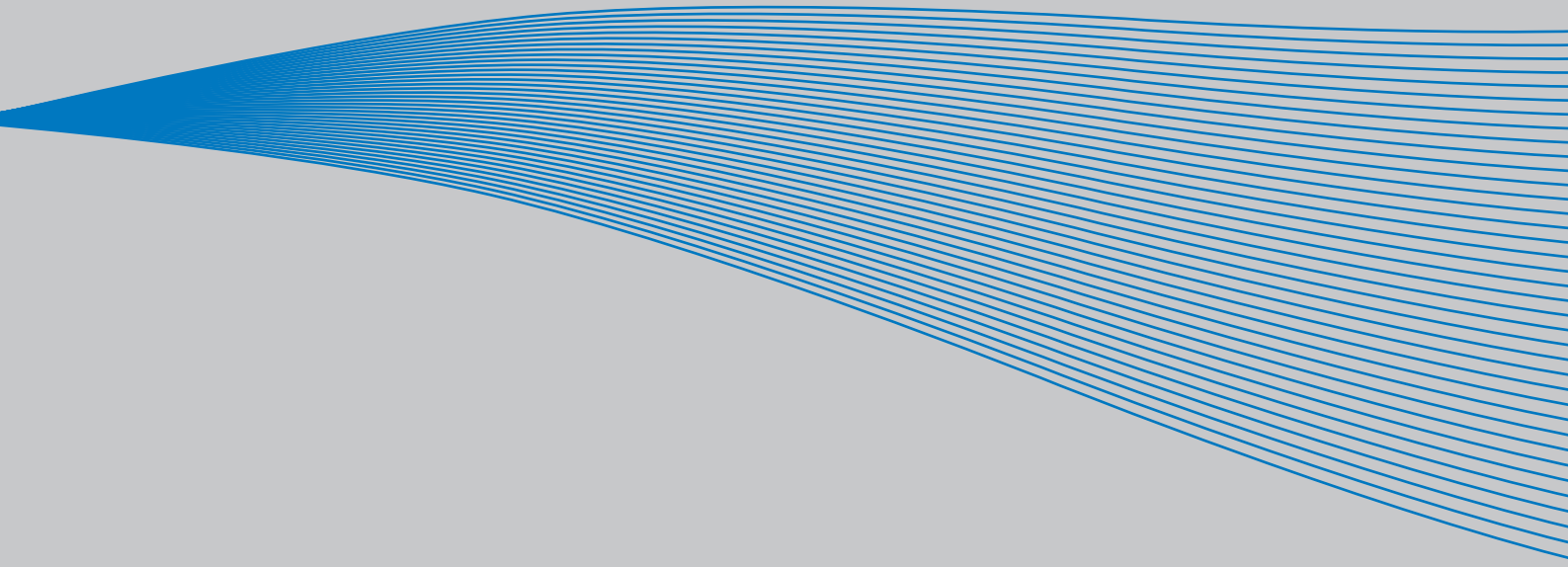
VACON® NX
AC DRIVES

ALL IN ONE APPLICATION MANUAL



VACON®
DRIVEN BY DRIVES

PREFACE

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Software code:	• Basic Application = ASFIFF01 • Standard Application = ASFIFF02 • Local/Remote Control Application = ASFIFF03 • Multi-step Speed Control Application = ASFIFF04 • PID Control Application = ASFIFF05 • Multi-purpose Control Application - NXS = ASFIFF06 - NXP = APFIFF06 • Pump and Fan Control Application = ASFIFF07

ABOUT THIS MANUAL

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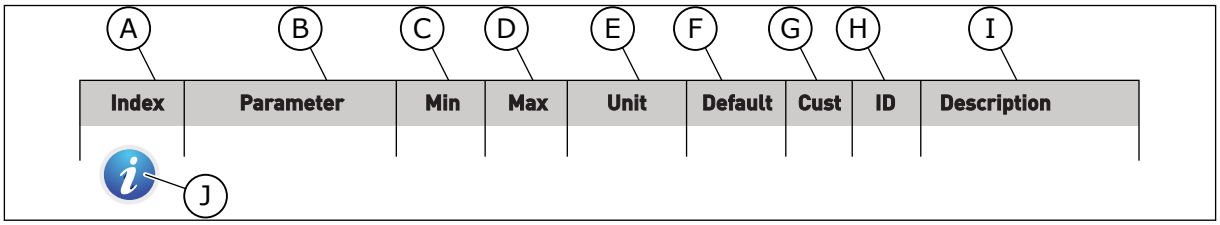
In this manual, you can read about the functions of the Vacon® AC drive and how to use the drive.

This manual includes a large quantity of parameter tables. These instructions tell you how to read the tables.



A. The location of the parameter in the menu, that is, the parameter number.
B. The name of the parameter.
C. The minimum value of the parameter.
D. The maximum value of the parameter.
E. The unit of the value of the parameter. The unit shows if it is available.
F. The value that was set in the factory.
G. The customer's own setting.
H. The ID number of the parameter.
I. A short description of the values of the parameter and/or its function.
J. When the symbol shows, you can find more data about the parameter in Chapter Parameter descriptions.

NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from www.vacon.com/downloads.

REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site www.vacon.com/downloads.

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1 BASIC APPLICATION

1.1 INTRODUCTION

The Basic Application is a simple and easy-to-use application. It is the default setting on delivery from the factory. Otherwise select the Basic Application in menu M6 on page S6.2. See the product's User Manual.

Digital input DIN3 is programmable.

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

1.1.1 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
- Thermistor fault protection
- Fieldbus fault protection
- Slot fault protection

Unlike the other applications, the Basic Application does not provide any parameters for choosing the response function or limit values for the faults. For more information on the motor thermal protection, see ID704 in Chapter *8 Parameter descriptions*.

1.2 CONTROL I/O

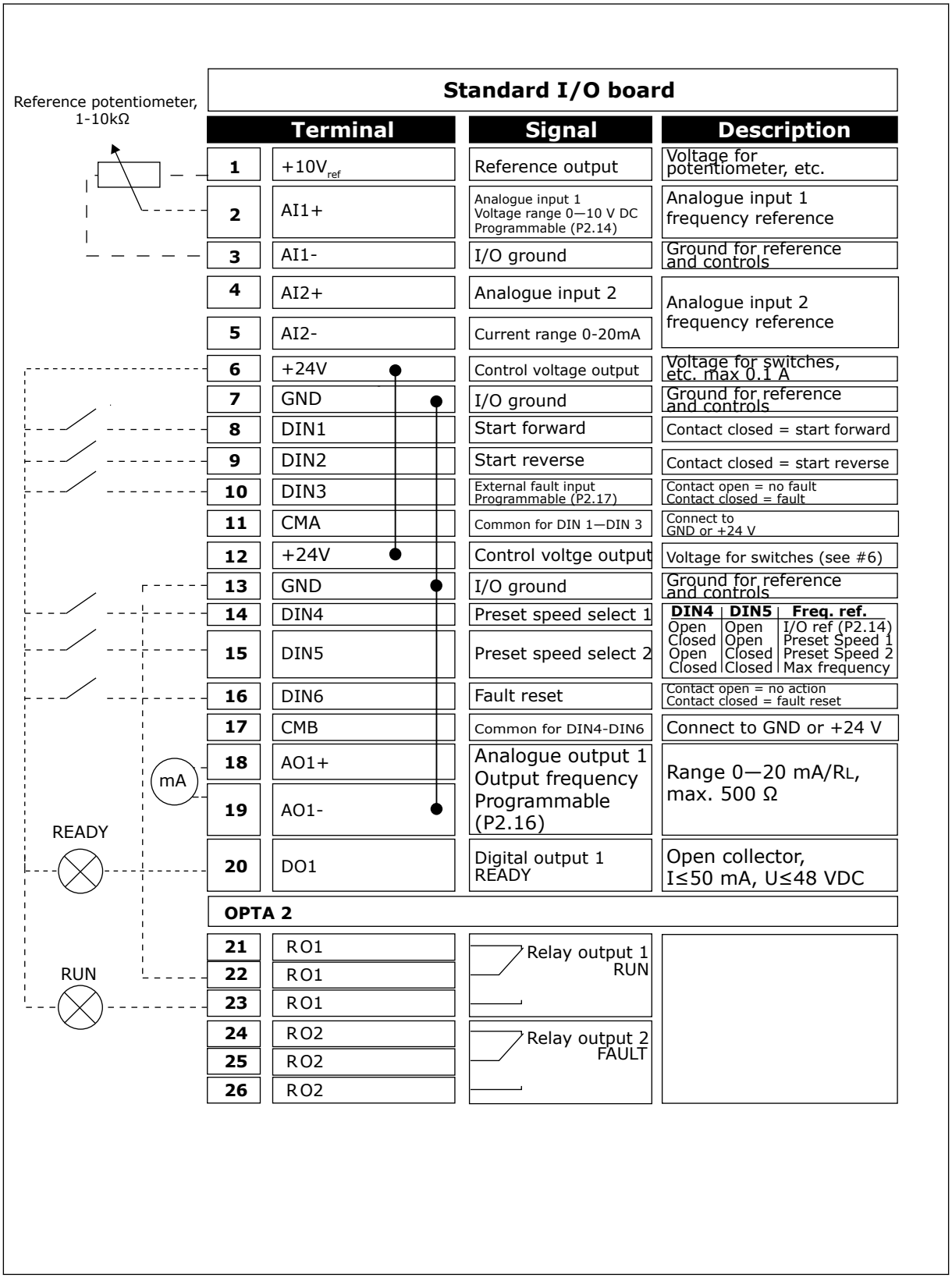

Fig. 1: Basic application default I/O configuration

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NOTE!

See jumper selections below. More information in the product's User Manual.

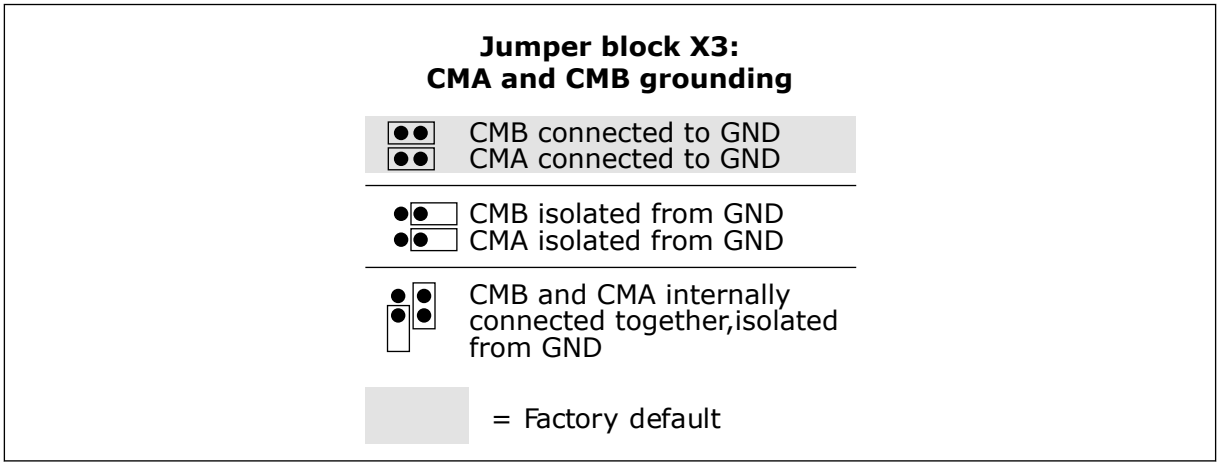

Fig. 2: Jumper selections

1.3 CONTROL SIGNAL LOGIC IN BASIC APPLICATION

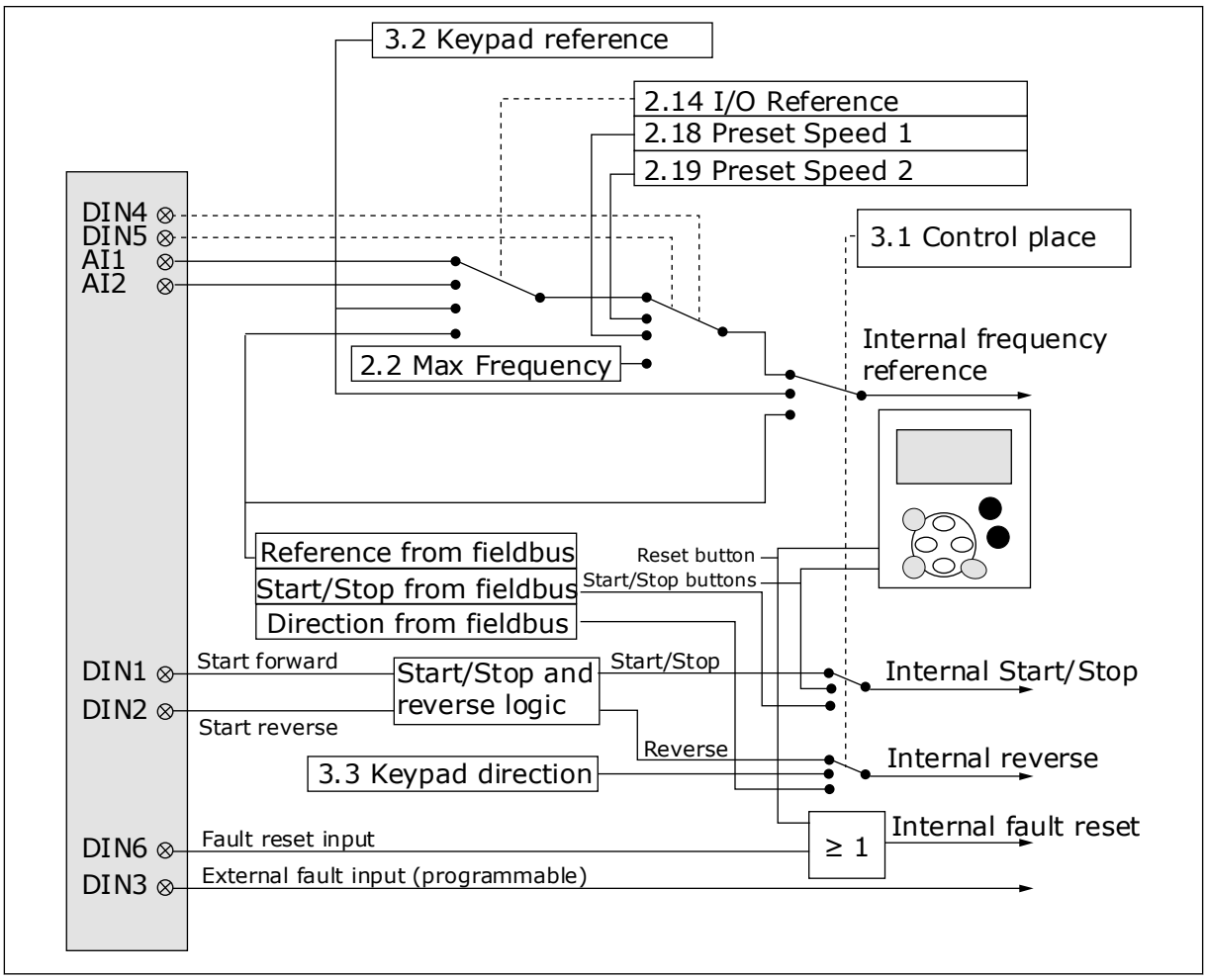

Fig. 3: Control signal logic of the Basic Application

1.4 BASIC APPLICATION - PARAMETER LISTS

1.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

Table 1: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.16	Analogue I_{out}	mA	26	AO1
V1.17	Multimonitoring items			Displays three selectable monitoring values

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1.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 2: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1	Min frequency	0.00	P2.2	Hz	0.00		101	
P2.2	Max frequency	P2.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.3	Acceleration time 1	0.1	3000.0	s	3.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.4	Decelaration time 1	0.1	3000.0	s	3.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.6	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.7	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.8	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.9	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

Table 2: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.10	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.11	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.12	Stop function	0	3		0		506	0 = Costing 1 = Ramp 2 = Ramp + Run enable coast 3 = Coast + Run enable ramp
P2.13	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.14	I/O reference	0	3		0		117	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.15	Analogue input 2, reference offset	0	1		1		302	0 = 0-20 mA 1 = 4 mA-20mA
P2.16	Analogue output function	0	8		1		307	0 = Not used 1 = Output freq. (0-f_{max}) 2 = Freq. reference (0-f_{max}) 3 = Motor speed (0-Motor nominal speed) 4 = Output current (0-I_{nMotor}) 5 = Motor torque (0-T_{nMotor}) 6 = Motor power (0-P_{nMotor}) 7 = Motor voltage (0-U_{nMotor}) 8 = DC-link volt (0-1000V)

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Table 2: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.17	DIN3 function	0	7		1		301	0 = Not used 1 = Ext. fault, closing cont. 2 = Ext. fault, opening cont. 3 = Run enable, cc 4 = Run enable, oc 5 = Force cp. to IO 6 = Force cp. to keypad 7 = Force cp. to fieldbus
P2.18	Preset speed 1	0.00	P2.2	Hz	0.00		105	Speeds preset by operator
P2.19	Preset speed 2	0.00	P2.2	Hz	50.00		106	Speeds preset by operator
P2.20	Automatic restart	0	1		0		731	0 = Disabled 2 = Enabled

1.4.3 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

Table 3: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1	P2.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	You can adjust the frequency reference on the keypad with this parameter.
R3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

1.4.4 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

1.4.5 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

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2 STANDARD APPLICATION

2.1 INTRODUCTION

Select the Standard Application in menu M6 on page S6.2.

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 prohibit frequency area
- Programmable U/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 Parameter descriptions* of this manual. The explanations are arranged according to the individual ID number of the parameter.

2.2 CONTROL I/O

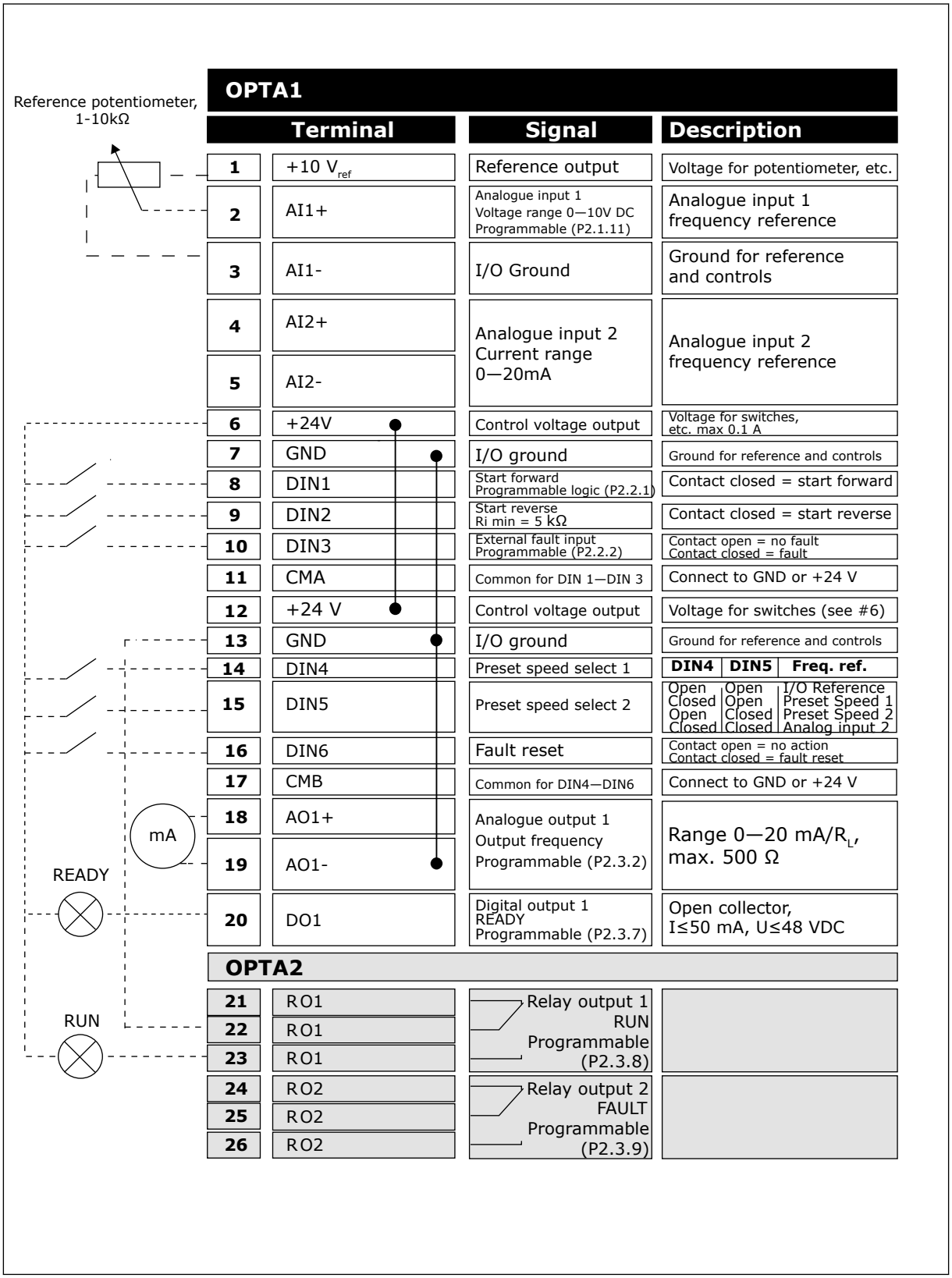

Fig. 4: Standard application default I/O configuration

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NOTE!

See jumper selections below. More information in the product's User Manual.

