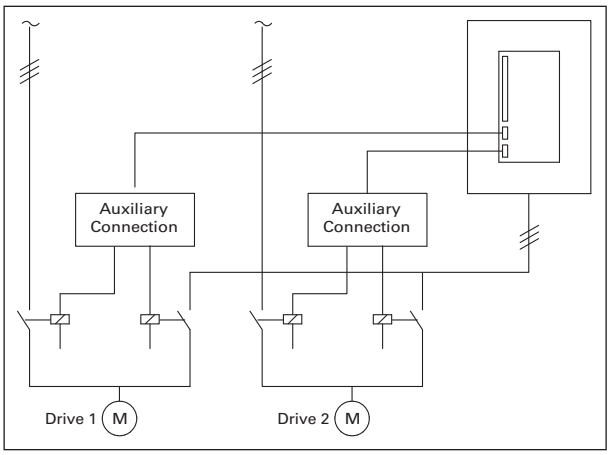
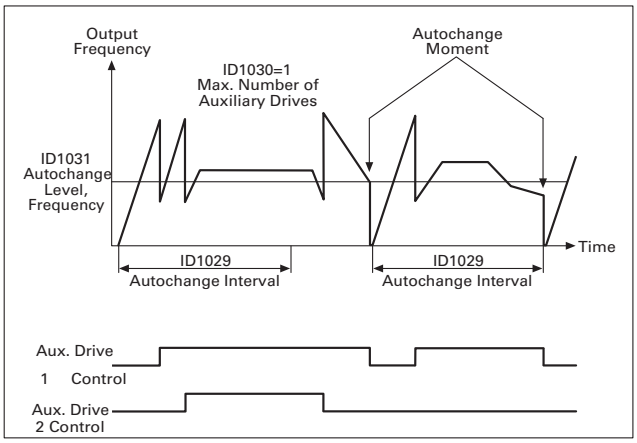
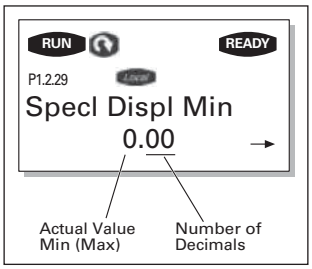
(P1.9.21)	**1025**	**Frequency drop delay after starting auxiliary drive**	
(P1.9.22)	**1026**	**Frequency increase delay after stopping auxiliary drive** If the speed of auxiliary drive increases slowly (e.g. in soft starter control) then a delay between the start of auxiliary drive and the frequency drop of the adjustable frequency drive will make the control smoother. This delay can be adjusted with ID1025. In the same way, if the speed of the auxiliary drives decreases slowly a delay between the auxiliary drive stop and the frequency increase of the adjustable frequency drive can be programmed with ID1026. See **Figure 8.56**. If either of the values of ID1025 or ID1026 is set to maximum (300.0 s) no frequency drop nor increase takes place.	
(P1.9.22)	**1026**		

Figure 8.56. Frequency drop and increase delays

(P1.9.24)	**1027**	**Autochange** 0 Autochange not used 1 Autochange used	

Code	Id	Descriptions	Notes
(P1.9.25)	1028	**Autochange/interlocks automatics selection** 0 Automatics (autochange/interlockings) applied to auxiliary drives only The drive controlled by the frequency converter remains the same. Only the mains contactor is needed for each drive. See **Figure 8.57.**  **Figure 8.57. Autochange applied to auxiliary drives only** 1 All drives included in the autochange/interlockings sequences The drive controlled by the frequency converter is included in the automatics and two contactors are needed for each drive to connect it to the mains or the frequency converter. See **Figure 8.58.**  **Figure 8.58. Autochange with all drives**	
(P1.9.26)	1029	**Autochange interval** After the expiration of the time defined with this parameter, the autochange function takes place if the capacity used lies below the level defined with ID1031 (Autochange frequency limit) and ID1030 (Maximum number of auxiliary drives). Should the capacity exceed the value of ID1031, the autochange will not take place before the capacity goes below this limit. • The time count is activated only if the Start/Stop request is active. • The time count is reset after the autochange has taken place. See **Figure 8.59**.	
(P1.9.27)	1030	**Maximum number of auxiliary drives**	