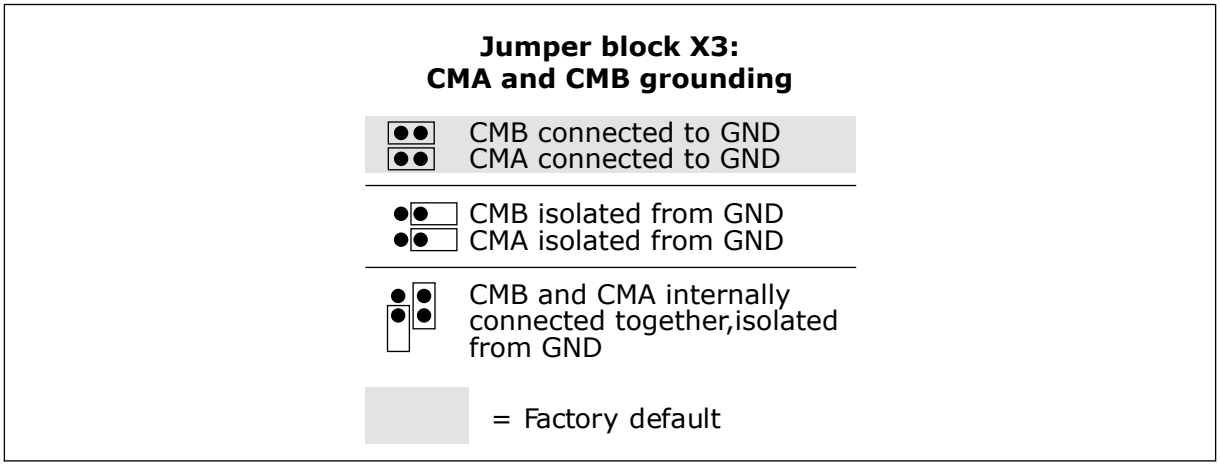

Fig. 5: Jumper selections

2.3 CONTROL SIGNAL LOGIC IN STANDARD APPLICATION

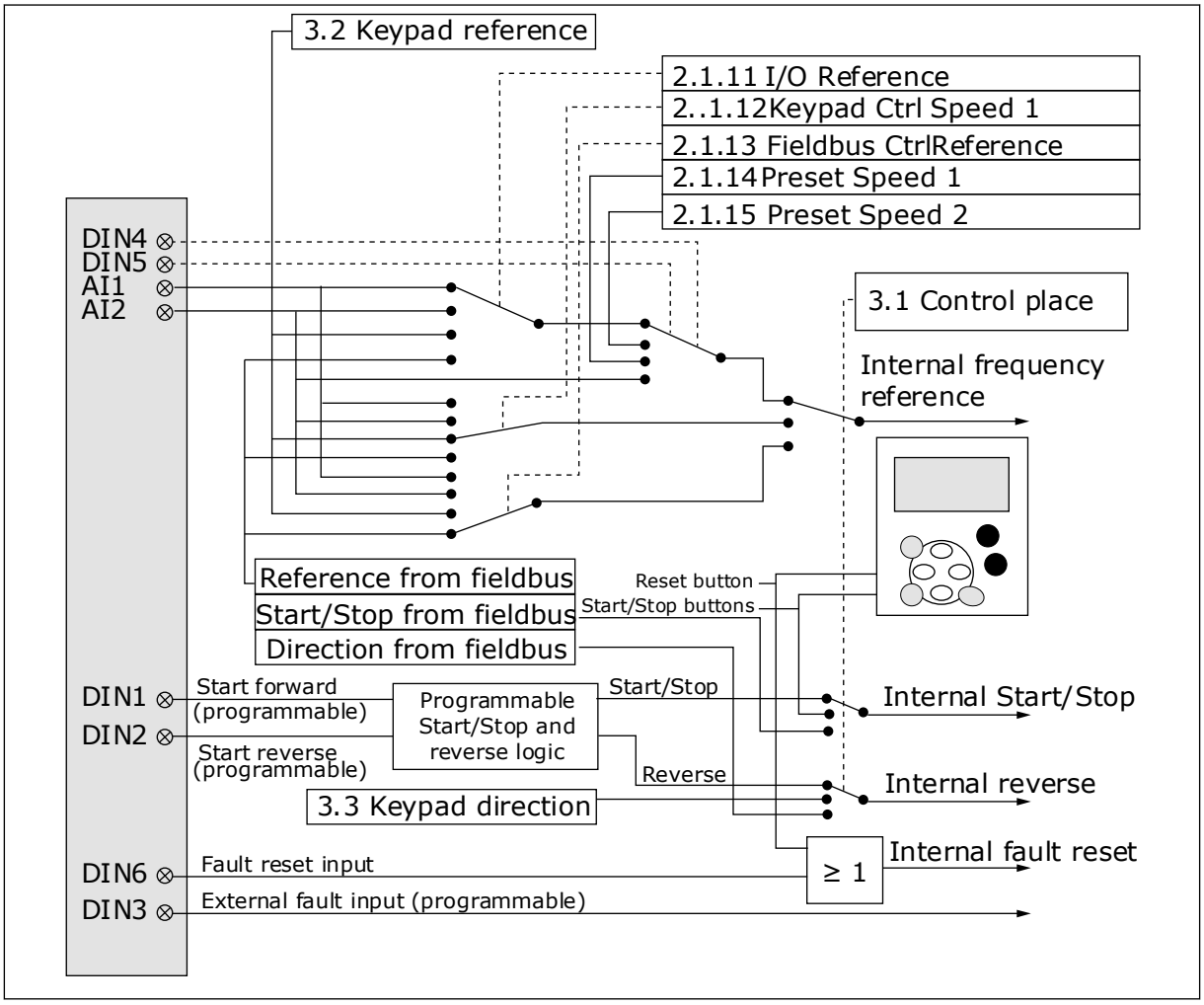

Fig. 6: Control signal logic of the Standard Application

2.4 STANDARD APPLICATION - PARAMETER LISTS

2.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

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Table 4: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.16	Analogue I_{out}	mA	26	AO1
V1.17	Multimonitoring items			Displays three selectable monitoring values
V1.18.1	Current	A	1113	
V1.18.2	Torque	%	1125	
V1.18.3	DC Voltage	V	44	
V1.18.4	Status Word		43	
V1.18.5	U Phase Current	%	39	RealTime U phase current 1000 = motor nominal current.
V1.18.6	V Phase Current	%	40	RealTime V phase current 1000 = motor nominal current.
V1.18.7	W Phase Current	%	41	RealTime W phase current 1000 = motor nominal current.

2.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 5: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	0.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	0.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.1.9	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

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Table 5: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.10	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11	I/O reference	0	3		0		117	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.12	Keypad control reference	0	3		2		121	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.13	Fieldbus control reference	0	3		3		122	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.14	Preset speed 1	0.00	P2.1.2	Hz	10.00		105	Speeds preset by operator.
P2.1.15	Preset speed 2	0.00	P2.1.2	Hz	50.00		106	Speeds preset by operator.

2.4.3 INPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.2)

Table 6: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1	Start/Stop logic	0	6		0		300	**Logic = 0** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Start reverse **Logic = 1** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Reverse **Logic = 2** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Run enable **Logic = 3** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Stop pulse **Logic = 4** Ctrl sgn 1 = Forward pulse (edge) Ctrl sgn 2 = Reverse pulse (edge) **Logic = 5** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Reverse pulse **Logic = 6** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Enable pulse

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Table 6: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.2	DIN3 function	0	8		1		301	0 = Not used 1 = Ext. fault, closing cont. 2 = Ext. fault, opening cont. 3 = Run enable 4 = Acc./Dec. time select. 5 = Force cp. to IO 6 = Force cp. to keypad 7 = Force cp. to fieldbus 8 = Reverse
P2.2.3	Analogue input 2 reference offset	0	1		1		302	0 = 0-20 mA (0-10 V) ** 1 = 4-20 mA (2-10 V) **
P2.2.4	Reference scaling minimum value	0.00	320.00	Hz	0.00		303	Selects the frequency that corresponds to the min. reference signal 0.00 = No scaling
P2.2.5	Reference scaling maximum value	0.00	320.00	Hz	0.00		304	Selects the frequency that corresponds to the max. reference signal 0.00 = No scaling
P2.2.6	Reference inversion	0	1		0		305	0 = Not inverted 1 = Inverted
P2.2.7	Reference filter time	0.00	10.00	s	0.10		306	0 = No filtering
P2.2.8 ***	AI1 signal selection				A1		377	TTF programming method used. See *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.9 ***	AI2 signal selection				A2		388	TTF programming method used. See *8.9 "Terminal to function" (TTF) programming principle*.

** = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

*** = Use TTF method to program these parameters.

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2.4.4 OUTPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.3

Table 7: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1	Analogue output 1 signal selection	0			A.1		464	TTF programming method used. See *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.2	Analogue output function	0	8		1		307	0 = Not used (20 mA/10V) 1 = Output freq. (0-f_{max}) 2 = Freq. reference (0-f_{max}) 3 = Motor speed (0-Motor nominal speed) 4 = Motor current (0-I_{nMotor}) 5 = Motor torque (0-T_{nMotor}) 6 = Motor power (0-P_{nMotor}) 7 = Motor voltage (0-U_{nMotor}) 8 = DC-link volt (0-1000V)
P2.3.3	Analogue output filter time	0.00	10.00	s	1.00		308	0 = No filtering
P2.3.4	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.5	Analogue output minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.6	Analogue output scale	10	1000	%	100		311	

Table 7: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.7	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 = Control place: IO 15 = Therminstor fault/warning 16 = Fieldbus DIN1
P2.3.8	RO1 function	0	16		2		313	As parameter 2.3.7
P2.3.9	RO2 function	0	16		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.11	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.12 *	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming method used. See *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.13	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.14	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering

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Table 7: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.15	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.16	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P.2.3.17	Analogue output 2 scaling	10	1000	%	1.00		476	

* = Use TTF method to program these parameters.

2.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 8: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.3	Acceleration time 2	0.1	3000.0	s	1.0		502	
P2.4.4	Deceleration time 2	0.1	3000.0	s	1.0		503	
P2.4.5	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	I_L	A	0.7 x I_H		507	

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Table 8: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12 *	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	

2.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 9: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	0.00	320.00	Hz	0.00		509	
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	
P2.5.3	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

2.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 10: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1 *	Motor control mode	0	1/3		0		600	0 = Frequency control 1 = Speed control **NXP:** 2 = Open loop torque control 3 = Closed loop speed ctrl 4 = Closed loop torque control
P2.6.2 *	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3 *	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P2.6.4 *	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5 *	Voltage at field weakening point	10.00	200.00	%	100.00		603	The voltage at the field weakening point as a percentage of the motor nominal voltage.
P2.6.6 *	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.

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Table 10: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.7 *	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.8 *	Output voltage at zero frequency	0.00	40.00	%	Varies		606	This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.
P2.6.9	Switching frequency	1.0	Varies	kHz	Varies		601	If you increase the switching frequency, the capacity of the AC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	0 = Not used 1 = Used
P2.6.12	Load drooping	0.00	100.00	%	0.00		620	The function enables a speed drop as a function of load. The load drooping is given as a percentage of the nominal speed at a nominal load.

Table 10: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.13	Identification	0	1/2		0		631	0 = No action 1 = Identification w/o run 2 = Identification with run 3 = Encoder ID run 4 = No action 5 = ID Run Failed
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	The magnetising current (no-load current) of the motor. The magnetising current identifies the values of the U/f parameters if they are given before the identification run. If the value is set to 0, the magnetising current is calculated internally.
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0.0	3200.0	ms	30.0		614	
P2.6.14.5	Acceleration compensation	0.00	300.00	s	0.00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0.00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	

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Table 10: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.14.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	-300.0	300.0	%	0.0		633	
P2.6.14.13	Start-up torque REV	-300.0	300.0	%	0.0		634	
P2.6.14.15	Encoder filter time	0.0	100.0	ms	0.0		618	
P2.6.14.17	Current control P gain	0.00	100.00	%	40.00		617	
Identification parameter group 2.6.15								
P2.6.15.1	Speed step	-50.0	50.0	0.0	0.0		1252	NCDrive speed tuning

* = Parameter value can only be changed after the AC drive has been stopped.

2.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7

Table 11: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		0		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+Preset-Freq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

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Table 11: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		0		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.0	P2.1.2	Hz	25.00		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	UP From Torque	10.0	150.0	%	50.0		714	
P2.7.19	UP Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

2.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 12: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

2.4.10 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

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Table 13: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1	P2.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	You can adjust the frequency reference on the keypad with this parameter.
R3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

2.4.11 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

2.4.12 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

3 LOCAL/REMOTE CONTROL APPLICATION

3.1 INTRODUCTION

Select the Local/Remote Control Application in menu M6 on page S6.2.

With the Local/Remote Control Application it is possible to have two different control places. For each control place the frequency reference can be selected from either the control keypad, I/O terminal or fieldbus. The active control place is selected with the digital input DIN6.

- 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 prohibit frequency area
- Programmable U/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 Parameter descriptions* of this manual. The explanations are arranged according to the individual ID number of the parameter.

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3.2 CONTROL I/O

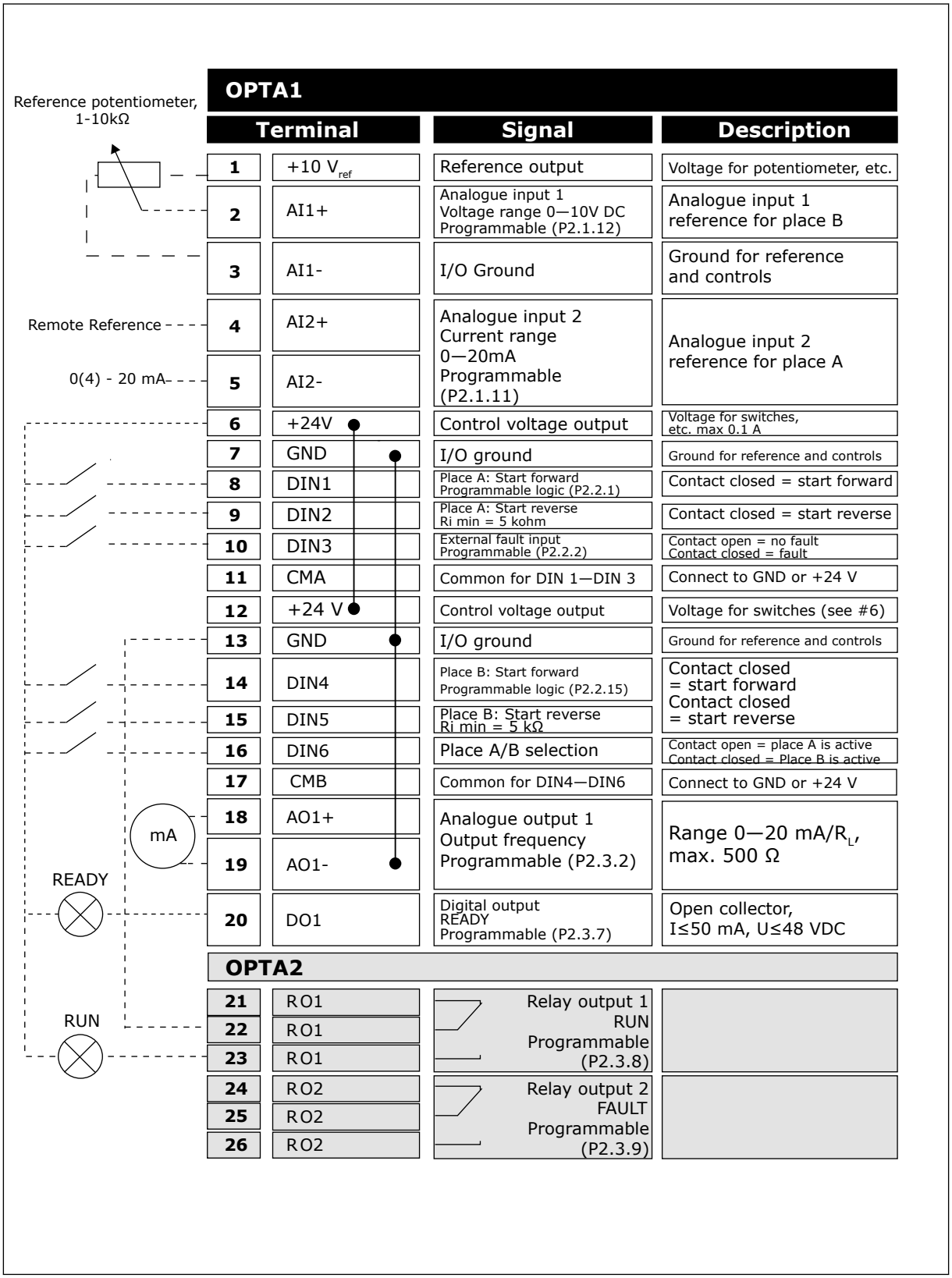

Fig. 7: Local/Remote control application default I/O configuration

NOTE!

See jumper selections below. More information in the product's User Manual.

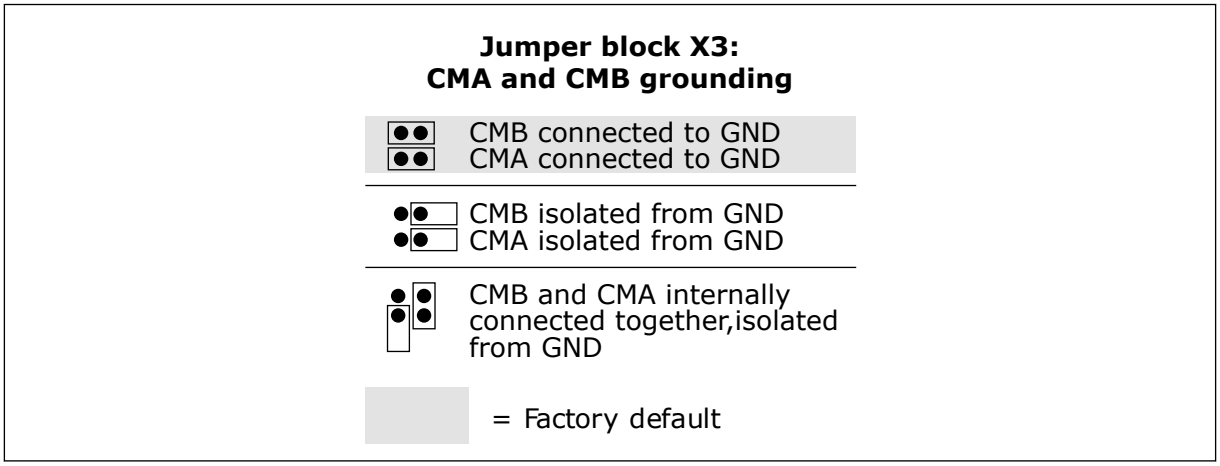

Fig. 8: Jumper selections

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3.3 CONTROL SIGNAL LOGIC IN LOCAL/REMOTE APPLICATION

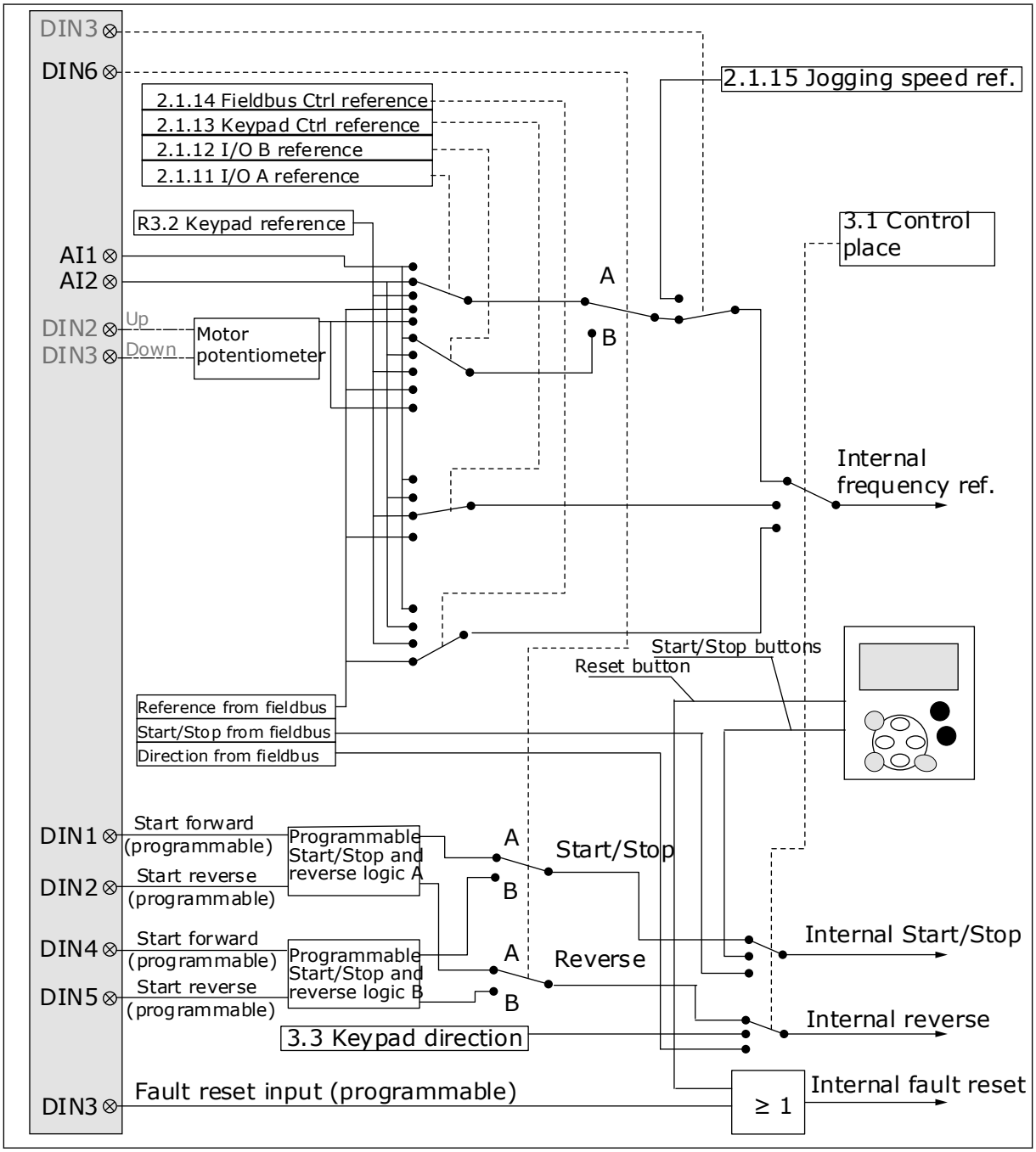

Fig. 9: Control signal logic of the Local/Remote Control Application

3.4 LOCAL/REMOTE CONTROL APPLICATION - PARAMETER LISTS

3.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

Table 14: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.16	Analogue I_{out}	mA	26	AO1
V1.17	Multimonitoring items			Displays three selectable monitoring values
V1.18.1	Current	A	1113	
V1.18.2	Torque	%	1125	
V1.18.3	DC Voltage	V	44	
V1.18.4	Status Word		43	

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3.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 15: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	0.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	0.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.1.6 *	Nominal voltage of the motor	180	690	V	**NX2**: 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7 *	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8 *	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.1.9 *	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

Table 15: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.10 *	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11 *	I/O A reference	0	4		1		117	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus 4 = Motor potentiometer
P2.1.12 *	I/O B reference	0	4		0		131	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus 4 = Motor potentiometer
P2.1.13 *	Keypad control reference	0	3		2		121	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.14 *	Fieldbus control reference	0	3		3		122	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.15 *	Jogging speed reference	0.00	P2.1.2	Hz	0.00		124	

* = Parameter value can only be changed after the AC drive has been stopped.

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3.4.3 INPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.2)

Table 16: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1 ***	Place A Start/Stop logic selection	0	8		0		300	**Logic = 0** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Start reverse **Logic = 1** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Reverse **Logic = 2** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Run enable **Logic = 3** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Stop pulse **Logic = 4** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Motor potentiometer UP **Logic = 5** Ctrl sgn 1 = Start forward (edge) Ctrl sgn 2 = Start reverse (edge)

Table 16: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1 ***	Place A Start/Stop logic selection	0	8		0		300	**Logic = 6** Ctrl sgn 1 = Start (edge) / Stop Ctrl sgn 2 = Reverse **Logic = 7** Ctrl sgn 1 = Start (edge) / Stop Ctrl sgn 2 = Run enable **Logic = 8** Ctrl sgn 1 = Start forward (edge) Ctrl sgn 2 = Motor potentiometer UP
P2.2.2	DIN3 function	0	13		1		301	0 = Not used 1 = Ext. fault, closing cont. 2 = Ext. fault, opening cont. 3 = Run enable 4 = Acc./Dec. time select. 5 = Force cp. to IO 6 = Force cp. to keypad 7 = Force cp. to fieldbus 8 = Reverse 9 = Jogging speed 10 = Fault reset 11 = Acc./Dec. operation prohibit 12 = DC Braking command 13 = Motor potentiometer DOWN
P2.2.3 ****	AI1 signal selection	0.1	E.10		A1		377	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.

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Table 16: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.4	AI1 signal range	0	2		0		320	0 = 0-10V (0-20 mA**) 1 = 2-10V (4-20 mA**) 2 = Custom setting range**
P2.2.5	AI1 custom setting minimum	-160.00	160.00	%	0.00		321	Analogue input 1 scale minimum.
P2.2.6	AI1 custom setting maximum	-160.00	160.00	%	100.00		322	Analogue input 1 scale maximum.
P2.2.7	AI1 signal inversion	0	1		0		323	Analogue input 1 reference inversion yes/no.
P2.2.8	AI1 signal filter time	0.00	10.00	s	0.10		324	Analogue input 1 reference filter time, constant.
P2.2.9 ****	AI2 signal selection	0.1	E.10		A.2		388	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.10	AI2 signal range	0	2		1		325	0 = 0-10V (0-20 mA**) 1 = 2-10V (4-20 mA**) 2 = Custom setting range**
P2.2.11	AI2 custom setting minimum	-160.00	160.00	%	0.00		326	Analogue input 2 scale minimum.
P2.2.12	AI2 custom setting maximum	-160.00	160.00	%	100.00		327	Analogue input 2 scale maximum.
P2.2.13	AI2 signal inversion	0	1		0		328	Analogue input 2 reference inversion yes/no.
P2.2.14	AI2 signal filter time	0.00	10.00	s	0.10		329	Analogue input 2 reference filter time, constant.

Table 16: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.15 ***	Place B Start/Stop logic selection	0	6		0		363	**Logic = 0** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Start reverse **Logic = 1** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Reverse **Logic = 2** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Run enable **Logic = 3** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Stop pulse **Logic = 4** Ctrl sgn 1 = Forward pulse (edge) Ctrl sgn 2 = Reverse pulse (edge) **Logic = 5** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Reverse pulse **Logic = 6** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Enable pulse
P2.2.16	Place A Reference scaling minimum value	0.00	320.00	Hz	0.00		303	Selects the frequency that corresponds to the min. reference signal.

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Table 16: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.17	Place A Reference scaling maximum value	0.00					304	Selects the frequency that corresponds to the max. reference signal 0.00 = No scaling >0 = scaled max. value.
P2.2.18	Place B Reference scaling minimum value	0.00	320.00	Hz	0.00		364	Selects the frequency that corresponds to the min. reference signal.
P2.2.19	Place B Reference scaling maximum value	0.00	320.00	Hz	0.00		365	Selects the frequency that corresponds to the max. reference signal. 0.00 = No scaling >0 = scaled max. value
P2.2.20	Free analogue input, signal selection	0	2		0		361	0 = Not used 1 = Analogue input 1 2= Analogue input 2
P2.2.21	Free analogue input, function	0	4		0		362	0 = No reset 1 = Reduces current limit (P2.1.5) 2 = Reduces DC braking current 3 = Reduces accel. and decel. times 4 = Reduces torque super vision limit
P2.2.22	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0		331	
P2.2.23	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
P2.2.24	Start pulse memory	0	1		0		498	0 = Run state not copied 1 = Run state copied

** = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

*** = Parameter value can only be changed after the AC drive has been stopped.

**** = Use TTF method to program these parameters.

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3.4.4 OUTPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.3

Table 17: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1	AO1 signal selection	0.1	E.10		A11		464	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.2	Analogue output function	0	8		1		307	0 = Not used (20 mA/10V) 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-link volt (0-1000V)
P2.3.3	Analogue output filter time	0.00	10.00	s	1.00		308	0 = No filtering
P2.3.4	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.5	Analogue output minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.6	Analogue output scale	10	1000	%	100		311	

Table 17: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.7	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 spd selected 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit superv. 1 14 = OP freq. limit superv.2 15 = Torque limit superv. 16 = Ref. limit superv. 17 = Ext. brake control 18 = Control place: IO 19 = FC temp. limit superv.
P2.3.7	Digital output 1 function	0	22		1		312	20 = Unrequested rotation direction 21 = Ext. brake control inverted 22 = Thermistor fault/warn.
P2.3.8	RO1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	RO2 function	0	22		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	0 = No limit 1 = Low limit supervision 2 = High limit supervision

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Table 17: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.11	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.12	Output frequency limit 2 supervision	0	2		0		346	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.13	Output frequency limit 2; Supervision value	0.00	320.00	Hz	0.00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	0 = No 1 = Low limit 2 = High limit
P2.3.15	Torque limit supervision value	-300.0	300.0	%	0.0		349	
P2.3.16	Reference limit supervision function	0	2		0		350	0 = No 1 = Low limit 2 = High limit
P2.3.17	Reference limit supervision value	0.0	100.0	%	0.0		351	
P2.3.18	External brake Off-delay	0.0	100.0	s	0.5		352	
P2.3.19	External brake On-delay	0.0	100.0	s	1.5		353	
P2.3.20	Frequency converter temperature limit supervision	0	2		0		354	0 = No 1 = Low limit 2 = High limit
P2.3.21	Frequency converter temperature limit value	-10	100	°C	40		355	
P2.3.22	Analogue output 2 scaling	0.1	E.10		0.1		471	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.

Table 17: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.23	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.24	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering
P2.3.25	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.26	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P.2.3.27	Analogue output 2 scaling	10	1000	%	1.00		476	

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3.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 18: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.3	Acceleration time 2	0.1	3000.0	s	1.0		502	
P2.4.4	Deceleration time 2	0.1	3000.0	s	1.0		503	
P2.4.5	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	I_L	A	0.7 x I_H		507	

Table 18: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12 *	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	

3.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 19: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	0.00	320.00	Hz	0.00		509	
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	0 = Prohibit range 1 is off
P2.5.3	Prohibit frequency range 2 low limit	0.00	320.00	Hz	0.00		511	
P2.5.4	Prohibit frequency range 2 high limit	0.00	320.00	Hz	0.00		512	0 = Prohibit range 2 is off
P2.5.5	Prohibit frequency range 3 low limit	0.00	320.00	Hz	0.00		513	
P2.5.6	Prohibit frequency range 3 high limit	0.00	320.00	Hz	0.00		514	0 = Prohibit range 3 is off
P2.5.7	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

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3.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 20: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1 *	Motor control mode	0	1/3		0		600	0 = Frequency control 1 = Speed control **NXP:** 2 = Open loop torque control 3 = Closed loop speed ctrl 4 = Closed loop torque control
P2.6.2 *	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3 *	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P2.6.4 *	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5 *	Voltage at field weakening point	10.00	200.00	%	100.00		603	The voltage at the field weakening point as a percentage of the motor nominal voltage.
P2.6.6 *	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.

Table 20: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.7 *	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.8 *	Output voltage at zero frequency	0.00	40.00	%	Varies		606	This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.
P2.6.9	Switching frequency	1.0	Varies	kHz	Varies		601	If you increase the switching frequency, the capacity of the AC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	0 = Not used 1 = Used
P2.6.12	Load drooping	0.00	100.00	%	0.00		620	The function enables a speed drop as a function of load. The load drooping is given as a percentage of the nominal speed at a nominal load.

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Table 20: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.13	Identification	0	1/2		0		631	0 = No action 1 = Identification w/o run 2 = Identification with run 3 = Encoder ID run 4 = No action 5 = ID Run Failed
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	The magnetising current (no-load current) of the motor. The magnetising current identifies the values of the U/f parameters if they are given before the identification run. If the value is set to 0, the magnetising current is calculated internally.
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0.0	3200.0	ms	30.0		614	
P2.6.14.5	Acceleration compensation	0.00	300.00	s	0.00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0.00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	

Table 20: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.14.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	-300.0	300.0	%	0.0		633	
P2.6.14.13	Start-up torque REV	-300.0	300.0	%	0.0		634	
P2.6.14.15	Encoder filter time	0.0	100.0	ms	0.0		618	
P2.6.14.17	Current control P gain	0.00	100.00	%	40.00		617	
Identification parameter group 2.6.15								
P2.6.15.1	Speed step	-50.0	50.0	0.0	0.0		1252	NCDrive speed tuning

* = Parameter value can only be changed after the AC drive has been stopped.

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3.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7

Table 21: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		0		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

Table 21: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		0		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.0	P2.1.2	Hz	25.00		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	UP From Torque	10.0	150.0	%	50.0		714	
P2.7.19	UP Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

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3.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 22: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

3.4.10 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

Table 23: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1	P2.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	You can adjust the frequency reference on the keypad with this parameter.
R3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

3.4.11 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

3.4.12 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

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4 MULTI-STEP SPEED CONTROL APPLICATION

4.1 INTRODUCTION

Select the Multi-step Speed Control Application in menu M6 on page S6.2.

The Multi-step Speed Control Application can be used in applications where fixed speeds are needed. In total, 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 analogue input terminals (2/ 3 or 4/5). The other one of the analogue 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 prohibit 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 Parameter descriptions* of this manual. The explanations are arranged according to the individual ID number of the parameter.

4.2 CONTROL I/O

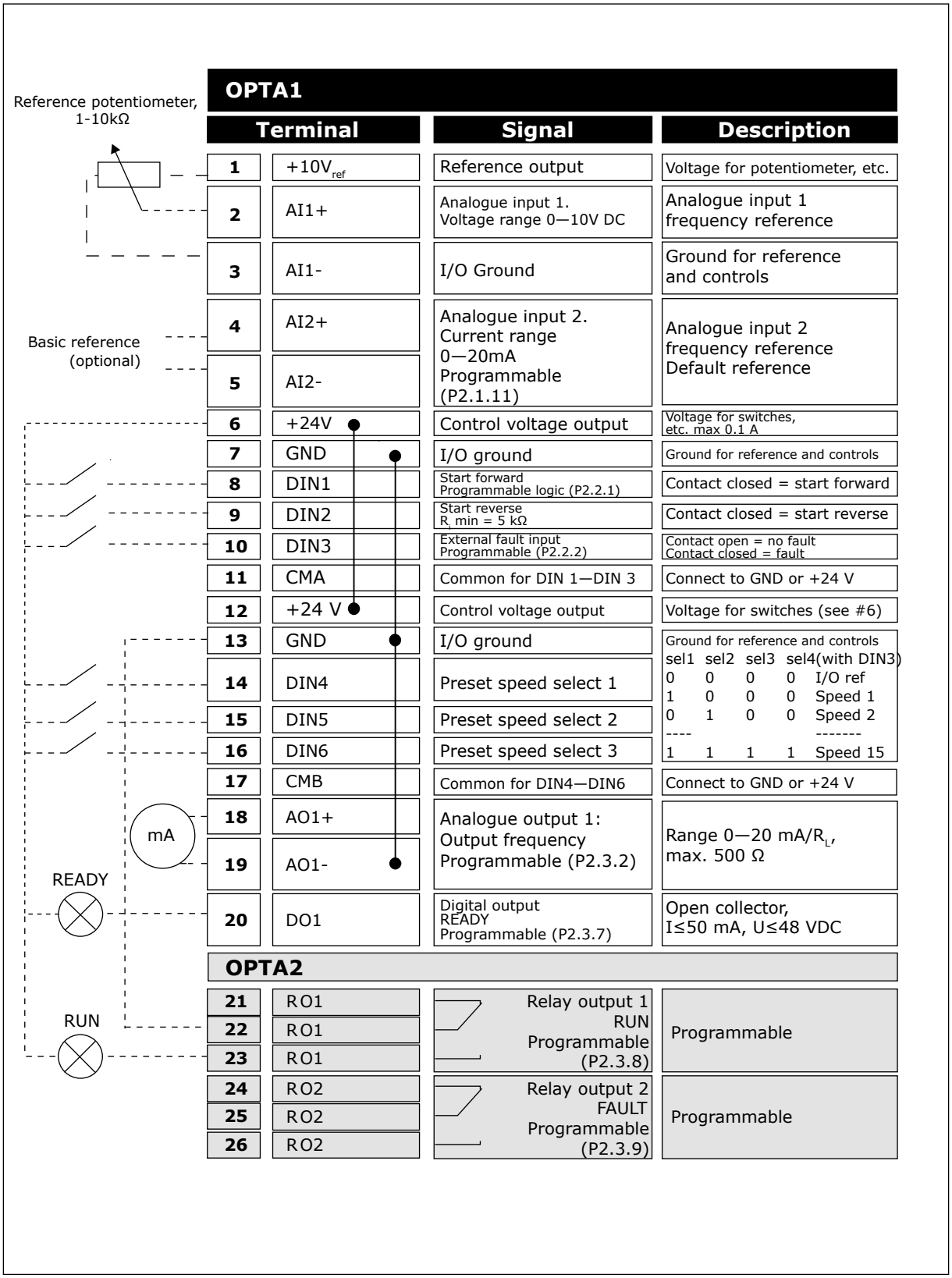

Fig. 10: Multi-step speed control application default I/O configuration

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NOTE!

See jumper selections below. More information in the product's User Manual.

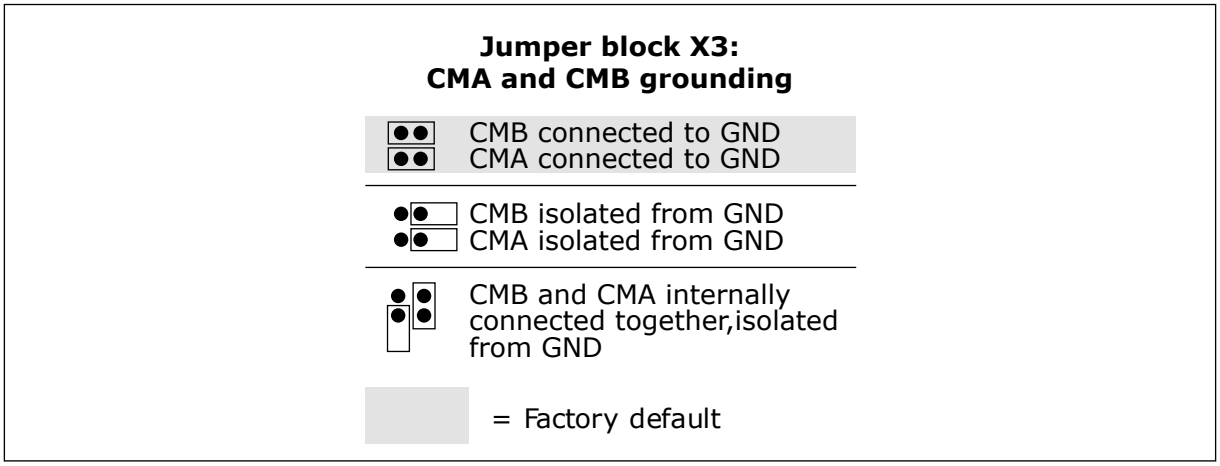

Fig. 11: Jumper selections

4.3 CONTROL SIGNAL LOGIC IN MULTI-STEP SPEED CONTROL APPLICATION

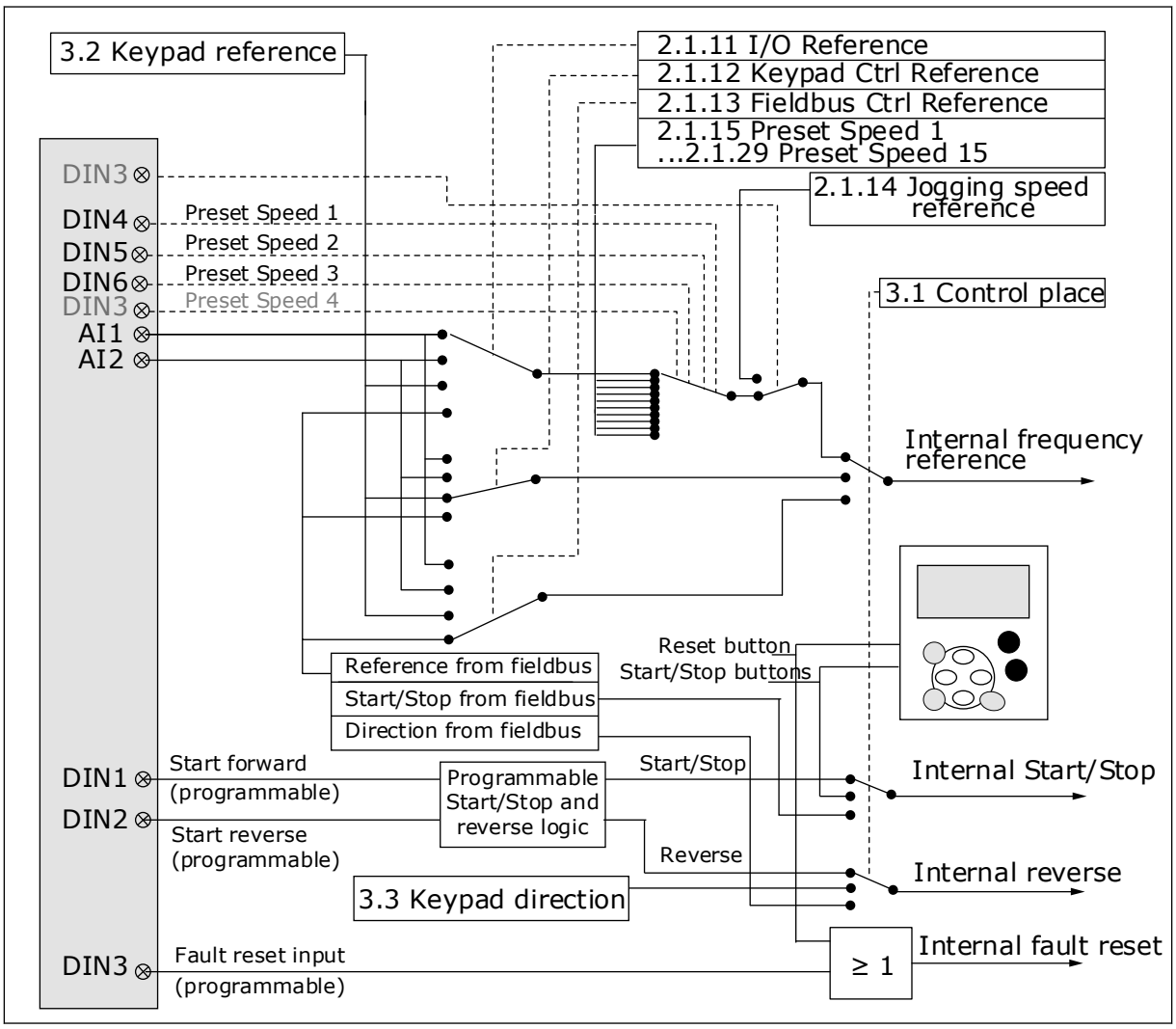

Fig. 12: Control signal logic of the Multi-step Speed Application

4.4 MULTI-STEP SPEED CONTROL APPLICATION - PARAMETER LISTS

4.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

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Table 24: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.16	Analogue I_{out}	mA	26	AO1
V1.17	Multimonitoring items			Displays three selectable monitoring values
V1.18.1	Current	A	1113	
V1.18.2	Torque	%	1125	
V1.18.3	DC Voltage	V	44	
V1.18.4	Status Word		43	

4.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 25: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	0.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	0.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.1.6 *	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7 *	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8 *	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.1.9 *	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

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Table 25: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.10 *	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11 *	I/O reference	0	3		1		117	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.12 *	Keypad control reference	0	3		2		121	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.13 *	Fieldbus control reference	0	3		3		122	0 = AI1 1 = AI2 2 = Keypad 3 = Fieldbus
P2.1.14	Jogging speed ref.	0.00	P2.1.2	Hz	0.00		124	
P2.1.15	Preset speed 1	0.00	P2.1.2	Hz	5.00		105	Speeds preset by operator.
P2.1.16	Preset speed 2	0.00	P2.1.2	Hz	10.00		106	Speeds preset by operator.
P2.1.17	Preset speed 3	0.00	P2.1.2	Hz	12.50		126	Speeds preset by operator.
P2.1.18	Preset speed 4	0.00	P2.1.2	Hz	15.00		127	Speeds preset by operator.
P2.1.19	Preset speed 5	0.00	P2.1.2	Hz	17.50		128	Speeds preset by operator.
P2.1.20	Preset speed 6	0.00	P2.1.2	Hz	20.00		129	Speeds preset by operator.
P2.1.21	Preset speed 7	0.00	P2.1.2	Hz	22.50		130	Speeds preset by operator.
P2.1.22	Preset speed 8	0.00	P2.1.2	Hz	25.00		133	Speeds preset by operator.
P2.1.23	Preset speed 9	0.00	P2.1.2	Hz	27.50		134	Speeds preset by operator.
P2.1.24	Preset speed 10	0.00	P2.1.2	Hz	30.00		135	Speeds preset by operator.

Table 25: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.25	Preset speed 11	0.00	P2.1.2	Hz	32.50		136	Speeds preset by operator.
P2.1.26	Preset speed 12	0.00	P2.1.2	Hz	35.00		137	Speeds preset by operator.
P2.1.27	Preset speed 13	0.00	P2.1.2	Hz	40.00		138	Speeds preset by operator.
P2.1.28	Preset speed 14	0.00	P2.1.2	Hz	45.00		139	Speeds preset by operator.
P2.1.29	Preset speed 15	0.00	P2.1.2	Hz	50.00		140	Speeds preset by operator.

* = Parameter value can only be changed after the AC drive has been stopped.

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4.4.3 INPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.2)

Table 26: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1 ***	Start/Stop logic	0	6		0		300	**Logic = 0** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Start reverse **Logic = 1** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Reverse **Logic = 2** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Run enable **Logic = 3** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Stop pulse **Logic = 4** Ctrl sgn 1 = Forward pulse (edge) Ctrl sgn 2 = Reverse pulse (edge) **Logic = 5** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Reverse pulse **Logic = 6** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Enable pulse

Table 26: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.2	DIN3 function	0	13		1		301	0 = Not used 1 = Ext. fault, closing cont. 2 = Ext. fault, opening cont. 3 = Run enable 4 = Acc./Dec. time select. 5 = Force cp. to IO 6 = Force cp. to keypad 7 = Force cp. to fieldbus 8 = Rvs (if P2.2.1 ≠ 2,3 or 6) 9 = Jogging speed 10 = Fault reset 11 = Acc./Dec. operation prohibit 12 = DC Braking command 13 = Preset speed
P2.2.3 ****	AI1 signal selection	0.1	E.10		A1		377	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*
P2.2.4	AI1 signal range	0	2		0		320	0 = 0-10V (0-20 mA**) 1 = 2-10V (4-20 mA**) 2 = Custom setting range**
P2.2.5	AI1 custom setting minimum	-160.00	160.00	%	0.00		321	Analogue input 1 scale minimum.
P2.2.6	AI1 custom setting maximum	-160.00	160.00	%	100.00		322	Analogue input 1 scale maximum.
P2.2.7	AI1 signal inversion	0	1		0		323	Analogue input 1 reference inversion yes/no.
P2.2.8	AI1 signal filter time	0.00	10.00	s	0.10		324	Analogue input 1 reference filter time, constant.