Code	Id	Descriptions	Notes
(P1.9.28)	1031	**Autochange frequency limit** These parameters define the level below which the capacity used must remain for autochange to take place. This level is defined as follows: • If the number of running auxiliary drives is smaller than the value of ID1030 the autochange function can take place • If the number of running auxiliary drives is equal to the value of ID1030 and the frequency of the controlled drive is below the value of ID1031 the autochange can take place • If the value of ID1031 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of ID1030  **Figure 8.59. Autochange interval and limits**	
(P1.9.23)	1032	**Interlock selection** With this parameter you can activate or deactivate the feedback signal from the drives. The interlock feedback signals come from the switches that connect the motors to the automatic control (frequency converter), directly to the mains line or place them in the off-state. The interlock feedback functions are connected to the digital inputs of the frequency converter. Program ID426 to ID430 to connect the feedback functions to the digital inputs. Each auxiliary drive must be connected to its own interlock input. The Pump and fan control only controls those motors whose interlock input is active. 0 Interlock feedback not used The frequency converter receives no interlock feedback from the auxiliary drives 1 Update of autochange order in Stop The frequency converter receives interlock feedback from the auxiliary drives. In case one of the auxiliary drives is, for some reason, disconnected from the system and eventually re-connected, it will be placed last in the autochange line without stopping the system. However, if the autochange order now becomes, for example, [P1 ➔ P3 ➔ P4 ➔ P2], it will be updated in the next Stop (autochange, sleep, stop, etc.). **Example:** [P1 ➔ P3 ➔ P4] ➔ [P2 LOCKED] ➔ [P1 ➔ P3 ➔ P4 ➔ P2] ➔ [SLEEP] ➔ [P1 ➔ P2 ➔ P3 ➔ P4] 2 Update of order immediately The frequency converter receives interlock feedback from the auxiliary drives. At reconnection of an auxiliary drive to the autochange line, the automatics will stop all motors immediately and re-start with a new setup. **Example:** [P1 ➔ P2 ➔ P4] ➔ [P3 LOCKED] ➔ [STOP] ➔ [P1 ➔ P2 ➔ P3 ➔ P4]	

Code	Id	Descriptions	Notes
(P1.9.29)	1033	**Actual value special display minimum**	
(P1.9.30)	1034	**Actual value special display maximum**	
(P1.9.31)	1035	**Actual value special display decimals** These parameters set the minimum and maximum values and the number of decimals of the actual value special display. Observe the actual value display in menu M1, Monitoring values.  **Figure 8.60. Actual value special display**	
(P1.7.25, P1.7.29, P1.7.37)	1333	**Earth fault current limit** With this parameter, you are able to select the level of protection for the Ground Fault Protection.	
(P1.7.32)	1354	**FB Watchdog delay** With this parameter, you activate the WatchDog timer. If bit 11 of the Main Control Word stops cycling for this set period of time, an FB Communication Fault occurs.	
(P1.2.1.8)	1399	**CPX Temp open delay** This Parameter specifies the time the CPX temp open Input is ignored after the run signal, this provides time for the input contactor to close after the run is initated.	
(P1.9.1, P1.11.1)	1490	**Cold weather** With this parameter, you are able to enable the cold weather function of the drive, this will cause the frequency converters under temp limit to drop from -10 deg C to -30 deg C, this then enables a warm up feature when the frequency converter is between -30 deg C and -20 deg C, the motor when given a run command with turn on for the Cold Weather Timeout (ID1492) and output the Cold Weather Voltage (ID1491) at .5 Hz to allow the motor to warm up, if does not warm up above -20 deg C after that time frequency converter will fault on Under temp fault, if frequency converter does go above -20 deg C output will being to follow reference.	
(P1.9.2, P1.11.2)	1491	**Cold weather voltage** With this parameter, you are able to select the % of the motor voltage that is out put to the motor when in the cold weather warm up period.	
(P1.9.3, P1.11.3)	1492	**Cold weather time out** With this parameter, you are able to select the time limit that the frequency converter run in the warm up period.	
(P1.2.10, P1.2.18, P1.2.42, P1.2.1.7)	1494	**Start delay** This parameter allows for a delay in the start sequence.	
(P1.8.4)	1495	**Start delay mode** This parameter allows for selecting the mode for starting in an Auto Restart situation, if set to use start delay it will follow delay time after reset condition.	
(P1.2.7.22, P1.2.6.22)	1497	**Force local** This parameter forces the frequency converter into the local control location.	
(P1.4.14)	1522	**High speed mode** Changes maximum fundamental output frequency from 320.0 Hz to 600.0 Hz.	
(P1.3.5.8, P1.3.5.9, P1.3.6.8, P1.3.6.9, P1.3.7.8, P1.3.7.9)	1531 to 1536	**AO Temp range min and max** Using these parameters, you can scale the temperature range on the analog output	
(P1.2.7.23)	1546	**Force comms** This parameter forces the frequency converter into communications control.	
P1.2.7.24, P1.2.6.23)	1547	**Output contactor interlock input** This defines the input for an output contactor interlock	