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Table 26: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.9 ****	AI2 signal selection	0.1	E.10		A.2		388	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.10	AI2 signal range	0	2		1		325	0 = 0-10V (0-20 mA**) 1 = 2-10V (4-20 mA**) 2 = Custom setting range**
P2.2.11	AI2 custom setting minimum	-160.00	160.00	%	0.00		326	Analogue input 2 scale minimum.
P2.2.12	AI2 custom setting maximum	-160.00	160.00	%	100.00		327	Analogue input 2 scale maximum.
P2.2.13	AI2 signal inversion	0	1		0		328	Analogue input 2 reference inversion yes/no.
P2.2.14	AI2 signal filter time	0.00	10.00	s	0.10		329	Analogue input 2 reference filter time, constant.
P2.2.15	Reference scaling minimum value	0.00	320.00	Hz	0.00		303	Selects the frequency that corresponds to the min. reference signal.
P2.2.16	Reference scaling maximum value	0.00	320.00	Hz	0.00		304	Selects the frequency that corresponds to the max. reference signal. 0.00 = No scaling >0 = scaled max. value
P2.2.17	Free analogue input, signal selection	0	2		0		361	0 = Not used 1 = AI1 2 = AI2

Table 26: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.18	Free analogue input, function	0	4		0		362	0 = No function 1 = Reduces current limit (P2.1.5) 2 = Reduces DC braking current, P2.4.8 3 = Reduces accel. and decel. tmes 4 = Reduces torque supervision limit P2.3.15

CP = control place
cc = closing contact
oc = opening contact

** = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

*** = Parameter value can only be changed after the AC drive has been stopped.

**** = Use TTF method to program these parameters.

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4.4.4 OUTPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.3

Table 27: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1 *	AO1 signal selection	0.1	E.10		A11		464	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.2	Analogue output function	0	8		1		307	0 = Not used (20 mA/10V) 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-link volt (0-1000V)
P2.3.3	Analogue output filter time	0.00	10.00	s	1.00		308	0 = No filtering
P2.3.4	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.5	Analogue output minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.6	Analogue output scale	10	1000	%	100		311	

Table 27: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.7	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 spd selected 11 = At speed 12 = Mot. regulator active 13 = OP freq. limit superv. 1 14 = OP freq. limit superv.2 15 = Torque limit superv. 16 = Ref. limit superv. 17 = Ext. brake control 18 = Control place: IO 19 = FC temp. limit superv.
P2.3.7	Digital output 1 function	0	22		1		312	20 = Unrequested rotation direction 21 = Ext. brake control inverted 22 = Thermistor fault/warn.
P2.3.8	RO1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	RO2 function	0	22		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	0 = No limit 1 = Low limit supervision 2 = High limit supervision

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Table 27: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.11	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.12	Output frequency limit 2 supervision	0	2		0		346	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.13	Output frequency limit 2; Supervision value	0.00	320.00	Hz	0.00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	0 = No 1 = Low limit 2 = High limit
P2.3.15	Torque limit supervision value	-300.0	300.0	%	0.0		349	
P2.3.16	Reference limit supervision function	0	2		0		350	0 = No 1 = Low limit 2 = High limit
P2.3.17	Reference limit supervision value	0.0	100.0	%	0.0		351	
P2.3.18	External brake Off-delay	0.0	100.0	s	0.5		352	
P2.3.19	External brake On-delay	0.0	100.0	s	1.5		353	
P2.3.20	Frequency converter temperature limit supervision	0	2		0		354	0 = No 1 = Low limit 2 = High limit
P2.3.21	Frequency converter temperature limit value	-10	100	°C	40		355	
P2.3.22 *	Analogue output 2 scaling	0.1	E.10		0.1		471	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.

Table 27: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.23 *	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.24 *	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering
P2.3.25 *	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.26 *	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P.2.3.27 *	Analogue output 2 scaling	10	1000	%	1.00		476	

* = Use TTF method to program these parameters

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4.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 28: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.3	Acceleration time 2	0.1	3000.0	s	1.0		502	
P2.4.4	Deceleration time 2	0.1	3000.0	s	1.0		503	
P2.4.5	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	I_L	A	0.7 x I_H		507	

Table 28: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12 *	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	

4.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 29: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	0.00	320.00	Hz	0.00		509	
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	0 = Prohibit range 1 is off
P2.5.3	Prohibit frequency range 2 low limit	0.00	320.00	Hz	0.00		511	
P2.5.4	Prohibit frequency range 2 high limit	0.00	320.00	Hz	0.00		512	0 = Prohibit range 2 is off
P2.5.5	Prohibit frequency range 3 low limit	0.00	320.00	Hz	0.00		513	
P2.5.6	Prohibit frequency range 3 high limit	0.00	320.00	Hz	0.00		514	0 = Prohibit range 3 is off
P2.5.7	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

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4.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 30: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1 *	Motor control mode	0	1/3		0		600	0 = Frequency control 1 = Speed control **NXP:** 2 = Open loop torque control 3 = Closed loop speed ctrl 4 = Closed loop torque control
P2.6.2 *	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3 *	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P2.6.4 *	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5 *	Voltage at field weakening point	10.00	200.00	%	100.00		603	The voltage at the field weakening point as a percentage of the motor nominal voltage.
P2.6.6 *	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.

Table 30: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.7 *	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.8 *	Output voltage at zero frequency	0.00	40.00	%	Varies		606	This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.
P2.6.9	Switching frequency	1.0	Varies	kHz	Varies		601	If you increase the switching frequency, the capacity of the AC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	0 = Not used 1 = Used
P2.6.12	Load drooping	0.00	100.00	%	0.00		620	The function enables a speed drop as a function of load. The load drooping is given as a percentage of the nominal speed at a nominal load.

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Table 30: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.13	Identification	0	1/2		0		631	0 = No action 1 = Identification w/o run 2 = Identification with run 3 = Encoder ID run 4 = No action 5 = ID Run Failed
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	The magnetising current (no-load current) of the motor. The magnetising current identifies the values of the U/f parameters if they are given before the identification run. If the value is set to 0, the magnetising current is calculated internally.
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0.0	3200.0	ms	30.0		614	
P2.6.14.5	Acceleration compensation	0.00	300.00	s	0.00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0.00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	

Table 30: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.14.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	-300.0	300.0	%	0.0		633	
P2.6.14.13	Start-up torque REV	-300.0	300.0	%	0.0		634	
P2.6.14.15	Encoder filter time	0.0	100.0	ms	0.0		618	
P2.6.14.17	Current control P gain	0.00	100.00	%	40.00		617	
Identification parameter group 2.6.15								
P2.6.15.1	Speed step	-50.0	50.0	0.0	0.0		1252	NCDrive speed tuning

* = Parameter value can only be changed after the AC drive has been stopped.

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4.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7)

Table 31: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		0		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		3		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

Table 31: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		0		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	2 x I_H	A	1$_H$		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.00	P2.1.2	Hz	25.00		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	UP fnom Torque	10.0	150.0	%	50.0		714	
P2.7.19	UP Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3				734	See P2.7.21

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4.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 32: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

4.4.10 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

Table 33: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1.1	P2.1.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	You can adjust the frequency reference on the keypad with this parameter.
R3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

4.4.11 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

4.4.12 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

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5 PID CONTROL APPLICATION

5.1 INTRODUCTION

Select the PID Control Application in menu M6 on page S6.2

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 analogue inputs, fieldbus, motorised potentiometer, enabling the PID Reference 2 or applying the control keypad reference. The PID controller actual value can be selected from the analogue 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 analogue 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:

- Analogue 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 prohibit 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 Parameter descriptions* of this manual. The explanations are arranged according to the individual ID number of the parameter.

5.2 CONTROL I/O

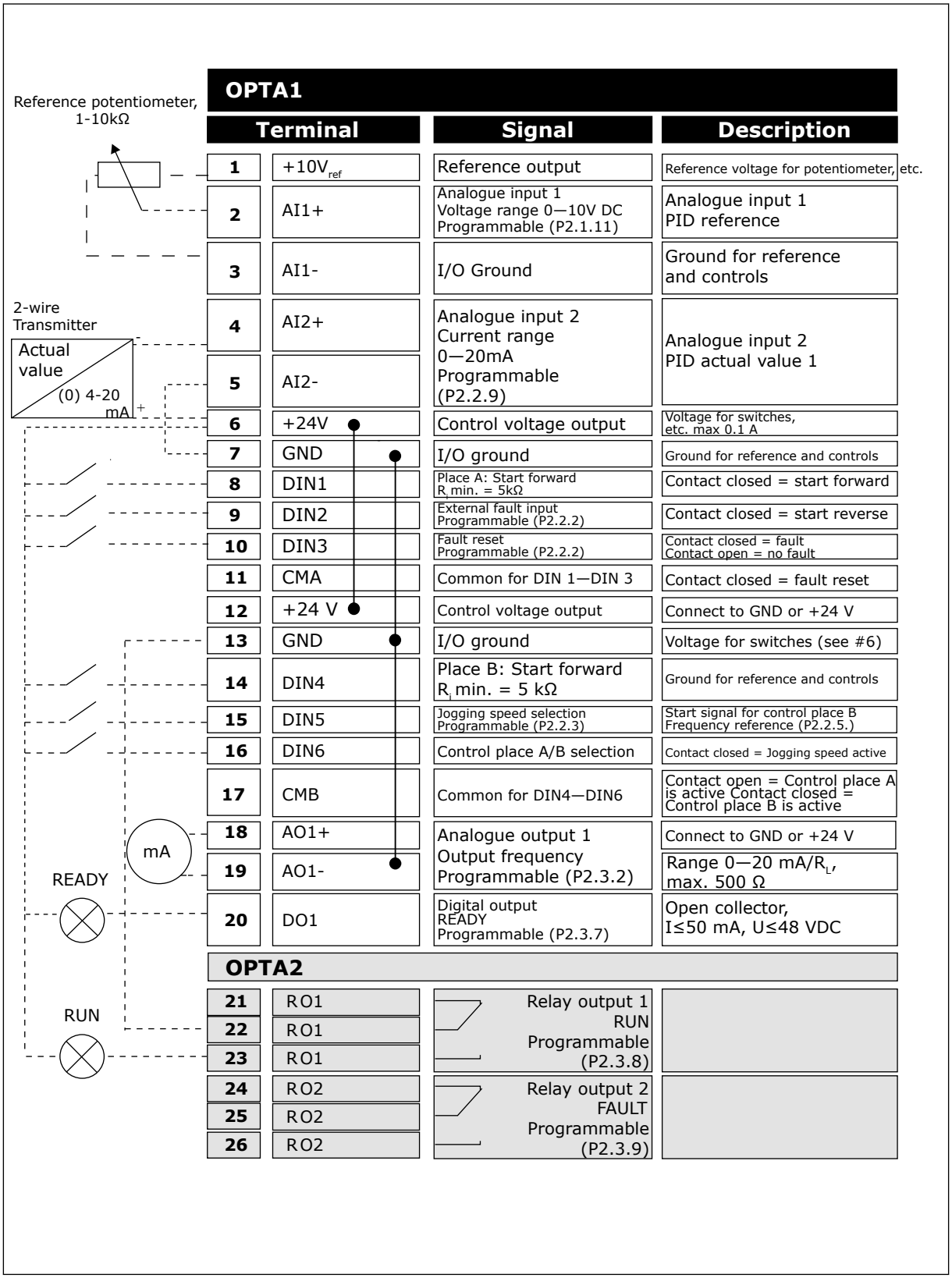

Fig. 13: PID application default I/O configuration (with 2-wire transmitter)

NOTE!

See jumper selections below. More information in the product's User Manual.

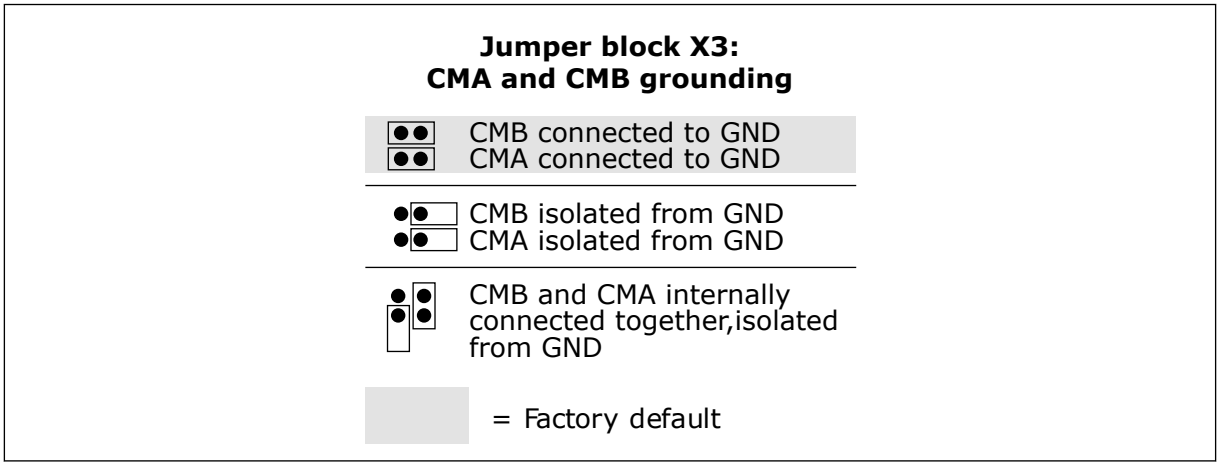

Fig. 14: Jumper selections

5.3 CONTROL SIGNAL LOGIC IN PID CONTROL APPLICATION

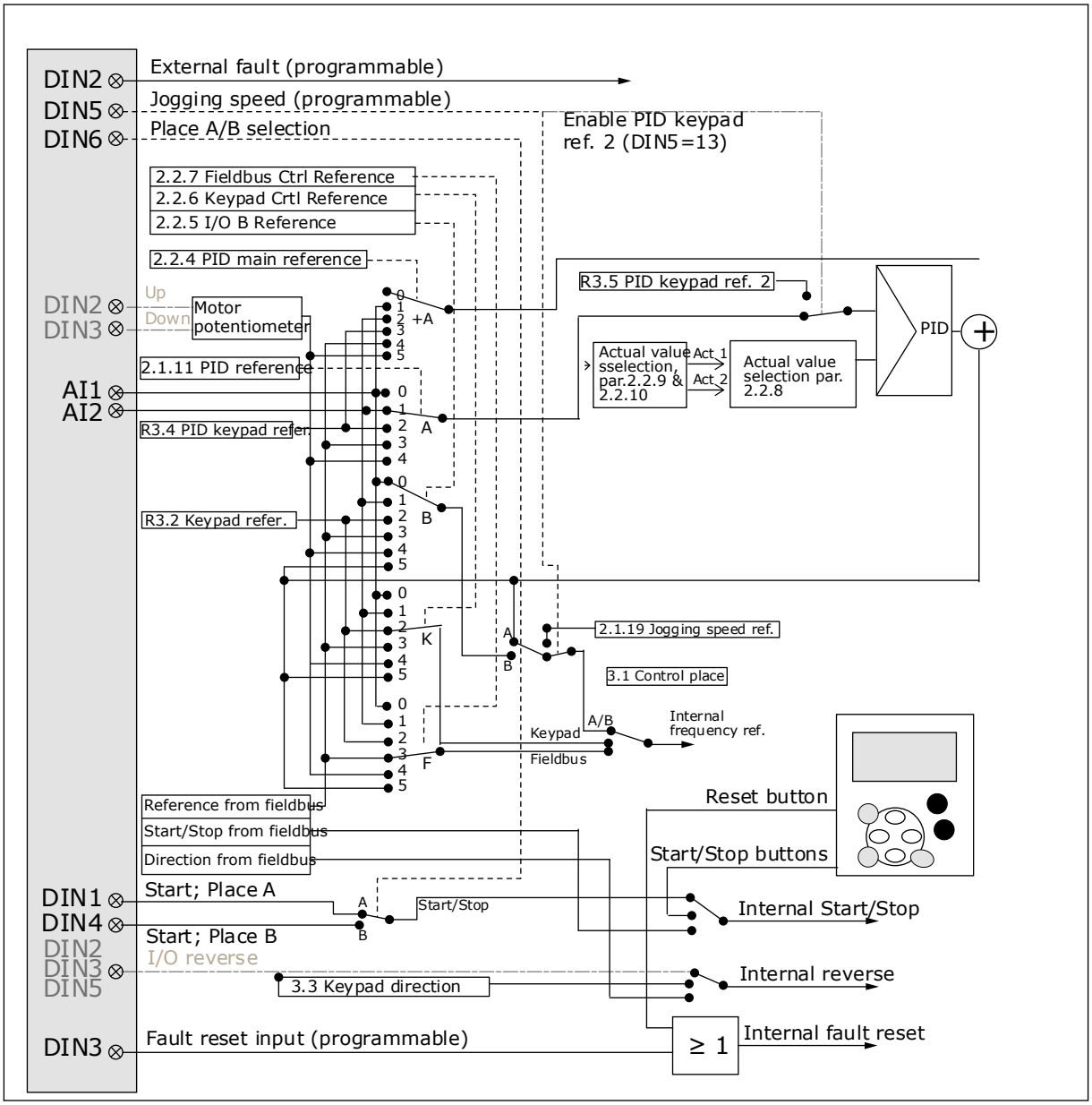

Fig. 15: Control signal logic of the PID Control Application

5.4 PID CONTROL APPLICATION - PARAMETER LISTS

5.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

NOTE!

The monitoring values V1.19 to V1.22 are available with the PID control application only.

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Table 34: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	Analogue input 3		27	AI3
V1.14	Analogue input 4		28	AI4
V1.15	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.16	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.17	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.18	Analogue Iout	mA	26	AO1
V1.19	PID Reference	%	20	In % of the max. frequency
V1.20	PID Actual value	%	21	In % of the max. actual value
V1.21	PID Error value	%	22	The error value of the PID controller. It is the deviation of feedback from the setpoint in process units. You can use a parameter to make the selection of the process unit.
V1.22	PID Output	%	23	The PID output as a percentage (0-100%). It is possible to give this value to the motor control (frequency reference) or to an analogue output.
V1.23	Special display for actual value		29	See parameters 2.2.46 to 2.2.49

Table 34: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.24	PT-100 Temperature	ºC	42	Highest temperature of used inputs
G1.25	Monitoring items			Displays three selectable monitoring values
V1.26.1	Current	A	1113	
V1.26.2	Torque	%	1125	
V1.26.3	DC Voltage	V	44	
V1.26.4	Status Word		43	

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5.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 35: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	0.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	0.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.1.6 *	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7 *	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8 *	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.1.9 *	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

Table 35: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.10 *	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11 *	PID controller reference signal (Place A)	0	4		1		332	0 = AI1 1 = AI2 2 = PID ref from Keypad control page, P3.4 3 = PID ref from fieldbus (ProcessDataIN 1) 4 = Motor potentiometer
P1.1.12	PID controller gain	0.0	1000.0	%	100.0		118	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%.
P1.1.13	PID controller I-time	0.00	320.00	s	1.00		119	If this parameter is set to 1.00 s, a change of 10% in the error value causes the controller output to change by 10.00%/s.
P1.1.14	PID controller D-time	0.00	100.00	s	0.00		132	If this parameter is set to 1.00 s, a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%.
P1.1.15	Sleep frequency	0.00	P2.1.2	Hz	10.00		1016	The drive goes to sleep mode when the output frequency stays below this limit for a longer time than set by Sleep Delay.

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Table 35: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P1.1.16	Sleep delay	0	3600	s	30		1017	The minimum quantity of time during which the frequency has to stay below the sleep level before the drive stops.
P1.1.17	Wake up level	0.00	100.00	%	25.00		1018	Gives the level for the PID feedback value wake-up supervision. Uses the set process units.
P1.1.18	Wake up function	0	1		0		1019	0 = Wake-up at fall below wake up level (2.1.17) 1 = Wake-up at exceeded wake up level (2.1.17)
P1.1.19	Jogging speed reference	0.00	P2.1.2	Hz	10.00		124	

* = Parameter value can only be changed after the AC drive has been stopped.

5.4.3 INPUT SIGNALS

Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1 **	DIN2 function	0	13		1		319	0 = Not used 1 = External fault cc 2 = External fault oc 3 = Run enable 4 = Acc/Dec time selection 5 = CP: I/O terminal (ID125) 6 = CP: Keypad (ID125) 7 = CP: Fieldbus (ID125) 8 = Forward/ Reverse 9 = Jogging frequency (cc) 10 = Fault reset (cc) 11 = Acc/Dec prohibit (cc) 12 = DC braking command 13 = Motor pot. UP (cc)
P2.2.2 **	DIN3 function	0	13		10		301	See above except: 13 = Motor pot. DOWN (cc)
P2.2.3 **	DIN5 function	0	13		9		330	See above except: 13 = Enable PID reference 2

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Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.4 **	PID sum point reference	0	7		0		376	0 = Direct PID output value 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
P2.2.5 **	I/O B reference selection	0	7		1		343	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = Keypad reference 5 = Fieldbus reference (FBSpeedReference) 6 = Motor potentiometer 7 = PID controller
P2.2.6 **	Keypad control reference selection	0	7		4		121	As in P2.2.5
P2.2.7 **	Fieldbus control reference selection	0	7		5		122	As in P2.2.5
P2.2.8 **	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 = Min(Actual 1, Actual 2) 5 = Max(Actual 1, Actual 2) 6 = Mean(Actual1, Actual2 7 = Sqrt (Act1) + Sqrt (Act2)

Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.9 **	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
P2.2.10 **	Actual value 2 input	0	10		0		335	0 = Not used 1 = AI1 signal 2 = AI2 signal 3 = AI3 4 = AI4 5 = Fieldbus ProcessDataIN3 6 = Motor torque 7 = Motor speed 8 = Motor current 9 = Motor power 10 = Encoder Frequency
P2.2.11	Actual value 1 minimum scale	–1600.0	1600.0	%	0.0		336	0 = No minimum scaling
P2.2.12	Actual value 1 maximum scale	–1600.0	1600.0	%	100.0		337	100 = No maximum scaling
P2.2.13	Actual value 2 minimum scale	–1600.0	1600.0	%	0.0		338	0 = No minimum scaling
P2.2.14	Actual value 2 maximum scale	–1600.0	1600.0	%	100.0		339	100 = No maximum scaling
P2.2.15 ***	AI1 signal selection	0.1	E.10		A.1		377	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.

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Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.16	AI1 signal range	0	2		0		320	0 = 0—10 V (0—20 mA*) 1 = 2—10 V (4 – 20 mA*) 2 = Custom range*
P2.2.17	AI1 custom minimum setting	–160.00	160.00	%	0.00		321	
P2.2.18	AI1 custom maximum setting	–160.00	160.00	%	100.0		322	
P2.2.19	AI1 inversion	0	1		0		323	0 = Not inverted 1 = Inverted
P2.2.20	AI1 filter time	0.00	10.00	s	0.10		324	0 = No filtering
P2.2.21	AI2 signal selection	0.1	E.10		A.2		388	0 = 0—20 mA (0—10 V *) 1 = 4 – 20 mA (2—10 V *) 2 = Custom range*
P2.2.22	AI2 signal range	0	2		1		325	0 = 0—20 mA* 1 = 4—20 mA* 2 = Customised*
P2.2.23	AI2 custom minimum setting	-160.00	160.00	%	0.00		326	
P2.2.24	AI2 custom maximum setting	-160.00	160.00	%	0.00		327	
P2.2.25	AI2 inversion	0	1		0		328	0 = Not inverted 1 = Inverted
P2.2.26	AI2 filter time	0.00	10.00	s	0.10		329	0 = No filtering
P2.2.27	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0		331	

Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.28	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
P2.2.29	Motor potentiometer PID reference memory reset	0	2		0		370	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P2.2.30	PID minimum limit	-1600.0	P2.2.31	%	0.0		359	
P2.2.31	PID maximum limit	P2.2.30	1600.0	%	100.0		360	
P2.2.32	Error value inversion	0	1		0		340	0 = No inversion 1 = Inversion
P2.2.33	PID reference rising time	0.1	100.0	s	5.0		341	
P2.2.34	PID reference falling time	0.1	100.0	s	5.0		342	
P2.2.35	Reference scaling minimum value, place B	0.00	320.0	Hz	0.00		344	
P2.2.36	Reference scaling maximum value, place B	0.00	320.0	Hz	0.00		345	
P2.2.37	Easy changeover	0	1		0		366	0 = Keep reference 1 = Copy actual reference
P2.2.38 ***	AI3 signal selection	0.1	E.10		0.1		141	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.

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Table 36: Input signals, G2.2

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.39	AI3 signal range	0	1		1		143	0 = Signal range 0 —10 V 1 = Signal range 2 —10 V
P2.2.40	AI3 inversion	0	1		0		151	0 = Not inverted 1 = Inverted
P2.2.41	AI3 filter time	0.00	10.00	s	0.10		142	0 = No filtering
P2.2.42 ***	AI4 signal selection	0.1	E.10		0.1		152	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.43	AI4 signal range	0	1		1		154	0 = Signal range 0 —10 V 1 = Signal range 2 —10 V
P2.2.44	AI4 inversion	0	1		0		162	0 = Not inverted 1 = Inverted
P2.2.45	AI4 filter time	0.00	10.00	s	0.10		153	0 = No filtering
P2.2.46	Actual value special display minimum	0	30000		0		1033	
P2.2.47	Actual value special display maximum	0	30000		100		1034	
P2.2.48	Actual value special display decimals	0	4		1		1035	
P2.2.49	Actual value special display unit	0	29		4		1036	See ID1036 in Chapter *8 Parameter descriptions*.

CP = control place
cc = contact
oc = opening contact

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Parameter value can only be changed after the FC has been stopped.

*** = Use TTF method to program these parameters.

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5.4.4 OUTPUT SIGNALS (CONTROL KEYPAD: MENU M2 -> G2.3

Table 37: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1 *	AO1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.2	Analogue output function	0	14		1		307	0 = Not used 1 = Output freq. (0-f_{max}) 2 = Freq. reference (0-f_{max}) 3 = Motor speed (0-Motor nominal speed) 4 = Motor current (0-I_{nMotor}) 5 = Motor torque (0-T_{nMotor}) 6 = Motor power (0-P_{nMotor}) 7 = Motor voltage (0-U_{nMotor}) 8 = DC-link volt (0-1000V) 9 = PID controller ref. value 10 = PID contr. act. value 1 11 = PID contr. act. value 2 12 = PID contr. error value 13 = PID controller output 14 = PT100 temperature
P2.3.3	Analogue output filter time	0.00	10.00	s	1.00		308	0 = No filtering
P2.3.4	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.5	Analogue output minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)

Table 37: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.7	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 superv. 1 14 = OP freq. limit superv.2 15 = Torque limit superv. 16 = Ref. limit superv. 17 = Ext. brake control 18 = Control place: IO 19 = FC temp. limit superv. 20 = Unrequested rotation direction
P2.3.7	Digital output 1 function	0	23		1		312	21 = Ext. brake control inverted 22 = Thermistor fault/warn. 23 = Fieldbus DIN1
P2.3.8	RO1 function	0	23		2		313	As parameter 2.3.7
P2.3.9	RO2 function	0	23		3		314	As parameter 2.3.7

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Table 37: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.11	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.12	Output frequency limit 2 supervision	0	2		0		346	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.13	Output frequency limit 2; Supervision value	0.00	320.00	Hz	0.00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	0 = No 1 = Low limit 2 = High limit
P2.3.15	Torque limit supervision value	-300.0	300.0	%	100.0		349	
P2.3.16	Reference limit supervision function	0	2		0		350	0 = No 1 = Low limit 2 = High limit
P2.3.17	Reference limit supervision value	0.0	100.0	%	0.0		351	
P2.3.18	External brake Off-delay	0.0	100.0	s	0.5		352	
P2.3.19	External brake On-delay	0.0	100.0	s	1.5		353	
P2.3.20	Frequency converter temperature limit supervision	0	2		0		354	0 = No 1 = Low limit 2 = High limit
P2.3.21	Frequency converter temperature supervised value	-10	100	°C	40		355	

Table 37: Output signals, G2.3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.22	Analogue output 2 scaling	0.1	E.10		0.1		471	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.23	Analogue output 2 function	0	14		4		472	As parameter 2.3.2
P2.3.24	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering
P2.3.25	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.26	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P.2.3.27	Analogue output 2 scaling	10	1000	%	1.00		476	

* = Use TTF method to program these parameters

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5.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 38: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	0 = Linear >0 = S-curve ramp time
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	0 = Linear >0 = S-curve ramp time
P2.4.3	Acceleration time 2	0.1	3000.0	s	1.0		502	
P2.4.4	Deceleration time 2	0.1	3000.0	s	1.0		503	
P2.4.5	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	IL	A	0.7 x IH		507	
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop

Table 38: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12 *	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	

5.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 39: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	-1.00	320.00	Hz	0.00		509	0 = Not used
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	0 = Not used
P2.5.3	Prohibit frequency range 2 low limit	0.00	320.00	Hz	0.00		511	0 = Not used
P2.5.4	Prohibit frequency range 2 high limit	0.00	320.00	Hz	0.00		512	0 = Not used
P2.5.5	Prohibit frequency range 3 low limit	0.00	320.00	Hz	0.00		513	0 = Not used
P2.5.6	Prohibit frequency range 3 high limit	0.00	320.00	Hz	0.00		514	0 = Not used
P2.5.7	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

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5.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 40: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1	Motor control mode	0	1/3		0		600	0 = Frequency control 1 = Speed control **NXP:** 2 = Not used 3 = Closed loop speed ctrl 4 = Closed loop torque control
P2.6.2	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P2.6.4	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5	Voltage at field weakening point	10.00	200.00	%	100.00		603	The voltage at the field weakening point as a percentage of the motor nominal voltage.
P2.6.6	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.

Table 40: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.7	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies		606	This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.
P2.6.9	Switching frequency	1	Varies	kHz	Varies		601	If you increase the switching frequency, the capacity of the AC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	0 = Not used 1 = Used
P2.6.12	Load drooping	0.00	100.00	%	0.00		620	The function enables a speed drop as a function of load. The load drooping is given as a percentage of the nominal speed at a nominal load.

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Table 40: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.13	Identification	0	1/2		0		631	0 = No action 1 = Identification w/o run 2 = Identification with run
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	The magnetising current (no-load current) of the motor. The magnetising current identifies the values of the U/f parameters if they are given before the identification run. If the value is set to 0, the magnetising current is calculated internally.
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0.0	3200.0	ms	30.0		614	
P2.6.14.5	Acceleration compensation	0.00	300.00	%	0.00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0.00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	

Table 40: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.14.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	-300.0	300.00	%	0.0		633	
P2.6.14.13	Start-up torque REV	-300.0	300.0	%	0.0		634	
P2.6.14.15	Encoder filter time	0.0	100.0	ms	0.0		618	
P2.6.14.17	Current control P gain	0.00	100.00	%	40.00		617	
Identification parameter group 2.6.15								
P2.6.15.1	Speed step	-50.0	50.0	%	0.0		1252	NCDrive speed tuning

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5.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7

Table 41: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		4		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

Table 41: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		1		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	2 x I_H	A	1_H		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.0	P2.1.2	Hz	25.0		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	UP fnom Torque	10.0	150.0	%	50.0		714	
P2.7.19	UP Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	5		0		739	

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Table 41: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.25	Response to PT100 fault	0	3		0		740	0 = No response 1 = Warning 2 = Fault,stop acc. to 2.4.7 3 = Fault,stop by coasting
P2.7.26	PT100 warning limit	-30.0	200.0	ºC	120.0		741	
P2.7.27	PT100 fault limit	-30.0	200.0	ºC	130.0		742	

5.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 42: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

5.4.10 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

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Table 43: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1.1	P2.1.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	You can adjust the frequency reference on the keypad with this parameter.
P3.4	PID reference	0.00	100.00	%	0.00		167	
P3.5	PID reference 2	0.00	100.00	%	0.00		168	
R3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

5.4.11 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

5.4.12 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

6 MULTI-PURPOSE CONTROL APPLICATION

6.1 INTRODUCTION

Select the Multi-purpose Control Application in menu M6 on page S6.2.

The 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 the PID Control Application or Pump and Fan Control Application).

The frequency reference can be selected e.g. from the analogue inputs, joystick control, motor potentiometer and from a mathematical function of the analogue 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:

- Analogue 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 prohibit 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
- Joystick hysteresis
- Sleep function

NXP functions:

- Power limit functions
- Different power limits for motoring and generating side
- Master Follower function
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Brake monitoring input and actual current monitor for immediate brake close.
- Separate speed control tuning for different speeds and loads
- Inching function two different references
- Possibility to connect the FB Process data to any parameter and some monitoring values
- Identification parameter can be adjusted manually

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

6.2 CONTROL I/O

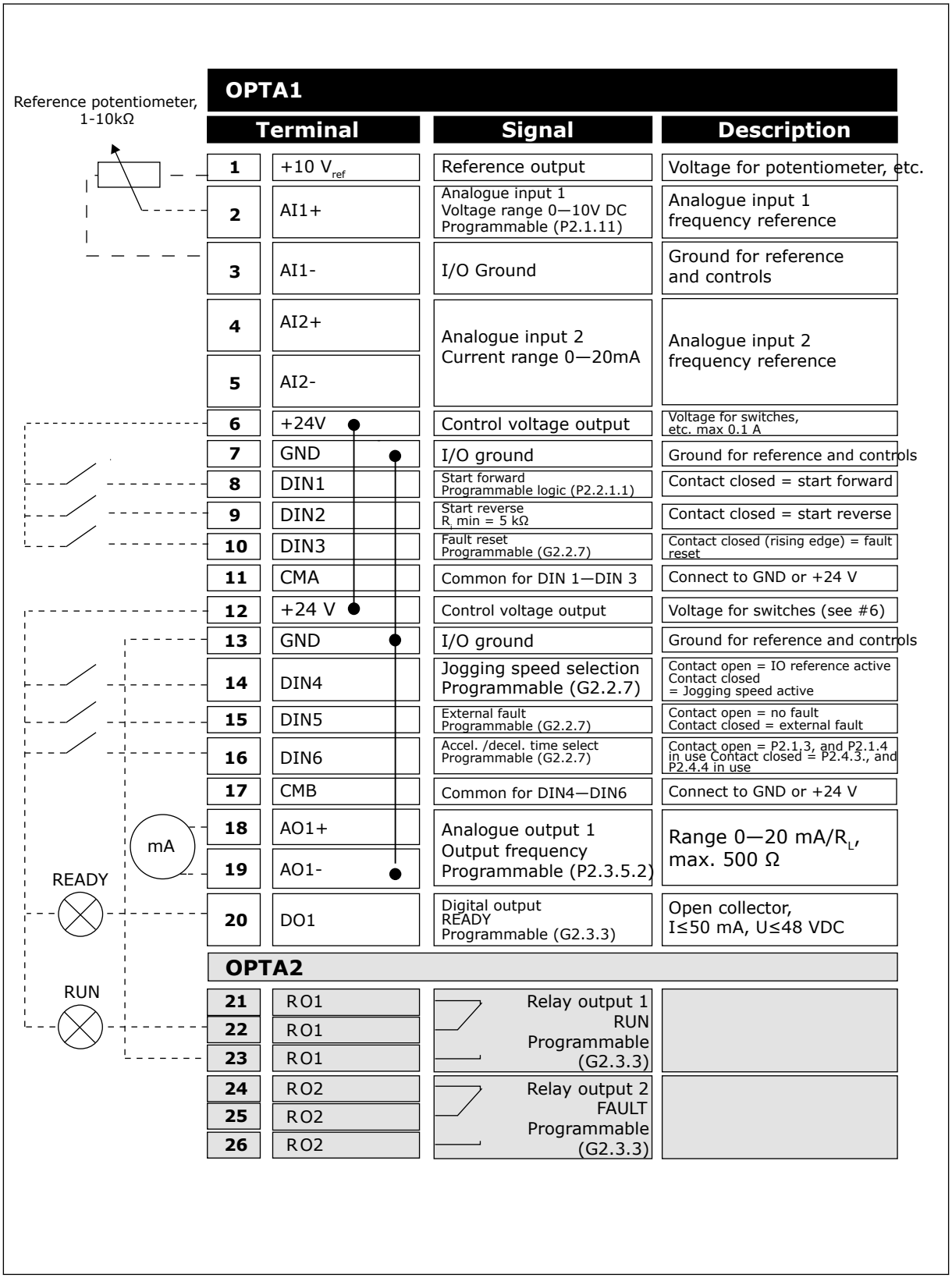

Fig. 16: Multi-purpose control application default I/O configuration and connection example

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NOTE!

See jumper selections below. More information in the product's User Manual.

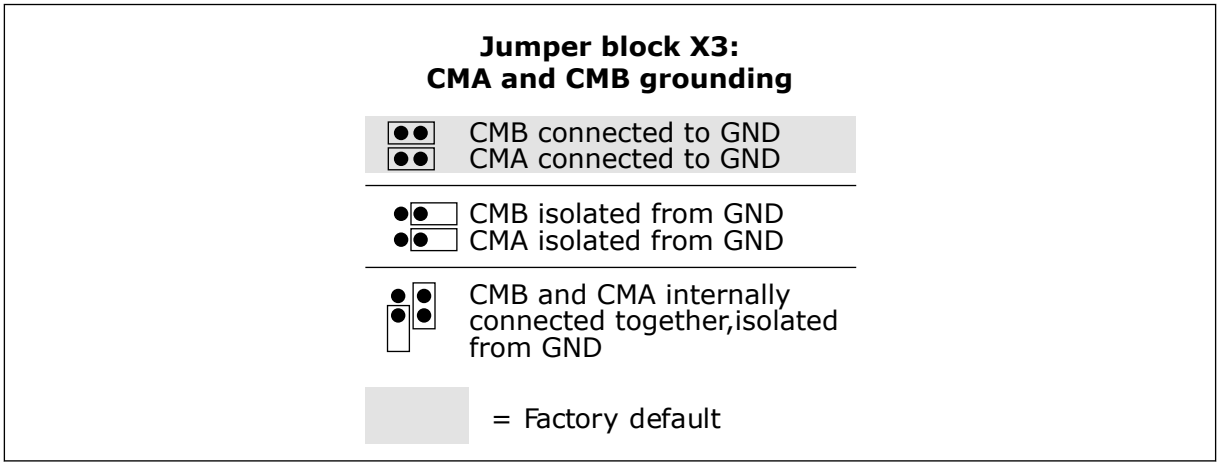

Fig. 17: Jumper selections

6.3 CONTROL SIGNAL LOGIC IN MULTI-PURPOSE CONTROL APPLICATION

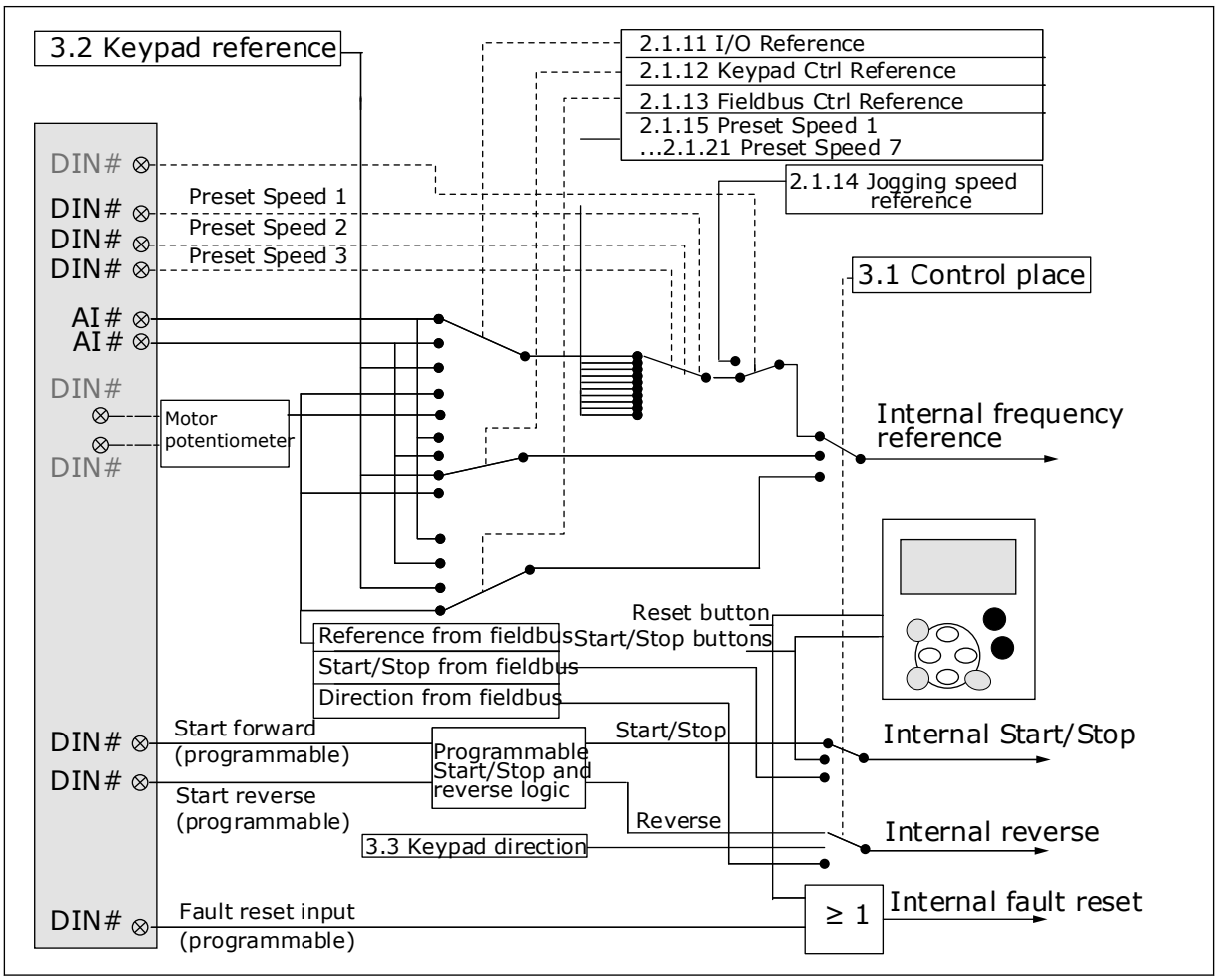

Fig. 18: Control signal logic of the Multi-purpose Control Application

6.4 MULTI-PURPOSE CONTROL APPLICATION - PARAMETER LISTS

6.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values marked with asterisk (*) can be controlled from the fieldbus.

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Table 44: Monitoring values, NXS drives

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
V1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
V1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	Analogue output 1	V/mA	26	AO1
V1.16	Analogue input 3	V/mA	27	AI3
V1.17	Analogue input 4	V/mA	28	AI4
V1.18	Torque reference	%	18	
V1.19	Sensor max temp.	ºC	42	Highest measured temperature
G1.20	Multimonitoring items			Displays three selectable monitoring values
V1.21.1	Current	A	1113	Unfiltered motor current
V1.21.2	Torque	%	1125	Unfiltered motor torque
V1.21.3	DC Voltage	V	44	Unfiltered DC link voltage
V1.21.4	Status Word		43	See*Table 53 Appliction Status word content*.
V1.21.5	Fault History		37	Last active fault code
V1.21.6	Motor Current	A	45	

Table 44: Monitoring values, NXS drives

Index	Monitoring value	Unit	ID	Description
V1.21.7	Warnig		74	Last active warning.
V1.21.8	Sensor 1 Temp	ºC	50	Sensor 1 temperature
V1.21.9	Sensor 2 Temp	ºC	51	Sensor 2 temperature
V1.21.10	Sensor 3 Temp	ºC	52	Sensor 3 temperature
V1.21.25	Sensor 4 Temp	ºC	69	Sensor 4 temperature
V1.21.26	Sensor 5 Temp	ºC	70	Sensor 5 temperature
V1.21.27	Sensor 6 Temp	ºC	71	Sensor 6 temperature

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Table 45: Monitoring values, NXP drives

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
V1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
V1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11 *	Analogue input 1	V/mA	13	AI1
V1.12 *	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	Analogue output 1	V/mA	26	AO1
V1.16 *	Analogue input 3	V/mA	27	AI3
V1.17 *	Analogue input 4	V/mA	28	AI4
V1.18	Torque reference	%	18	
V1.19	Sensor max temp	Cº	42	Highest measured temperature
G1.20	Multimonitoring items			Displays three selectable monitoring values
V1.21.1	Current	A	1113	Unfiltered motor current
V1.21.2	Torque	%	1125	Unfiltered motor torque
V1.21.3	DC Voltage	V	44	Unfiltered DC link voltage
V1.21.4	Status Word		43	See *Table 53 Appliction Status word content*.
V1.21.5	Encoder 1 Frequency	Hz	1124	Input C.1
V1.21.6	Shaft Rounds	r	1170	See ID1090

Table 45: Monitoring values, NXP drives

Index	Monitoring value	Unit	ID	Description
V1.21.7	Shaft Angle	Deg	1169	See ID1090
V1.21.8	Sensor 1 Temp	°C	50	Sensor 1 temperature
V1.21.9	Sensor 2 Temp	°C	51	Sensor 2 temperature
V1.21.10	Sensor 3 Temp	°C	52	Sensor 3 temperature
V1.21.11	Encoder 2 Frequency	Hz	53	From OPTA7 board (input C.3)
V1.21.12	Absolute encoder position		54	From OPTBB board
V1.21.13	Absolute encod. rotations		55	From OPTBB board
V1.21.14	ID Run Status		49	
V1.21.15	PolePairNumber		58	Used PPN from motor nom. values
V1.21.16	Analogue input 1	%	59	AI1
V1.21.17	Analogue input 2	%	60	AI2
V1.21.18 *	Analogue input 3	%	61	AI3
V1.21.19 *	Analogue input 4	%	62	AI4
V1.21.20	Analogue output 2	%	31	AO2
V1.21.21	Analogue output 3	%	32	AO3
V1.21.22	Final Frequency Reference Closed Loop	Hz	1131	Used for Closed Loop speed tuning
V1.21.23	Step Response	Hz	1132	Used for Closed Loop speed tuning
V1.21.24	Output power	kW	1508	Drive output power in kW
V1.21.25	Sensor 4 Temp	°C	69	Sensor 4 temperature
V1.21.26	Sensor 5 Temp	°C	70	Sensor 5 temperature
V1.21.27	Sensor 6 Temp	°C	71	Sensor 6 temperature
V1.22.1 *	FB torque reference	%	1140	Default control of FB PD In 1
V1.22.2 *	FB limit scaling	%	46	Default control of FB PD In 2
V1.22.3 *	FB adjust reference	%	47	Default control of FB PD In 3
V1.22.4 *	FB analogue output	%	48	Default control of FB PD In 4
V1.22.5	Last Active Fault		37	

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Table 45: Monitoring values, NXP drives

Index	Monitoring value	Unit	ID	Description
V1.22.6	Motor Current to FB	A	45	Motor current (drive independent) given with one decimal point
V1.22.7	DIN StatusWord 1		56	See *Table 47 Digital input statuses: ID56 and ID57*
V1.22.8	DIN StatusWord 2		57	See *Table 47 Digital input statuses: ID56 and ID57*
V1.22.9	Warning		74	Last active warning code
V1.22.10	Fault Word1		1172	See *Table 48 Fault Word 1, ID1172*
V1.22.11	Fault Word2		1173	See *Table 49 Fault Word 2, ID1173*
V1.22.12	Warning Word1		1174	See *Table 50 Warning Word 1, ID1174*
V1.23.1	SystemBus System Status		1601	See *Table 51 SystemBus Status Word, ID1601*
V1.23.2	Total current	A	83	Total current of the drives in Master Follower system.
V1.23.3.1	Motor current D1	A	1616	D1: This value is the current of drive number one power unit. D2, D3 and D4: Not updated.
V1.23.3.2	Motor current D2	A	1605	D1:This value is the current of drive number two power unit. D2, D3 and D4: Not updated.
V1.23.3.3	Motor current D3	A	1606	D1:This value is the current of drive number three power unit. D2, D3 and D4: Not updated.
V1.23.3.4	Motor current D4	A	1607	D1: This value is the current of drive number four power unit. D2, D3 and D4: Not updated.
V1.23.4.1	StatusWord D1		1615	See *Table 52 Follower drive Status Word*
V1.23.4.2	StatusWord D2		1602	See *Table 52 Follower drive Status Word*
V1.23.4.3	StatusWord D3		1603	See *Table 52 Follower drive Status Word*
V1.23.4.4	StatusWord D4		1604	See *Table 52 Follower drive Status Word*