Code	Id	Descriptions	Notes
(P1.3.3.29)	1680	**Safe disable** With this parameter, you select the digital output to show the status of the Safe Disable. (Requires SPX drive and OPTAF in Slot B.)	
(P1.3.3.30)	1681	**ChargeSWState** With this parameter, you select the digital output to show the status of the DC Bus charge. Can be used to close contactor when CPX precharge is complete.	
(P1.2.7.21, P1.2.6.24)	1686	**CPX Temperature fault** Contact open: Fault is displayed and motor stopped.	
(P1.3.3.31)	1690	**Run 2** See ID 433.	
(P1.3.3.32)	1691	**Fault 2** See ID 434.	
(P1.2.43)	1796	**Engineering units** PID engineering units used.	

Value	Unit
0	%
1	Temp F
2	Temp C
3	PSIG
4	BAR
5	Feet
6	" Water column
7	Gallons per minute
8	Feet per minute
9	CFM
10	PPM

(P1.8.12)	1901	**CPX Temp open restart tries** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after CPX Temp Open Fault >0 Number of automatic restarts the CPX Temp Open input must be closed to allow a restart.	
(P1.8.13)	1902	**Output contactor interlock restart tries** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after an output contactor interlock fault >0 Number of automatic restarts the output contactor interlock input must be closed to allow a restart.	
(P1.7.38, P1.7.30)	1903	**Output contactor interlock fault response** 0 No response 1 Warning 2 Fault, stop mode after fault according to ID506 3 Fault, stop mode after fault always by coasting	
(P1.8.15)	1904	**Fault 53 auto-reset** When set to enabled an F53 communications fault will be reset upon reestablished connection to the master.	
(P1.8.14)	1905	**Slot fault restart tries** This parameter determines how many automatic restarts can be made during the trial time set by ID718. 0 No automatic restart after a slot fault >0 Number of automatic restarts for a slot fault	

Code	Id	Descriptions	Notes
(P1.3.4.16)	**1906**	**Current supervision** 0 No response 1 Low limit supervision 2 High limit supervision	
(P1.3.4.17)	**1907**	**Current supervision value** 0 No response 1 Low limit supervision 2 High limit supervision	
(P1.3.3.33)	**1908**	**Current supervision output** Defines which output will be used for the current supervision function TTF method	

Keypad control parameters

Unlike the parameters listed above, these parameters are located in the M2 menu of the control keypad.
The reference parameters do not have an ID number.

Code	Id	Descriptions	Notes
(P2.4, P2.6)	**114**	**STOP button activated** To make the STOP button a "hotspot" which always stops the drive regardless of the selected control place, set the value of this parameter to 1. See also ID125.	
(P2.3)	**123**	**Keypad direction** 0 Forward: The rotation of the motor is forward, when the keypad is the active control place. 1 Reverse: The rotation of the motor is reversed, when the keypad is the active control place. For more information, see the 9000X AF Drives User Manual, Chapter 5, Keypad Control Menu (**M2**).	
(R2.2)	**R3.2**	**Keypad reference** The frequency reference can be adjusted from the keypad with this parameter. The output frequency can be copied as the keypad reference by pushing the STOP button for 3 seconds when you are on any of the pages of menu M2. For more information, see the 9000X AF Drives User Manual, Chapter 5, Keypad Control Menu (M2).	
(R2.4)	**R3.4**	**PID reference 1** The PID controller keypad reference can be set between 0% and 100%. This reference value is the active PID reference if ID332 = 2.	
(R2.5)	**R3.5**	**PID reference 2** The PID controller keypad reference 2 can be set between 0% an 100%. This reference is active if the DIN5 function = 13 and the DIN5 contact is closed.	
(R2.5)	**R3.5**	**Torque reference** Defines the torque reference from 0.0 to 100.0%.	
	1685	**Control Place** This parameter defines the control place or where the control place is selected.	
	1688	**Operate menu hide — disables operate menu to use monitor menu without auto return to operate.**	
	1707	**Hide operate menu** With this parameter, you can disable the Keypad Operate Menu so the Multimonitor Menu can be used to display three monitor values at a time. if one of the values is a reference, the up/down arrows will adjust the reference as with the Operate Menu.	

Appendix A — Additional information

In this chapter you will find additional information on special parameter groups. Such groups are:

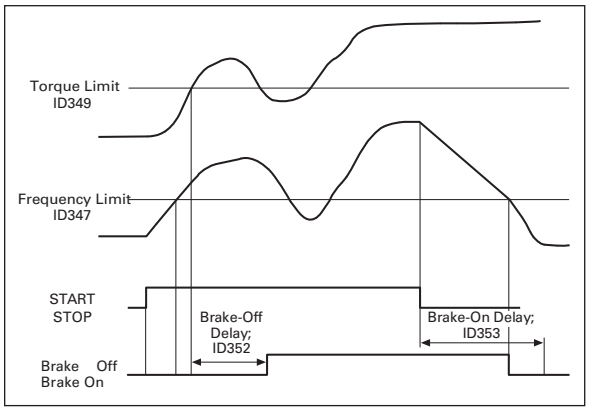
- Parameters of External Brake Control with Additional Limits (see below)
- Closed Loop Parameters (See **Page 146**)
- Advanced Open Loop Parameters (See **Page 147**)
- Parameters of Motor Thermal Protection (See **Page 147**)
- Parameters of Stall Protection (See **Page 147**)
- Parameters of Underload Protection (See **Page 147**)
- Fieldbus Control Parameters (See **Page 147**)

External brake control with additional limits

ID315, ID316, ID346 to ID349, ID352, ID353

The external brake used for additional braking can be controlled through ID315, ID316, ID346 to ID349 and ID352/ ID353. Selecting On/Off Control for the brake, defining the frequency or torque limit(s) the brake should react to and defining the Brake-On/-Off delays will allow an effective brake control. See Figure A-1.

Figure A-1: Brake control with additional limits



In Figure A-1 the brake control is set to react to both the torque supervision limit (ID349) and frequency supervision limit (ID347). Additionally, the same frequency limit is used for both brake-off and brake-on control by giving ID346 the value 4. Use of two different frequency limits is also possible. Then ID315 and ID346 must be given the value 3.

Brake-off: In order for the brake to release, three conditions

must be fulfilled: 1) the drive must be in Run state, 2) the torque must be over the set limit (if used) and 3) the output frequency must be over the set limit (if used).