Table 46: Digital input statuses: ID15 and ID16

	DIN1/DIN2/DIN3 status	DIN4/DIN5/DIN6 status
b0	DIN3	DIN6
b1	DIN2	DIN5
b2	DIN1	DIN4

Table 47: Digital input statuses: ID56 and ID57

	DIN StatusWord 1	DIN StatusWord 2
b0	DIN: A.1	DIN: C.5
b1	DIN: A.2	DIN: C.6
b2	DIN: A.3	DIN: D.1
b3	DIN: A.4	DIN: D.2
b4	DIN: A.5	DIN: D.3
b5	DIN: A.6	DIN: D.4
b6	DIN: B.1	DIN: D.5
b7	DIN: B.2	DIN: D.6
b8	DIN: B.3	DIN: E.1
b9	DIN: B.4	DIN: E.2
b10	DIN: B.5	DIN: E.3
b11	DIN: B.6	DIN: E.4
b12	DIN: C.1	DIN: E.5
b13	DIN: C.2	DIN: E.6
b14	DIN: C.3	
b15	DIN: C.4	

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Table 48: Fault Word 1, ID1172

	Fault	Comment
b0	Overcurrent or IGBT	F1, F31, F41
b1	Overvoltage	F2
b2	Undervoltage	F9
b3	Motor stalled	F15
b4	Earth fault	F3
b5	Motor underload	F17
b6	Drive overtemperature	F14
b7	Overtemperature	F16, F56, F29
b8	Input phase	F10
b11	Keypad or PC control	F52
b12	Fieldbus	F53
b13	SystemBus	F59
b14	Slot	F54
b15	4 mA	F50

Table 49: Fault Word 2, ID1173

	Fault	Comment
b2	Encoder	F43
b4		
b6	External	F51
b9	IGBT	F31, F41
b10	Brake	F58
b14	Main switch open	F64
b15		

Table 50: Warning Word 1, ID1174

	Fault	Comment
b0	Motor stalled	W15
b1	Motor overtemperature	W16
b2	Motor underload	W17
b3	Input phase loss	W10
b4	Output phase loss	W11
b9	Analogue input < 4mA	W50
b10	Not used	
b13	Not used	
b14	Mechanical brake	W58
b15	Keypad or PC Fault/Warning	FW52

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Table 51: SystemBus Status Word, ID1601

	False	True
b0		Reserved
b1		Drive 1 Ready
b2		Drive 1 Running
b3		Drive 1 Fault
b4		Reserved
b5		Drive 2 Ready
b6		Drive 2 Running
b7		Drive 2 Fault
b8		Reserved
b9		Drive 3 Ready
b10		Drive 3 Running
b11		Drive 3 Fault
b12		Reserved
b13		Drive 4 Ready
b14		Drive 4 Running
b15		Drive 4 Fault

Table 52: Follower drive Status Word

	False	True
b0	Flux not ready	Flux ready (>90 %)
b1	Not in Ready state	Ready
b2	Not running	Running
b3	No fault	Fault
b4		Charge switch state
b5		
b6	Run disabled	Run enable
b7	No warning	Warning
b8		
b9		
b10		
b11	No DC brake	DC brake is active
b12	No run request	Run request
b13	No limit controls active	Limit control active
b14	External brake control OFF	External brake control ON
b15		Heartbeat

Application Status Word combines different drive statuses to one data word (see Monitoring Value V1.21.4 Status Word). Status Word is visible on keypad in Multi-Purpose application only. The Status Word of any other application can be read with the NCDrive PC software.

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Table 53: Appliction Status word content

Application / Status Word	Standard	Loc/Rem	Multi-Step	PID	MP	PFC
b0						
b1	Ready	Ready	Ready	Ready	Ready	Ready
b2	Run	Run	Run	Run	Run	Run
b3	Fault	Fault	Fault	Fault	Fault	Fault
b4						
b5					No EMStop (NXP)	
b6	Run Enable	Run Enable	Run Enable	Run Enable	Run Enable	Run Enable
b7	Warning	Warning	Warning	Warning	Warning	Warning
b8						
b9						
b10						
b11	DC Brake	DC Brake	DC Brake	DC Brake	DC Brake	DC Brake
b12	Run request	Run request	Run request	Run request	Run request	Run request
b13	Limit control	Limit control	Limit control	Limit control	Limit control	Limit control
b14					Brake control	Aux 1
b15		Place B is active		PID active		Aux 2

6.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 54: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	3.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	3.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	Varies	Varies	A	0.00		107	Motor current limit. The AC drive lowers the output frequency when the limit function is operational.
P2.1.6 *	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7 *	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8 *	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.

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Table 54: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.9 *	Nominal current of the motor	Varies	Varies	A	5.40		113	Find the value In on the rating plate of the motor.
P2.1.10	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11	I/O reference	0	15/16		0		117	0 = AI1 1 = AI2 2 = AI1+AI2 3 = AI1-AI2 4 = AI2-AI1 5 = AI1xAI2 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 1 16 = Encoder 2 (NXP only)
P2.1.12	Keypad control reference	0	9		8		121	Select the frequency reference input when the control place is Panel. 0 = AI1 1 = AI2 2 = AI1+AI2 3 = AI1-AI2 4 = AI2-AI1 5 = AI1xAI2 6 = AI1 Joystick 7 = AI2 Joystick 8 = Keypad 9 = Fieldbus
P2.1.13	Fieldbus control reference	0	9		9		122	See P2.1.12

Table 54: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.14	Jogging speed refrerence	0.00	P2.1.2	Hz	5.00		124	See ID413 in Chapter *8 Parameter descriptions*.
P2.1.15	Preset speed 1	0.00	P2.1.2	Hz	10.00		105	Speeds preset by operator.
P2.1.16	Preset speed 2	0.00	P2.1.2	Hz	15.00		106	Speeds preset by operator.
P2.1.17	Preset speed 3	0.00	P2.1.2	Hz	20.00		126	Speeds preset by operator.
P2.1.18	Preset speed 4	0.00	P2.1.2	Hz	25.00		127	Speeds preset by operator.
P2.1.19	Preset speed 5	0.00	P2.1.2	Hz	30.00		128	Speeds preset by operator.
P2.1.20	Preset speed 6	0.00	P2.1.2	Hz	40.00		129	Speeds preset by operator.
P2.1.21	Preset speed 7	0.00	P2.1.2	Hz	50.00		130	Speeds preset by operator.

* = Parameter value can only be changed after the FC has been stopped.

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6.4.3 INPUT SIGNALS

Table 55: Basic Settings (Control keypad: Menu M2 -> G2.2.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1.1 **	Start/Stop logic selection	0	7		0		300	**Logic = 0** Ctrl sgn 1 = Start forward Ctrl sgn 2 = Start reverse **Logic = 1** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Reverse **Logic = 2** Ctrl sgn 1 = Start/ Stop Ctrl sgn 2 = Run enable **Logic = 3** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Stop pulse **Logic = 4** Ctrl sgn 1 = Start Ctrl sgn 2 = Motor potentiometer UP **Logic = 5** Ctrl sgn 1 = Forward pulse (edge) Ctrl sgn 2 = Reverse pulse (edge)

Table 55: Basic Settings (Control keypad: Menu M2 -> G2.2.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1.1 **	Start/Stop logic selection	0	7		0		300	**Logic = 6** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Reverse pulse **Logic = 7** Ctrl sgn 1 = Start pulse (edge) Ctrl sgn 2 = Enable pulse
P2.2.1.2 **	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0		331	The rate of change in the motor potentiometer reference when it is increased or decreased with DI5 or DI6.
P2.2.1.3 **	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
P. 2.2.1.4 **	Adjust input	0	5		0		493	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Fieldbus (see group G2.9)
P2.2.1.5	Adjust minimum	0.0	100.0	%	0.0		494	
P2.2.1.6	Adjust maximum	0.0	100.0	%	0.0		495	

** = Parameter value can only be changed after the FC has been stopped.

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Table 56: Analogue input 1 (Control keypad: Menu M2 -> G2.2.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.2.1 **	AI1 signal selection	0.1	E.10		A.1		377	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.2.2	AI1 filter time	0.00	320.00	s	0.10		324	Filters out disturbances from the incoming analogue signal.
P2.2.2.3	AI1 signal range	0	3		0		320	0 = 0-10 V (0-20 mA*) 1 = 2-10 V (4-20 mA*) 2 = -10V...+10 V* 3 = Custom range *
P2.2.2.4	AI1 custom minimum setting	-160.00	160.00	%	0.00		321	The percentage of input signal range. For example, 3 V = 30%.
P2.2.2.5	AI1 custom maximum setting	-160.00	160.00	%	100.00		322	For example 9 V = 90%.
P2.2.2.6	AI1 reference scaling, minimum value	0.00	320.00	Hz	0.00		303	Selects the frequency that corresponds to the min. reference signal.
P2.2.2.7	AI1 reference scaling, maximum value	0.00	320.00	Hz	0.00		304	Selects the frequency that corresponds to the max. reference signal.
P2.2.2.8	AI1 joystick hysteresis	0.00	20.00	%	0.00		384	When the reference is between 0 and 0 ± this parameter, the reference is set to 0.
P2.2.2.9	AI1 sleep limit	0.00	100.00	%	0.00		385	The AC drive goes to sleep mode if input is below this limit for set time.
P2.2.2.10	AI1 sleep delay	0.00	320.00	s	0.00		386	

Table 56: Analogue input 1 (Control keypad: Menu M2 -> G2.2.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.2.11	AI1 joystick offset	-100.00	100.00	%	0.00		165	Press 'Enter' for 1s to set offset, 'Reset' to set 0.00.

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

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Table 57: Analogue input 2 (Control keypad: Menu M2 -> G2.2.3)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.3.1 **	AI2 signal selection	0.1	E.10		A.2		388	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.3.2	AI2 filter time	0.00	320.00	s	0.10		329	0 = No filtering
P2.2.3.3	AI2 signal range	0	3		1		325	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 2 = -10V...+10 V* 3 = Custom range *
P2.2.3.4	AI2 custom minimum setting	-160.00	160.00	%	20.00		326	The percentage of input signal range. For example, 2 mA = 10%
P2.2.3.5	AI2 custom maximum setting	-160.00	160.00	%	100.00		327	For example 18 mA = 90%
P2.2.3.6	AI2 reference scaling, minimum value	0.00	320.00	Hz	0.00		393	Selects the frequency that corresponds to the min. reference signal.
P2.2.3.7	AI2 reference scaling, maximum value	0.00	320.00	Hz	0.00		394	Selects the frequency that corresponds to the max. reference signal.
P2.2.3.8	AI2 joystick hysteresis	0.00	20.00	%	0.00		395	When the reference is between 0 and 0 ± this parameter, the reference is set to 0.
P2.2.3.9	AI2 sleep limit	0.00	100.00	%	0.00		396	The AC drive goes to sleep mode if input is below this limit for set time.
P2.2.3.10	AI2 sleep delay	0.00	320.00	s	0.00		397	
P2.2.3.11	AI2 joystick offset	-100.00	100.00	%	0.00		166	Press 'Enter' for 1s to set offset, 'Reset' to set 0.00.

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

Table 58: Analogue input 3 (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.4.1 **	AI3 signal selection	0.1	E.10		0.1		141	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.4.2	AI3 filter time	0.00	320.00	s	0.00		142	0 = No filtering
P2.2.4.3	AI3 signal range	0	3		0		143	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 2 = -10V...+10 V* 3 = Custom range *
P2.2.4.4	AI3 custom minimum setting	-160.00	160.00	%	0.00		144	% of input signal range. e.g. 2 mA = 10 %
P2.2.4.5	AI3 custom maximum setting	-160.00	160.00	%	100.00		145	e.g. 18 mA = 90 %
P2.2.4.6	AI3 signal inversion	0	1		0		151	0 = Not inverted 1 = Inverted

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

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Table 59: Analogue input 4 (Control keypad: Menu M2 -> G2.2.5)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.5.1 **	AI4 signal selection	0.1	E.10		0.1		152	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.5.2	AI4 filter time	0.00	320.00	s	0.00		153	0 = No filtering
P2.2.5.3	AI4 signal range	0	3		1		154	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 2 = -10V...+10 V* 3 = Custom range *
P2.2.5.4	AI4 custom minimum setting	-160.00	160.00	%	20.00		155	% of input signal range. e.g. 2 mA = 10 %
P2.2.5.5	AI4 custom maximum setting	-160.00	160.00	%	100.00		156	e.g. 18 mA = 90 %
P2.2.5.6	AI4 signal inversion	0	1		0		162	0 = Not inverted 1 = Inverted

*= Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

Table 60: Free analogue input, signal selection (Keypad: Menu M2 -> G2.2.6)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.6.1	Scaling of current limit	0	5		0		399	0 = Not used 1= AI1 2 = AI2 3 = AI3 4 = AI4 5 = FB Limit Scaling See group G2.9
P2.2.6.2	Scaling of DC-braking current	0	5		0		400	As parameter P2.2.6.1 Scaling from 0 to ID507.
P2.2.6.3	Scaling of acc./dec. times	0	5		0		401	As parameter P2.2.6.1 Scales active ramp from 100 % to 10 %.
P2.2.6.4	Scaling of torque supervision limit	0	5		0		402	As parameter P2.2.6.1 Scaling from 0 to ID348.
P2.2.6.5	Scaling of torque limit	0	5		0		485	As parameter P2.2.6.1 Scaling from 0 to (ID609 (NXS) or ID1287 (NXP)).
NXP drives only								
P2.2.6.6	Scaling of generator torque limit	0	5		0		1087	As parameter P2.2.6.1 Scaling from 0 to ID1288.
P2.2.6.7	Scaling of motoring power limit	0	5		0		179	As parameter P2.2.6.1 Scaling from 0 to ID1289.
P2.2.6.8	Scaling of generator power limit	0	5		0		1088	As parameter P2.2.6.1 Scaling from 0 to ID1290.

Use TTF programming method for all Digital inputs parameters. See Chapter *8.9 "Terminal to function" (TTF) programming principle*

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Table 61: Digital inputs (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.2.7.1 *	Start signal 1	0.1	A.1		403	See P2.2.1.1.
P2.2.7.2 *	Start signal 2	0.1	A.2		404	See P2.2.1.1.
P2.2.7.3 *	Run enable	0.1	0.2		407	Motor start enabled (cc)
P2.2.7.4 *	Reverse	0.1	0.1		412	Direction forward (oc) Direction reverse (cc)
P2.2.7.5 *	Preset speed 1	0.1	0.1		419	See preset speeds in Basic Parameters (G2.1).
P2.2.7.6 *	Preset speed 2	0.1	0.1		420	
P2.2.7.7 *	Preset speed 3	0.1	0.1		421	
P2.2.7.8 *	Motor potentiometer reference DOWN	0.1	0.1		417	Mot.pot. reference decreases (cc).
P2.2.7.9 *	Motor potentiometer reference UP	0.1	0.1		418	Mot.pot. reference increases (cc).
P2.2.7.10 *	Fault reset	0.1	A.3		414	Resets all active faults when TRUE.
P2.2.7.11 *	External fault (close)	0.1	A.5		405	Ext. fault (F51) displayed (cc).
P2.2.7.12 *	External fault (open)	0.1	0.2		406	Ext. fault (F51) displayed (oc).
P2.2.7.13 *	Acc/Dec time selection	0.1	A.6		408	Acc/Dec time 1 (oc) Acc/Dec time 2 (cc)
P2.2.7.14 *	Acc/Dec prohibit	0.1	0.1		415	No acceleration or deceleration is possible until the contact is open.
P2.2.7.15 *	DC braking	0.1	0.1		416	DC braking active (cc).
P2.2.7.16 *	Jogging speed	0.1	A.4		413	Jogging speed selected for frequency reference (cc).
P2.2.7.17 *	AI1/AI2 selection	0.1	0.1		422	cc = AI2 is used as reference, when ID117 = 14
P2.2.7.18 *	Control from I/O terminal	0.1	0.1		409	Force Control to I/O terminal.
P2.2.7.19 *	Control from keypad	0.1	0.1		410	Force Control to Keypad.
P2.2.7.20 *	Control from fieldbus	0.1	0.1		411	Force Control to Fieldbus.

Table 61: Digital inputs (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.2.7.21 *	Parameter set 1/set 2 selection	0.1	0.1		496	Closed cont.=Set 2 is used Open cont.= Set 1 is used
P2.2.7.22 *	Motor control mode 1/2	0.1	0.1		164	Closed cont.= Mode 2 is used Open cont.= Mode 1 is used See parameter 2.6.1, 2.6.12
NXP drives only						
P2.2.7.23 *	Cooling monitor	0.1	0.2		750	Used with liquid-cooled unit.
P2.2.7.24 *	External brake acknowledge	0.1	0.2		1210	Monitoring signal from mechanical brake.
P2.2.7.26 *	Enable inching	0.1	0.1		532	Enables Inching function.
P2.2.7.27 *	Inching reference 1	0.1	0.1		530	Inching reference 1. (Default Forward 2 Hz. See P2.4.15). This will start the drive.
P2.2.7.28 *	Inching reference 2	0.1	0.1		531	Inching reference 2. (Default Forward 2 Hz. See P2.4.16). This will start the drive.
P2.2.7.29 *	Reset encoder counter	0.1	0.1		1090	Reset Shaft Rounds and Angle (see 6-3).
P2.2.7.30 *	Emergency stop	0.1	0.2		1213	Low signal activates EM.
P2.2.7.31 *	Master Follower mode 2	0.1	0.1		1092	See Chapter *8.2 Master/ follower function (NXP only)* and parameters P2.11.1-P2.11.7.
P2.2.7.32 *	Input switch acknowledgement	0.1	0.2		1209	Low signal generates fault (F64).

cc = closing contact
oc = opening contact

* = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

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6.4.4 OUTPUT SIGNALS

Table 62: Delayed digital output 1 (Keypad: Menu M2 -> G2.3.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1.1 *	Digital output 1 signal selection	0.1	E.10		0.1		486	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*. Possible to invert with ID1084 (NXP only).
P2.3.1.2	Digital output 1 function	0	29		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 = I/O control place act. 19 = FC temp. limit superv. 20 = Reference inverted 21 = Ext. brake control inverted

Table 62: Delayed digital output 1 (Keypad: Menu M2 -> G2.3.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.1.2	Digital output 1 function	0	29		1		312	22 = Therm. fault or warn. 23 = On/Off control 24 = Fieldbus DIN 1 25 = Fieldbus DIN 2 26 = Fieldbus DIN 3 27 = Temp.Warning **NXS drives only:** 28 = Temp.Fault **NXP drives only:** 29 = ID.Bit
P2.3.1.3	Digital output 1 on delay	0.00	320.00	s	0.00		487	0.00 = On delay not in use
P2.3.1.4	Digital output 1 off delay	0.00	320.00	s	0.00		488	0.00 = On delay not in use
NXP drives only								
P2.3.1.5	INV Delayed DO1	0	1		0		1587	0 = No 1 = Yes
P2.3.1.6	ID Bit Free DO1	0.0	200.15		0.0		1217	ID number on the left side of the dot and the bit number on the right side.

* = Use TTF method to program these parameters.

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Table 63: Delayed digital output 2 (Keypad: Menu M2 -> G2.3.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.2.1	Digital output 2 signal selection	0.1	E.10		0.1		489	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*. Possible to invert with ID1084 (NXP only)
P2.3.2.2	Digital output 2 function	0	29		0		490	See P2.3.1.2
P2.3.2.3	Digital output 2 on delay	0.00	320.00	s	0.00		491	0.00 = On delay not in use
P2.3.2.4	Digital output 2 off delay	0.00	320.00	s	0.00		492	0.00 = On delay not in use
NXP drives only								
P2.3.2.5	INV Delayed DO1	0	1		0		1588	0 = No 1 = Yes
P2.3.2.6	ID Bit Free DO1	0.0	200.15		0.0		1385	ID number on the left side of the dot and the bit number on the right side.

Table 64: Digital ouput signals (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.3.3.1 *	Ready	0.1	A.1		432	Ready to Run
P2.3.3.2 *	Run	0.1	B.1		433	Running
P2.3.3.3 *	Fault	0.1	B.2		434	Drive in fault state
P2.3.3.4 *	Inverted fault	0.1	0.1		435	Drive not in fault state
P2.3.3.5 *	Warning	0.1	0.1		436	Warning active
P2.3.3.6 *	External fault	0.1	0.1		437	External fault active
P2.3.3.7 *	Reference fault/warning	0.1	0.1		438	4 mA fault or warning active
P2.3.3.8 *	Overtemperature warning	0.1	0.1		439	Drive overtemperature active
P2.3.3.9 *	Reverse	0.1	0.1		440	Output frequency < 0 Hz
P2.3.3.10 *	Unrequested direction	0.1	0.1		441	Actual direction <> requested direction
P2.3.3.11 *	At speed	0.1	0.1		442	Reference = Output frequency
P2.3.3.12 *	Jogging speed	0.1	0.1		443	Jogging or preset speed command active
P2.3.3.13 *	I/O control place	0.1	0.1		444	IO control active
P2.3.3.14 *	External brake control	0.1	0.1		445	See IDs 445 and 446 in Chapter *8 Parameter descriptions*.
P2.3.3.15 *	External brake control, inverted	0.1	0.1		446	
P2.3.3.16 *	Output frequency limit 1 supervision	0.1	0.1		447	See ID315 in Chapter *8 Parameter descriptions*.
P2.3.3.17 *	Output frequency limit 2 supervision	0.1	0.1		448	See ID346 in Chapter *8 Parameter descriptions*.
P2.3.3.18 *	Reference limit supervision	0.1	0.1		449	See ID350 in Chapter *8 Parameter descriptions*.
P2.3.3.19 *	Temperature limit supervision	0.1	0.1		450	Drive temperature supervision. See ID354 in Chapter *8 Parameter descriptions*.
P2.3.3.20 *	Torque limit supervision	0.1	0.1		451	See ID348 in Chapter *8 Parameter descriptions*.
P2.3.3.21 *	Themistor fault or warning	0.1	0.1		452	
P2.3.3.22 *	Analogue input supervision limit	0.1	0.1		463	See ID356 in Chapter *8 Parameter descriptions*.

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Table 64: Digital ouput signals (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.3.3.23 *	Motor regulator activation	0.1	0.1		454	
P2.3.3.24 *	Fieldbus DIN 1	0.1	0.1		455	See fieldbus manual
P2.3.3.25 *	Fieldbus DIN 2	0.1	0.1		456	See fieldbus manual
P2.3.3.26 *	Fieldbus DIN 3	0.1	0.1		457	See fieldbus manual
P2.3.3.27 *	Fieldbus DIN 4	0.1	0.1		169	See fieldbus manual
P2.3.3.28 *	Fieldbus DIN 5	0.1	0.1		170	See fieldbus manual
NXP drives only						
P2.3.3.29 *	DC ready pulse	0.1	0.1		1218	For external DC charger
P2.3.3.30 *	Safe Disable Active	0.1	0.1		756	

* = Use TTF method to program these parameters.