Brake-on: Stop command activates the brake delay count and the brake is closed when the output frequency falls below the set limit (ID315 or ID346). As a precaution, the brake closes when the brake-on delay expires, at the latest.

Note: A fault or Stop state will close the brake immediately without a delay. See **Figure A-2**.

Note: It is strongly advisable that the brake-on delay be set longer than the ramp time in order to avoid damaging of the brake.

Closed loop parameters

ID612 to ID621

Select the Closed loop control mode by setting value 3 or 4 for ID600.

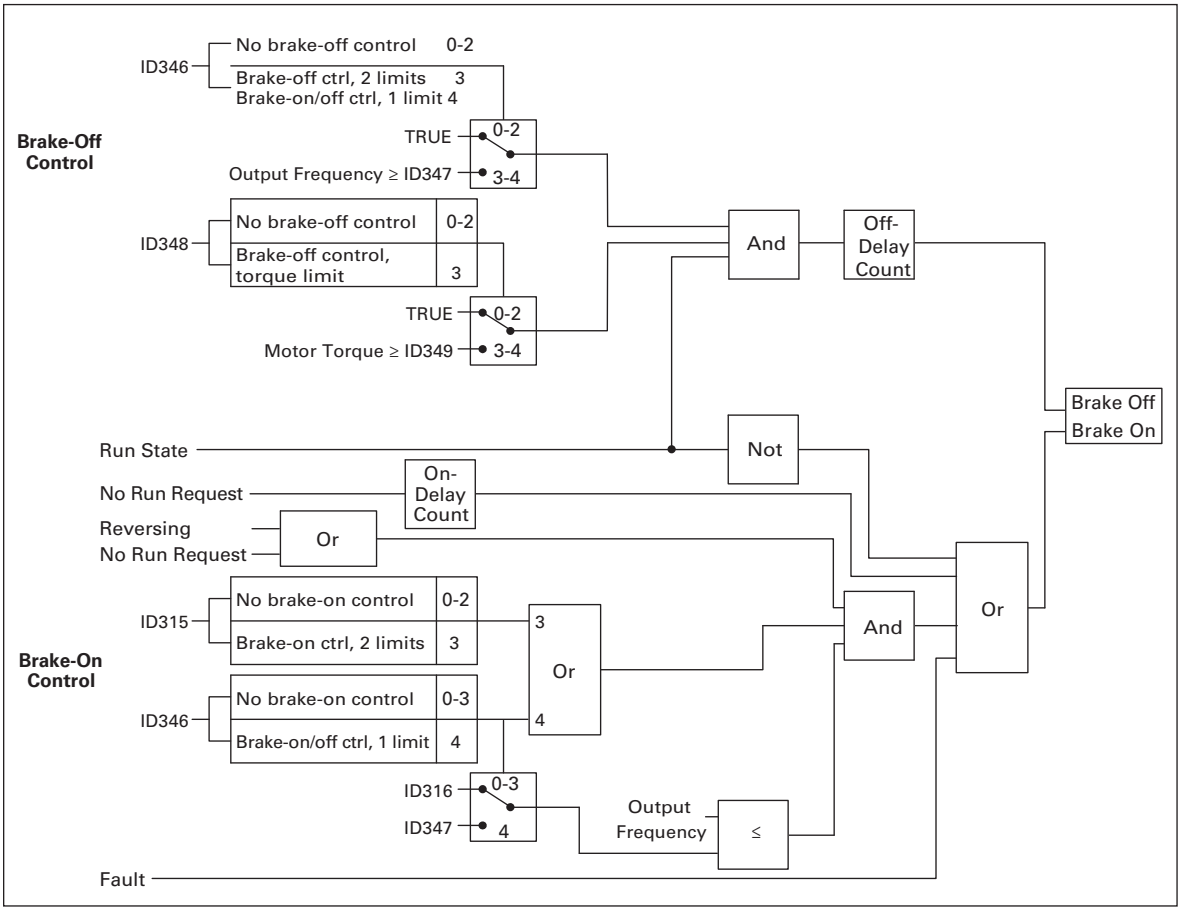
Closed loop control mode (See **Page 123**) is used when enhanced performance near zero speed and better static speed accuracy with higher speeds are needed. Closed loop control mode is based on "rotor flux oriented current vector control". With this controlling principle, the phase currents are divided into a torque producing current portion and a magnetizing current portion. Thus, the squirrel cage induction machine can be controlled in a fashion of a separately excited DC motor.