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.

Table 65: Limit settings (Control keypad: Menu M2 -> G2.3.4)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.4.1	Output frequency limit 1 supervision	0	3		0		315	0 = No supervision 1 = Low limit supervision 2 = High limit supervision 3 = Brake-on control
P2.3.4.2	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.4.3	Output frequency limit 2 supervision	0	4		0		346	0 = No supervision 1 = Low limit supervision 2 = High limit supervision 3 = Brake-off control 4 = Brake on/off control
P2.3.4.4	Output frequency limit 2; Supervised value	0.00	320.00	Hz	0.00		347	
P2.3.4.5	Torque limit supervision	0	3		0		348	0 = No supervision 1 = Low limit supervision 2 = High limit supervision 3 = Brake-off control
P2.3.4.6	Torque limit supervision value	-300.0	300.0	%	100.0		349	For brake control absolute values are used.
P2.3.4.7	Reference limit supervision	0	2		0		350	0 = No supervision 1 = Low limit 2 = High limit
P2.3.4.8	Reference limit supervision value	0.0	100.0	%	0.0		351	0.0 = Min frequency 100.0 = Max frequency

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Table 65: Limit settings (Control keypad: Menu M2 -> G2.3.4)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.4.9	External brake-off delay	0.0	100.0	s	0.5		352	From brake-off limits.
P2.3.4.10	External brake-on delay	0.0	100.0	s	1.5		353	From Run request. Use time longer than P2.1.4.
P2.3.4.11	Temperature limit supervision	0	2		0		354	0 = No supervision 1 = Low limit 2 = High limit
P2.3.4.12	Temperature supervised value	-10	100	°C	40		355	
P2.3.4.13	Analogue supervision signal	0	4		0		356	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4
P2.3.4.14	Analogue supervision low limit	0.00	100.00	%	10.00		357	DO Off limit. See P2.3.3.22.
P2.3.4.15	Analogue supervision high limit	0.00	100.00	%	90.00		358	DO Off limit. See P2.3.3.22.
NXP drives only								
P2.3.4.16	Brake On/Off Current Limit	0	2 x I_H	A	0		1085	Brake is closed and kept closed if current is below this value.

Table 66: Analogue output 1 (Control keypad: Menu M2 -> G2.3.5)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.5.1 *	Analogue output 1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.5.2	Analogue output 1 function	0	15		1		307	0 = Not used (20 mA / 10 V) 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 link 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 analogue output ProcessData4 (NXS)
P2.3.5.3	Analogue output 1 filter time	0.00	100.00	s	1.00		308	0 = No filtering
P2.3.5.4	Analogue output 1 inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.5.5	Analogue output 1 minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)

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Table 66: Analogue output 1 (Control keypad: Menu M2 -> G2.3.5)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.5.6	Analogue output 1 scale	10	1000	%	100		311	
P2.3.5.7	Analogue output 1 offset	-100.00	100.00	%	0.00		375	

* = Use TTF method to program these parameters.

Table 67: Analogue output 2 (Control keypad: Menu M2 -> G2.3.6)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.6.1 *	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.6.2	Analogue output 2 function	0	15		4		472	See P2.3.5.2
P2.3.6.3	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering
P2.3.6.4	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.6.5	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.6.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.6.7	Analogue output 2 offset	-100.00	100.00	%	0.00		477	

* = Use TTF method to program these parameters.

Table 68: Analogue output 3 (Control keypad: Menu M2 -> G2.3.7)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.7.1 *	Analogue output 3 signal selection	0.1	E.10		0.1		478	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle* .
P2.3.7.2	Analogue output 3 function	0	15		5		479	See P2.3.5.2
P2.3.7.3	Analogue output 3 filter time	0.00	10.00	s	1.00		480	0 = No filtering
P2.3.7.4	Analogue output 3 inversion	0	1		0		481	0 = Not inverted 1 = Inverted
P2.3.7.5	Analogue output 3 minimum	0	1		0		482	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.7.6	Analogue output 3 scale	10	1000	%	100		483	
P2.3.7.7	Analogue output 3 offset	-100.00	100.00	%	0.00		484	

* = Use TTF method to program these parameters.

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6.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 69: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	0 = Linear 100 = Full acc/dec inc/dec times
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	0 = Linear 100 = Full acc/dec inc/dec times
P2.4.3	Acceleration time 2	0.1	3000.0	s	10.0		502	Defines the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.4.4	Deceleration time 2	0.1	3000.0	s	10.0		503	Defines the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.4.5 *	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start

Table 69: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	I_L	A	0.7 x I_H		507	Defines the current injected into the motor during DC braking.
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	The output frequency at which the DCbraking is applied.
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	Gives the current level for the flux braking.
NXP drives only								
P2.4.14	DC-brake current at stop	0	I_L	A	0.1 x I_H		1080	
P2.4.15	Inching reference 1	-320.00	320.00	Hz	2.00		1239	
P2.4.16	Inching reference 2	-320.00	320.00	Hz	653.36		1240	
P2.4.17	Inching ramp	0.1	3200.0	s	1.0		1257	
P2.4.18	Emergency stop mode	0	1		0		1276	0 = Coasting 1 = Ramp
P2.4.19	Control options	0	65536		0		1084	Change allowed only in Stop state.

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Table 69: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.20	Modulator type	0	1		0		1516	Parameter for changing the modulator type.
P2.4.21	Ramp; Skip S2	0	1		0		1900	This function is used to bypass the second corner S ramp (i.e. to avoid the unnecessary speed increase, the blue line in *Fig. 90 Ramp; Skip S2*) when the reference is changed before the final speed is reached. Also S4 is bypassed when reference is increased while speed is ramping down.

* = Parameter value can only be changed aftr the FC has been stopped.

6.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 70: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	-1.00	320.00	Hz	0.00		509	0 = Not used
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	0 = Not used
P2.5.3	Prohibit frequency range 2 low limit	0.00	320.00	Hz	0.00		511	0 = Not used
P2.5.4	Prohibit frequency range 2 high limit	0.00	320.00	Hz	0.00		512	0 = Not used
P2.5.5	Prohibit frequency range 3 low limit	0.00	320.00	Hz	0.00		513	0 = Not used
P2.5.6	Prohibit frequency range 3 high limit	0.00	320.00	Hz	0.00		514	0 = Not used
P2.5.7	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

6.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 71: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1	Motor control mode	0	2/4		0		600	0 = Frequency control 1 = Speed control 2 = Torque control **NXP:** 3 = Closed loop speed ctrl 4 = Closed loop torque ctrl
P2.6.2	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim.
P2.6.4	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5	Voltage at field weakening point	10.00	200.00	%	100.00		603	The voltage at the field weakening point as a percentage of the motor nominal voltage.
P2.6.6	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.

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Table 71: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.7	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.8	Output voltage at zero frequency	0.00	40.00	%	Varies		606	This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.
P2.6.9	Switching frequency	1	Varies	kHz	Varies		601	If you increase the switching frequency, the capacity of the AC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	2		1		608	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.12	Motor control mode 2	0	4		2		521	See P2.6.1
P2.6.13	Speed controller P gain (open loop)	0	32767		3000		637	
P2.6.14	Speed controller I gain (open loop)	0	32767		300		638	

Table 71: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.15	Load drooping	0.00	100.00	%	0.00		620	The drooping function enables speed drop as a function of load. Drooping will be defined in percent of nominal speed at nominal load.
P2.6.16	Identification	0	1/4		0		631	0 = No action 1 = Identification w/o run **NXP:** 2 = Identification with run 3 = Encoder ID Run (PMSM) 4 = Ident All
NXP drives only								
P2.6.17	Restart delay	0.100	60000	s	Varies		1424	OL delay for coasting stop.
P2.6.18	Load drooping time	0	32000	ms	0		656	For dynamic changes.
P2.6.19	Negative frequency limit	-327.67	P2.6.20	Hz	-327.67		1286	Alternative limit for negative direction.
P2.6.20	Positive frequency limit	P2.6.19	327.67	Hz	327.67		1285	Alternative limit for positive direction.
P2.6.21	Generator torque limit	0.0	300.0	%	300.0		1288	The maximum torque limit of the generating side.
P2.6.22	Motoring torque limit	0.0	300.0	%	300.0		1287	The maximum torque limit of the motoring side.

* = Parameter value can only be changed after the AC drive has been stopped.

NOTE!

Depending on the application version, the parameter code may appear as 2.6.17.xx instead of 2.6.23.xx

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Table 72: NXS drives: Closed Loop parameters (Control keypad: Menu M2 ->G2.6.23)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.17.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	If zero internally calculated.
P2.6.17.2	Speed control P	1	1000		30		613	
P2.6.17.3	Speed control I time	-3200.0	3200.0	ms	100.0		614	Negative value uses 1 ms accuracy instead of 0.1 ms.
P2.6.17.5	Acceleration compensation	0.00	300.00	s	0.00		626	
P2.6.17.6	Slip adjust	0	500	%	75		619	
P2.6.17.7	Magnetizing current at start	0.00	I_L	A	0.00		627	
P2.6.17.8	Magnetizing time at start	0	32000	ms	0		628	
P2.6.17.9	0-speed time at start	0	32000	ms	100		615	
P2.6.17.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.17.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.17.12	Start-up torque FWD	-300.0	300.0	s	0.0		633	
P2.6.17.13	Start-up torque REV	-300.0	300.0	s	0.0		634	
P2.6.17.15	Encoder filter time	0.0	100.0	ms	0.0		618	

Table 72: NXS drives: Closed Loop parameters (Control keypad: Menu M2 ->G2.6.23)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.17.17	Current control P gain	0.00	100.00	%	40.00		617	Gain for the current controller. This controller is active only in closed loop and advanced open loop. It generates the voltage vector reference to the modulator.

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Table 73: NXP drives: Closed Loop parameters (Control keypad: Menu M2 ->G2.6.23)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.23.1	Magnetizing current	0.00	2 x I_H	A	0.00		612	If zero internally calculated.
P2.6.23.2	Speed control P	1	1000		30		613	
P2.6.23.3	Speed control I time	-32000	3200.0	ms	100.0		614	Negative value uses 1 ms accuracy instead of 0.1 ms.
P2.6.23.5	Acceleration compensation	0.00	300.00	s	0.00		626	
P2.6.23.6	Slip adjust	0	500	%	75		619	
P2.6.23.7	Magnetizing current at start	0	I_L	A	0.00		627	
P2.6.23.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.23.9	0-speed time at start	0	32000	ms	100		615	
P2.6.23.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.23.11	Start-up torque	0	3		0		621	0 = Not used 1 = Torque memory 2 = Torque reference 3 = Start-up torque fwd/rev
P2.6.23.12	Start-up torque FWD	-300.0	300.0	s	0.0		633	
P2.6.23.13	Start-up torque REV	-300.0	300.0	s	0.0		634	
P2.6.23.15	Encoder filter time	0.0	100.0	ms	0.0		618	

Table 73: NXP drives: Closed Loop parameters (Control keypad: Menu M2 ->G2.6.23)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.23.17	Current control P gain	0.00	320.00	%	40.00		617	Gain for the current controller. This controller is active only in closed loop and advanced open loop. It generates the voltage vector reference to the modulator.
P2.6.23.18	CurrentControl-Time	0.0	3200.0	ms	1.5		657	Current controller integrator time constant (0-1000) = 0-100.0 ms.
P2.6.23.19	Generator power limit	0.0	300.0	%	300.0		1290	The maximum power limit of the generating side.
P2.6.23.20	Motoring power limit	0.0	300.0	%	300.0		1289	The maximum power limit of the motoring side.
P2.6.23.21	Negative torque limit	0.0	300.0	%	300.0		645	
P2.6.23.22	Positive torque limit	0.0	300.0	%	300.0		646	
P2.6.23.23	Flux off delay	-1	32000	s	0		1402	-1 = Always
P2.6.23.24	Stop state flux	0.0	150.00	%	100.00		1401	
P2.6.23.25	SPC f1 point	0.00	320.00	Hz	0.00		1301	
P2.6.23.26	SPC f0 point	0.00	320.0	Hz	0.00		1300	
P2.6.23.27	SPC Kp f0	0	1000	%	100		1299	
P2.6.23.28	SPC Kp FWP	0	1000	%	100		1298	
P2.6.23.29	SPC torque minimum	0.0	400.0	%	0.0		1296	
P2.6.23.30	SPC torque minimum Kp	0	1000	%	100		1295	
P2.6.23.31	SPC Kp TC torque	0	1000	ms	0		1297	
P2.6.23.32	Flux reference	0.0	500.0	%	100.0		1250	
P2.6.23.33	Speed error filter TC	0	1000	ms	0		1311	

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Table 73: NXP drives: Closed Loop parameters (Control keypad: Menu M2 ->G2.6.23)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.23.34	Modulation limit	0	150	%	100		655	If sinus filter is used set this value to 96%.

Table 74: NXP drives: PMS Motor control parameters (Control keypad: Menu M2 -> G2.6.24)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.24.1	Motor type	0	1		0		650	0 = Induction Motor 1 = PMS Motor
P2.6.24.2	PMSMShaft position	0	65535		0		649	Low word of encoder (endat) angle corresponding to the shaft 0 position.
P2.6.24.3	Start angle ID modified	0	10		0		1691	
P2.6.24.4	Start Angle ID current	0.0	150.0	%	0.0		1756	Shaft angle identification current level 1000 = 100.0% of motor nominal.
P2.6.24.5	Polarity pulse current	-1.0	200.0	%	-1.0		1566	Shaft angle identification polarity pulse current level 1000 = 100.0% of motor nominal (0 = defaults are used, negative value disables polarity pulses).
P2.6.24.6	I/f current	0.0	150.0	%	50.0		1693	Dc-current level during the start positioning, 0-100.0% of nominal, PMSM.
P2.6.24.7	I/f control limit	0.0	300.0	%	10.0		1790	Second corner frquency (mixed current/voltage mode frequency) (0-1000) = 0-100% of MotorNomFreq.
P2.6.24.8	FluxCurrent Kp	0	32000		500		651	
P2.6.24.9	FluxCurrent Time	0.0	100.0	ms	5.0		652	

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Table 75: NXS drives: Identification parameters (Control keypad: Menu M2 -> G2.6.25)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.18.1	Speed step	-50.0	50.0	%	0.0		1252	NCDrive speed tuning.
P2.6.18.2	Torque step	-100.0	300.0	%	0.0		1253	NCDrive torque tuning.

Table 76: NXP drives: Identification parameters (Control keypad: Menu M2 -> G2.6.25)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.25.1	Flux 10 %	0.0	250.0	%	10.0		1355	
P2.6.25.2	Flux 20 %	0.0	250.0	%	20.0		1356	
P2.6.25.3	Flux 30 %	0.0	250.0	%	30.0		1357	
P2.6.25.4	Flux 40 %	0.0	250.0	%	40.0		1358	
P2.6.25.5	Flux 50 %	0.0	250.0	%	50.0		1359	
P2.6.25.6	Flux 60 %	0.0	250.0	%	60.0		1360	
P2.6.25.7	Flux 70 %	0.0	250.0	%	70.0		1361	
P2.6.25.8	Flux 80 %	0.0	250.0	%	80.0		1362	
P2.6.25.9	Flux 90 %	0.0	250.0	%	90.0		1363	
P2.6.25.10	Flux 100 %	0.0	250.0	%	100.0		1364	
P2.6.25.11	Flux 110 %	0.0	250.0	%	110.0		1365	
P2.6.25.12	Flux 120 %	0.0	250.0	%	120.0		1366	
P2.6.25.13	Flux 130 %	0.0	250.0	%	130.0		1367	
P2.6.25.14	Flux 140 %	0.0	250.0	%	140.0		1368	
P2.6.25.15	Flux 150 %	0.0	250.0	%	150.0		1369	
P2.6.25.16	Rs voltage drop	0	30000		Varies		662	Used for torque calculation in Open Loop.
P2.6.25.17	Ir add zero point voltage	0	30000		Varies		664	
P2.6.25.18	Ir add generator scale	0	30000		Varies		665	
P2.6.25.19	Ir add motoring scale	0	30000		Varies		667	
P2.6.25.20	MotorBEM Voltage	0.00	320.00	%	90.0		674	Motor-induced back voltage 10000 = 100.00%.
P2.6.25.21	Ls voltage drop	0	3000		512		673	Leakage inductance voltage drop with nominalcurrent and frequency of motor. Unit: 256=10%.

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Table 76: NXP drives: Identification parameters (Control keypad: Menu M2 -> G2.6.25)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.25.22	Iu Offset	-32000	32000		10000		668	
P2.6.25.23	Iv Offset	-32000	32000		0		669	
P2.6.25.24	Iw Offset	-32000	32000		0		670	
P2.6.25.25	Speed step	-50.0	50.0	%	0.0		1252	NCDrive speed tuning.
P2.6.25.26	Torque step	-100.0	100.0	%	0.0		1253	NCDrive torque tuning.

Table 77: Stabilators

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.26.1	Torque stabilator gain	0	1000		100		1412	The gain of the torque stabilator in an open loop control operation.
P2.6.26.2	Torque stabilator damping	0	1000		900		1413	The damping time constant of the torque stabilator. For PMSM, use value 980.
P2.6.26.3	Torque stabilator gain FWP	0	1000		50		1414	The gain of the torque stabilator at field weakening point in an open loop control operation.
P2.6.26.4	Torque stabilator limit ratio	0	20.00	%	3.00		1720	Defines how much the torque stabiliser can affect the output frequency.
P2.6.26.5	Flux circle stabilator gain	0	32767		10000		1550	Gain for flux circle stabilizer.
P2.6.26.6	Flux stabilator TC	0	32700		900		1551	Filter coefficient of idcurrent stabilizer.
P2.6.26.7	Flux stabilator gain	0	32000		500		1797	Gain of flux stabilizer.
P2.6.26.8	Flux stabilator coefficient	-30000	32766		64		1796	Filter coefficient of flux stabilizer, 32767 equals 1 ms.
P2.6.26.9	Voltage stabilator gain	0	100.0	%	10.0		1738	Gain of voltage stabilizer.
P2.6.26.10	Voltage stabilator TC	0	1000		900		1552	Damping rate of voltage stabilizer.
P2.6.26.11	Voltage stabilator limit	0	32000	Hz	1.50		1553	Limit of torque stabilator output Limit[Hz]= Value/ FreqScale.

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6.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7

Table 78: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		0		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		3		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

Table 78: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		0		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	P2.1.2	A	1H		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.0	P2.1.2	Hz	25.0		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	Field weakening area load	10.0	150.0	%	50.0		714	
P2.7.19	Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

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Table 78: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.24	TBoard1 Numbers	0	5		0		739	0 = Not used 1 = Channel 1 2 = Channel 1 & 2 3 = Channel 1 & 2 & 3 4 = Channel 2 & 3 5 = Channel 3
P2.7.25	TBoard Flt. Resp	0	3		0		740	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.26	TBoard1 Warn.Lim	-30.0	200.0	°C	120.0		741	Set here the limit at which the temperature warning will be activated.
P2.7.27	TBoard1 Flt.Lim	-30.0	200.0	°C	130.0		742	Set here the limit at which the temperature fault (F65) will be activated.
NXP drives only								
P2.7.28	Brake fault action	1	3		1		1316	1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.29	Brake fault delay	0.00	320.00	s	0.20		1317	
P2.7.30	System bus fault	3	3		3		1082	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.31	System bus fault delay	0.00	10.00	s	3.00		1352	
P2.7.32	Cooling fault delay	0.00	7.00	s	2.00		751	

Table 78: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.33	Speed error mode	0	2		0		752	0 = No response 1 = Warning 2 = Fault, stop by coasting
P2.7.34	Speed error maximum difference	0	100	%	5		753	
P2.7.35	Speed error fault delay	0.00	100.0	s	0.50		754	
P2.7.36	Safe disable mode	0	2		1		755	1 = Warning, stop by coasting 2 = Fault, stop by coasting
NXP and NXS drives								
P2.7.37	TBoard2 Numbers	0	5		0		743	If you have a secondary temperature board installed in your AC drive you can choose here the number of sensors in use. See also the Vacon I/O boards manual. 0 = Not used 1 = Channel 1 2 = Channel 1 & 2 3 = Channel 1 & 2 & 3 4 = Channel 2 & 3 5 = Channel 3 **NOTE!** If the selected value is greater than the actual number of used sensors, the display will read 200ºC. If the input is short-circuited the displayed value is –30ºC.

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Table 78: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.38	TBoard2 Warn.Lim	-30.0	200.0	C°	120		745	Set here the limit at which the temperature warning will be activated.
P2.7.39	TBoard2 Flt.Lim	-30.0	200.0	C°	130		746	Set here the limit at which the temperature fault (F65) will be activate.

6.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 79: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

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6.4.10 FIELDBUS PARAMETERS (CONTROL KEYPAD: MENU M2 ->G2.9)

Table 80: Fieldbus parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.1	Fieldbus min scale	0.00	320.00	Hz	0.00		850	
P2.9.2	Fieldbus max scale	0.00	320.00	Hz	0.00		851	
P2.9.3	Fieldbus process data out 1 selection	0	10000		1		852	The data that is sent to fieldbus with the ID of the parameter or monitor. The data is scaled to an unsigned 16-bit format according to the format on the control panel. For example, 25.5 on the display agrees with 255.
P2.9.4	Fieldbus process data out 2 selection	0	10000		2		853	Make the selection of the Process Data Out with the parameter ID.
P2.9.5	Fieldbus process data out 3 selection	0	10000		45		854	Make the selection of the Process Data Out with the parameter ID.
P2.9.6	Fieldbus process data out 4 selection	0	10000		4		855	Make the selection of the Process Data Out with the parameter ID.
P2.9.7	Fieldbus process data out 5 selection	0	10000		5		856	Make the selection of the Process Data Out with the parameter ID.
P2.9.8	Fieldbus process data out 6 selection	0	10000		6		857	Make the selection of the Process Data Out with the parameter ID.
P2.9.9	Fieldbus process data out 7 selection	0	10000		7		858	Make the selection of the Process Data Out with the parameter ID.

Table 80: Fieldbus parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.10	Fieldbus process data out 8 selection	0	10000		37		859	Make the selection of the Process Data Out with the parameter ID.
NXP drives only (In NXS, default values are not editable)								
P2.9.11	Fieldbus process data in 1 selection	0	10000		1140		876	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID Def: FB Torque Reference.
P2.9.12	Fieldbus process data in 2 selection	0	10000		46		877	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID Def: FB Limit Scaling.
P2.9.13	Fieldbus process data in 3 selection	0	10000		47		878	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID Def: FB Adjust Reference.
P2.9.14	Fieldbus process data in 4 selection	0	10000		48		879	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID Def: FB Analogue Output.
P2.9.15	Fieldbus process data in 5 selection	0	10000		0		880	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID.

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Table 80: Fieldbus parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.16	Fieldbus process data in 6 selection	0	10000		0		881	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID.
P2.9.17	Fieldbus process data in 7 selection	0	10000		0		882	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID.
P2.9.18	Fieldbus process data in 8 selection	0	10000		0		883	The raw value of process data in a 32-bit signed format. Choose controlled data with parameter ID.