Note: These parameters can be used with SVXP drive only.

Example: Motor Control Mode = 3 (Closed loop speed control)

This is the usual operation mode when fast response times, high accuracy or controlled run at zero frequencies are needed. Encoder board should be connected to slot C of the control unit. Set the encoder P/R-parameter (P7.3.1.1). Run in open loop and check the encoder speed and direction (V7.3.2.2). Change the direction parameter (P7.3.1.2) or switch the phases of motor cables if necessary. Do not run if encoder speed is wrong. Program the no-load current to ID612 and set ID619 (Slip Adjust) to get the voltage slightly above the linear V/Hz-curve with the motor frequency at about 66% of the nominal motor frequency. The Motor Nominal Speed parameter (ID112) is critical. The Current Limit parameter (ID107) controls the available torque linearly in relative to motor nominal current.

Figure A-2: Brake control logic



Parameters of motor thermal protection

ID704 to ID708

General

The motor thermal protection is to protect the motor from overheating. The Eaton drive is capable of supplying higher than nominal current to the motor. If the load requires this high current there is a risk that the motor will be thermally overloaded. This is the case especially at low frequencies. At low frequencies the cooling effect of the motor is reduced as well as its capacity. If the motor is equipped with an external fan the load reduction at low speeds is small.

The motor thermal protection is based on a calculated model and it uses the output current of the drive to determine the load on the motor.

The motor thermal protection can be adjusted with parameters. The thermal current I_T specifies the load current above which the motor is overloaded. This current limit is a function of the output frequency.

The thermal stage of the motor can be monitored on the control keypad display. See *9000X AF Drives User Manual*, *Chapter 5*.

⚠ CAUTION

The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill.

Parameters of stall protection

ID709 to ID712

General

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of motor thermal protection. The stall state is defined with two parameters, ID710 (Stall current) and ID712 (Stall frequency limit). If the current is higher than the set limit and output frequency is lower than the set limit, the stall state is true. There is actually no real indication of the shaft rotation. Stall protection is a type of overcurrent protection.

Parameters of underload protection

ID713 to ID716

General

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.

Motor underload protection can be adjusted by setting the underload curve with parameters ID714 (Field weakening area load) and ID715 (Zero frequency load), see below. The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5 Hz (the underload time counter is stopped).

The torque values for setting the underload curve are set in percentage which refers to the nominal torque of the motor. The motor's name plate data. parameter motor nominal current and the drive's nominal current I_H are used to find the scaling ratio for the internal torque value. If other than nominal motor is used with the drive, the accuracy of the torque calculation decreases.

Fieldbus control parameters

ID850 to ID859

The Fieldbus control parameters are used when the frequency or the speed reference comes from the fieldbus (Modbus, Profibus, DeviceNet, etc.). With the Fieldbus Data Out Selection 1 - 8, you can monitor values from the fieldbus.

Cold weather parameters

ID1490 to ID1493

The Cold Weather parameters were placed into the Standard, PID and Multipurpose applications. The frequency converter is defaulted with a under temperature limit of -10 deg C, when ID1490 is enabled it causes the under temperature fault limit to go to -30 deg C. When the drive drops below -20 deg C the drive will go into an alarm state where it will run the motor at 0.5 Hz at the rated ID1491 Voltage percentage. This runs for a set period of time based off ID1492, if the temperature rises above -20 deg C the drive will begin to ramp up as usual to the desired frequency. If the temperature does not increase pass -20 deg C it will fault out on drive under temperature. If the temperature is below -30 deg C it will fault out instantaneously and not go through the warm up process.

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