6.4.11 TORQUE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.10)

Table 81: Torque control parameters, G2.10

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.10.1	Torque limit	0.0	300.0	%	300.0		609	Combination of ID1288 & ID1287, lower is used.
P2.10.2	Torque limit control P-gain	0	32000		3000		610	Used only in Open Loop control mode.
P2.10.3	Torque limit control I-gain	0	32000		200		611	
P2.10.4	Torque reference selection	0	8		0		641	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = AI1 joystick (-10 ...10 V) 6 = AI2 joystick (-10 ...10V) 7 = Torque reference from keypad, R3.5 8 = Fieldbus torque ref.
P2.10.5	Torque reference max.	-300.0	300.0	%	100		642	The torque reference that agrees to the maximum value of the reference signal. This value is used as the maximum torque reference for negative and positive values.
P2.10.6	Torque reference min.	-300.0	300.0	%	0.0		643	The torque reference that agrees to the minimum value of the reference signal.
P2.10.7	Torque speed limit (OL)	0	3		1		644	0 = Max. frequency 1 = Selected frequency ref. 2 = Preset speed 7

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Table 81: Torque control parameters, G2.10

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.10.8	Minimum frequency for open loop torque control	0.00	P2.1.2	Hz	3.00		636	The output frequency limit below which the drive operates in the frequency control mode.
P2.10.9	Torque controller P gain	0	32000		150		639	Gives the P gain for the torque controller in the open loop control mode. The P Gain value 1.0 causes a 1 Hz change in the output frequency when the torque error is 1% of the motor nominal torque.
P2.10.10	Torque controller I gain	0	32000		10		640	Gives the I gain for the torque controller in the open loop control mode. The I Gain value 1.0 causes the integration to reach 1.0 Hz in 1 second when the torque error is 1% of the motor nominal torque.
NXP drives only								
P2.10.11	Torque speed limit (CL)	0	7		2		1278	0 = CL speed control 1 = Pos/neg freq limits 2 = RampOut (-/+) 3 = NegFreqLimit-RampOut 4 = RampOut-PosFreqLimit 5 = RampOut Window 6 = 0-RampOut 7 = RampOut Window On/Off
P2.10.12	Torque reference filtering time	0	32000	ms	0		1244	
P2.10.13	Window negative	0.00	50.00	Hz	2.00		1305	

Table 81: Torque control parameters, G2.10

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.10.14	Window positive	0.00	50.00	Hz	2.00		1304	
P2.10.15	Window negative off	0.00	P2.10.13	Hz	0.00		1307	
P2.10.16	Window positive off	0.00	P2.10.14	Hz	0.00		1306	
P2.10.17	Speed control output limit	0.0	300.0	%	300.0		1382	

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6.4.12 NXP DRIVES: MASTER FOLLOWER PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.11)

Table 82: Master Follower parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.11.1	Master Follower mode	0	2		0		1324	0 = Single drive 1 = Master drive 2 = Follower drive
P2.11.2	Follower stop function	0	2		2		1089	0 = Coasting 1 = Ramping 2 = As Master
P2.11.3	Follower speed reference select	0	18		18		1081	0 = AI1 1 = AI2 2 = AI1+AI2 3 = AI1-AI2 4 = AI2-AI1 5 = AI1xAI2 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 1 (C. 1) 16 = Encoder 2 (C. 3) 17 = Master Reference 18 = Master Ramp Out

Table 82: Master Follower parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.11.4	Follower torque reference select	0	9		9		1083	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = AI1 joystick 6 = AI2 joystick 7 = Torque reference from keypad, R3.5 8 = FB Torque Reference 9 = Master torque
P2.11.5	Speed share	-300.00	300.00	%	100.0		1241	Active also in Single mode
P2.11.6	Load share	0.0	500.0	%	100.0		1248	Active also in Single mode
P2.11.7	Master Follower mode 2	0	2		0		1093	Activated by P2.2.7.31 0 = Single drive 1 = Master drive 2 = Follower drive
P2.11.8	Follower fault	0	2		0		1536	0 = Single drive 1 = Master drive 2 = Follower drive

6.4.13 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

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Table 83: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	0	3		1		125	0 = PC Control 1 = I/0 terminal 2 = Keypad 3 = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	0 = Forward 1 = Reverse
P3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled
R3.5	Torque reference	-300.0	300.0	%	0.0			

6.4.14 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

6.4.15 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

7 PUMP AND FAN CONTROL APPLICATION

7.1 INTRODUCTION

Select the Pump and Fan Control Application in menu M6 on page S6.2.

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 AC drive 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 AC drive. 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 Chapter *8.11 Automatic changing between drives (application 7 only)*.

- All inputs and outputs are freely programmable.

Additional functions:

- Analogue 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 prohibit 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 Pump and Fan Control Application are explained in Chapter *8 Parameter descriptions* of this manual. The explanations are arranged according to the individual ID number of the parameter.

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7.2 CONTROL I/O

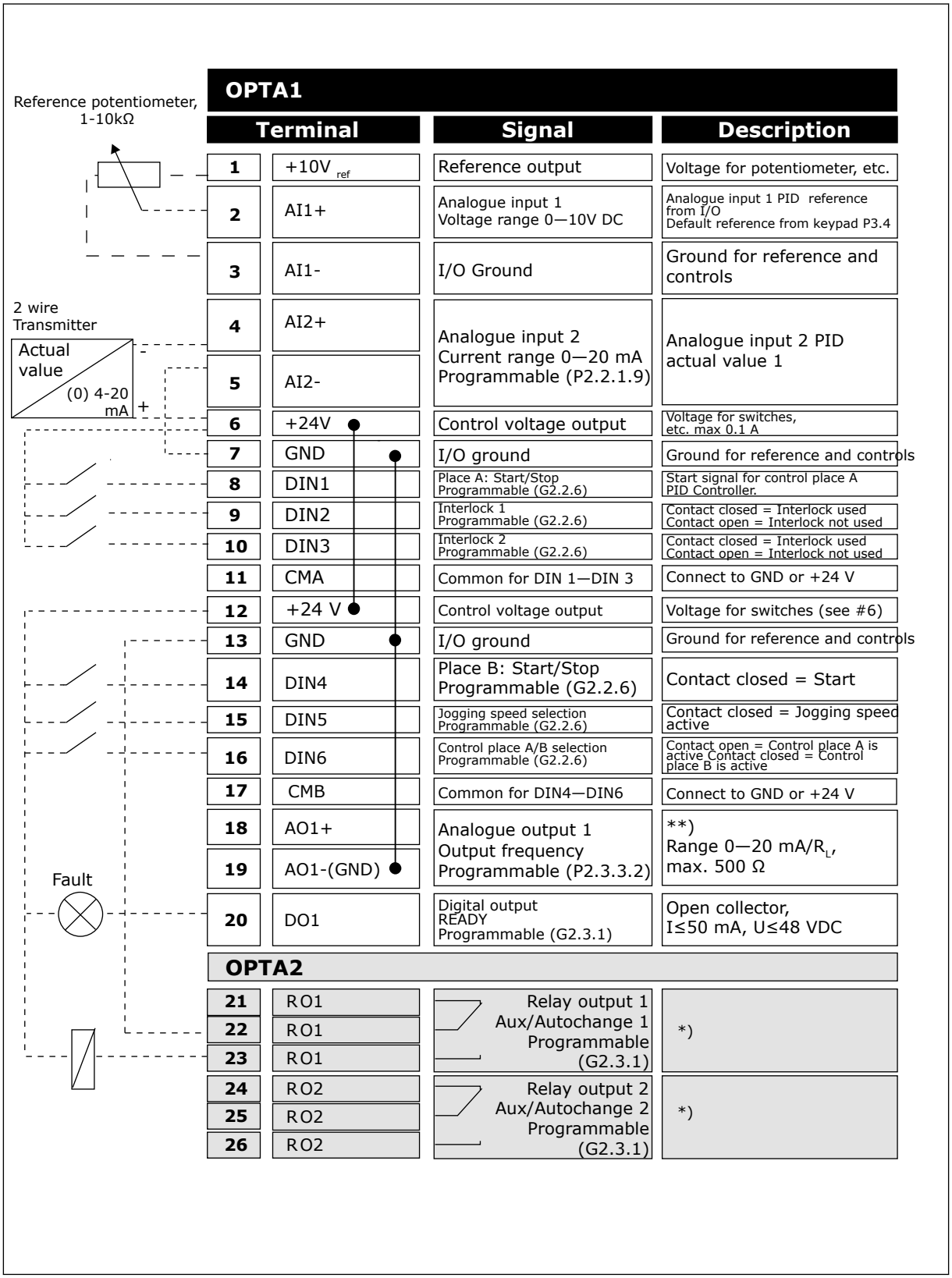

Fig. 19: Pump and fan control application default I/O configuration and connection example (with 2-wire transmitter)

*) See *Table 92 Digital output signals (Control keypad: Menu M2 -> G2.3.1)*.

**) See *Table 94 Analogue output 1 (Control keypad: Menu M2 -> G2.3.3)*, *Table 95 Analogue output 2 (Control keypad: Menu M2 -> G2.3.4)* and *Table 96 Analogue output 3 (Control keypad: Menu M2 -> G2.3.7)*.

NOTE!

See jumper selections below. More information in the product's User Manual.

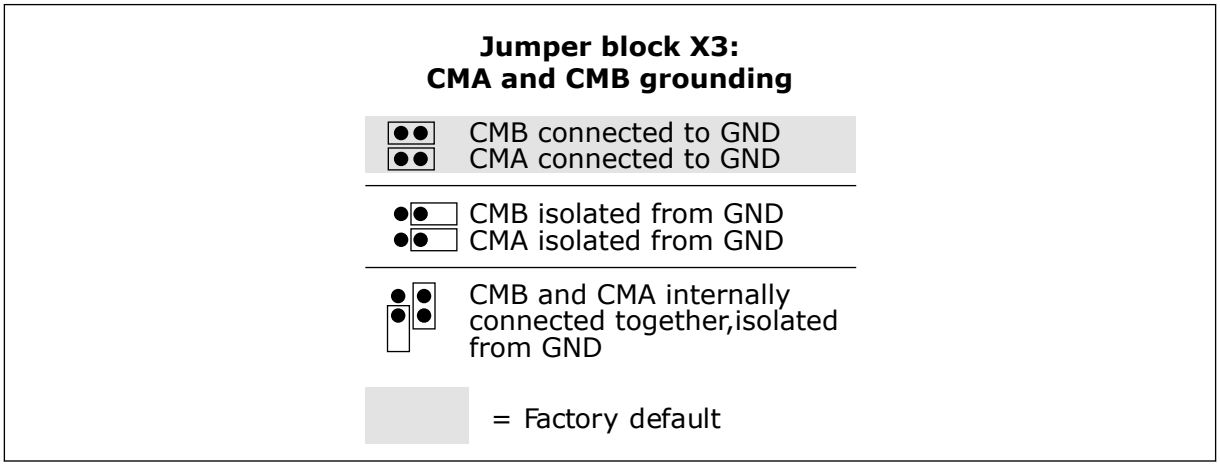

Fig. 20: Jumper selections

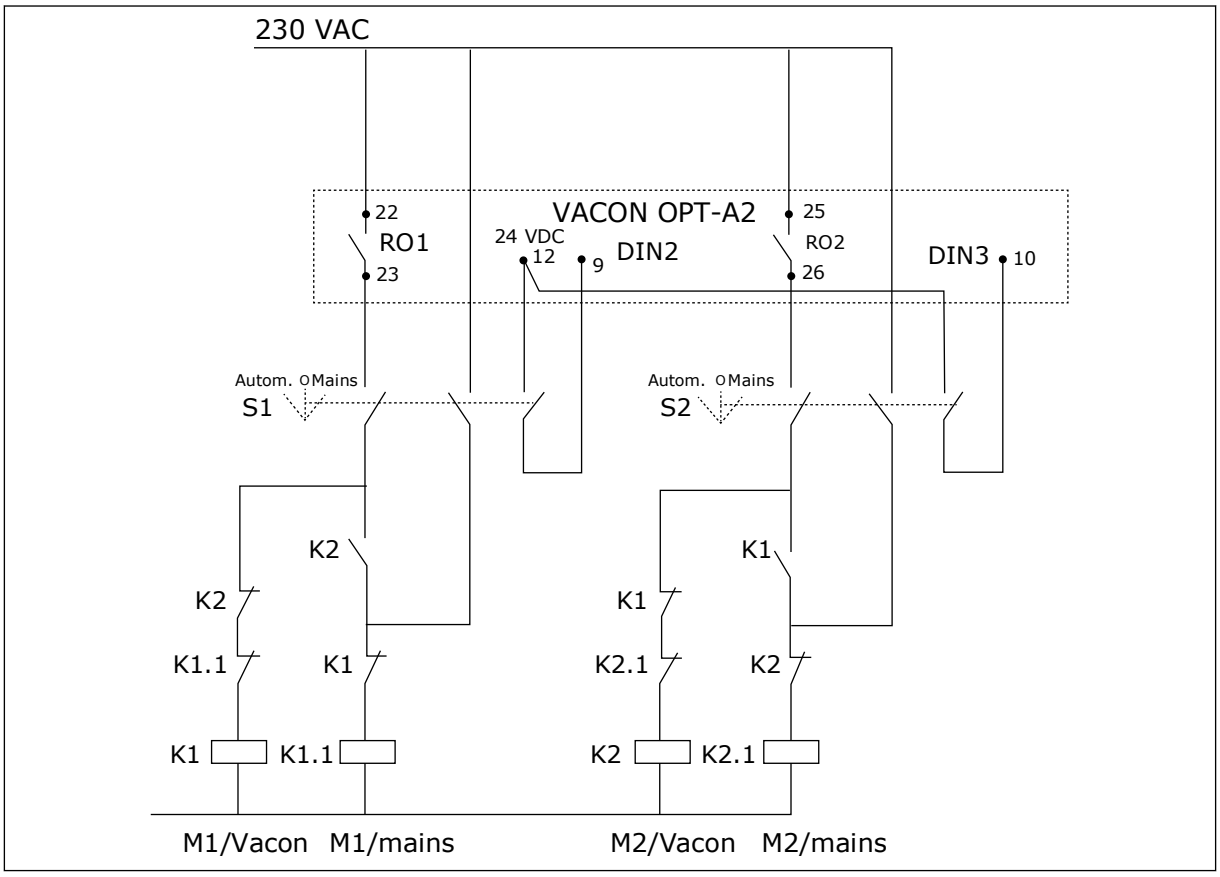

Fig. 21: Pump autochange system, principal control diagram

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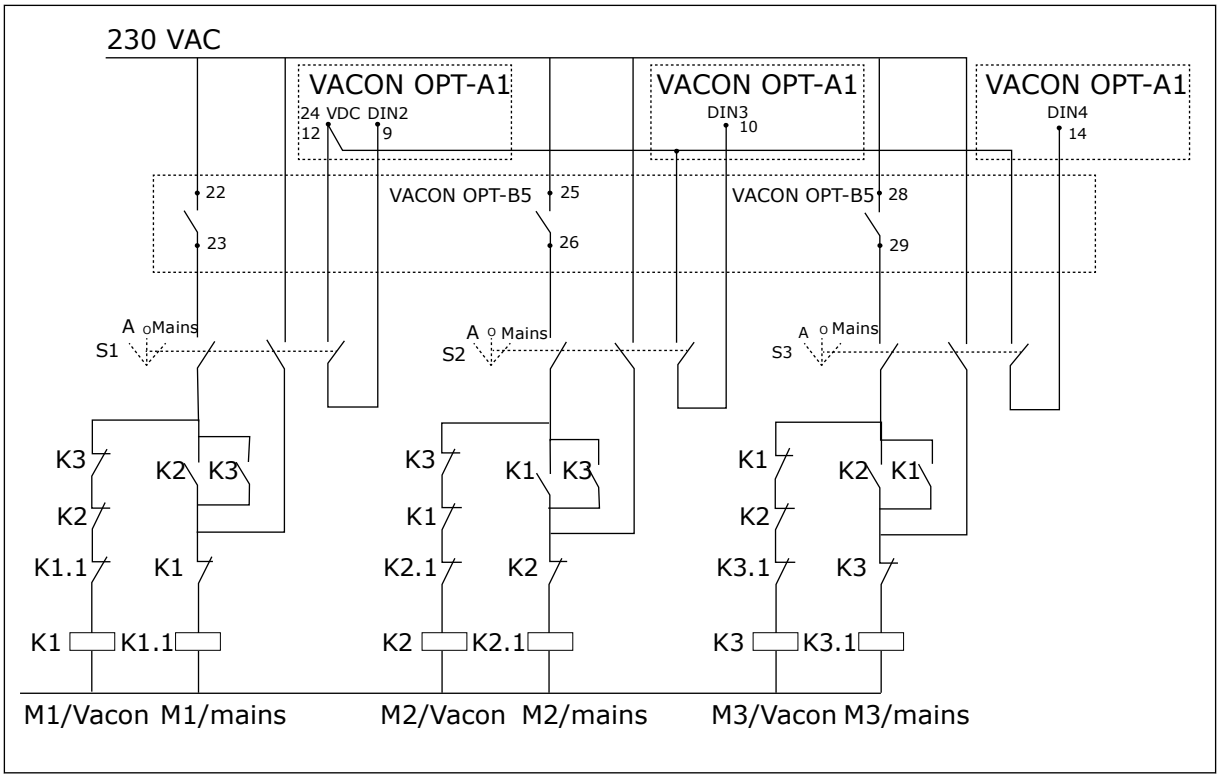

Fig. 22: Pump autochange system, principal control diagram

7.3 CONTROL SIGNAL LOGIC IN PUMP AND FAN CONTROL APPLICATION

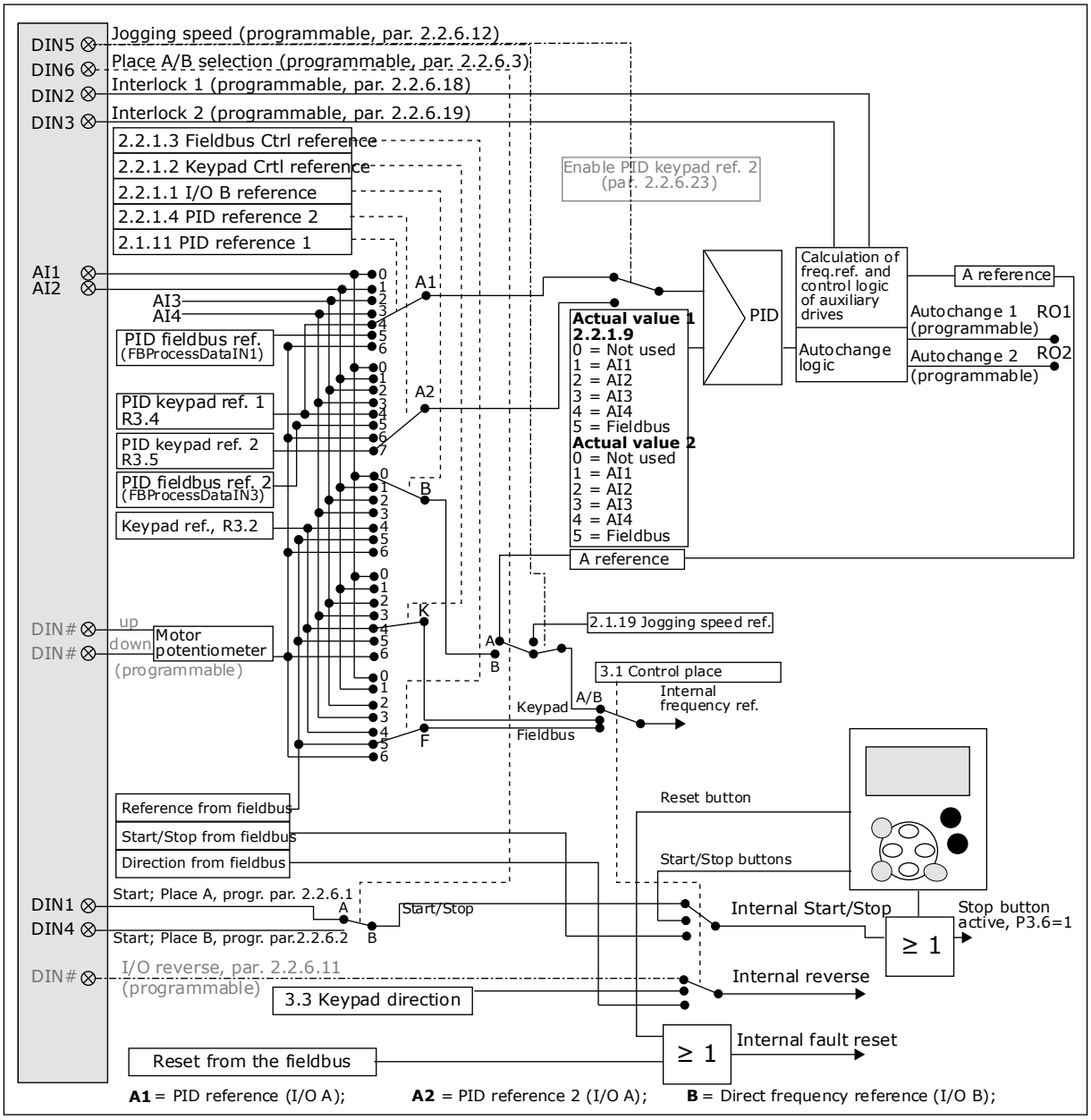

Fig. 23: Control signal logic of the Pump and Fan Control Application

7.4 PUMP AND FAN CONTROL APPLICATION - PARAMETER LISTS

7.4.1 MONITORING VALUES (CONTROL KEYPAD: MENU M1)

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

NOTE!

The monitoring values V1.18 to V1.23 are available in the PFC control application only.

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Table 84: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
1.9	Unit temperature	°C	8	The heatsink temperature in Celsius or Fahrenheit
1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal working temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	Analogue I_{out}	mA	26	AO1
V1.16	Analogue input 3	V/mA	27	AI3 input value
V1.17	Analogue input 4	V/mA	28	AI4 input value
V1.18	PID Reference	%	20	In % of the max. frequency
V1.19	PID Actual value	%	21	In % of the max actual value
V1.20	PID Error value	%	22	In % of the max error value
V1.21	PID Output	%	23	In % of the max output value
V1.22	Running auxiliary drives		30	Number of running auxiliary drives
V1.23	Special display for actual value		29	See parameters 2.9.29 to 2.9.31
V1.24	PT-100 temperature	ºC	42	Highest temperature of used PT100 inputs
G1.25	Multimonitoring items			Displays three selectable monitoring values

Table 84: Monitoring values

Index	Monitoring value	Unit	ID	Description
V1.26.1	Current	A	1113	Filtered Motor current
V1.26.2	Torque	%	1125	Unfiltered motor torque
V1.26.3	DC-link Voltage	V	7	Dc voltage in Volts
V1.26.4	Status Word		43	
V1.26.5	Fault History		37	
V1.26.6	Motor Current	A	45	

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7.4.2 BASIC PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.1)

Table 85: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.1	Min frequency	0.00	P2.1.2	Hz	0.00		101	
P2.1.2	Max frequency	P2.1.1	320.00	Hz	50.00		102	If fmax > than the motor synchronous speed, check suitability for motor and drive system.
P2.1.3	Acceleration time 1	0.1	3000.0	s	1.0		103	Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.
P2.1.4	Decelaration time 1	0.1	3000.0	s	1.0		104	Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.
P2.1.5	Current limit	0.1 x I_H	2 x I_H	A	I_L		107	
P2.1.6 *	Nominal voltage of the motor	180	690	V	**NX2:** 230V **NX5:** 400V **NX6:** 690V		110	Find the value Un on the rating plate of the motor. Find out if the motor connection is Delta or Star.
P2.1.7 *	Nominal frequency of the motor	8.00	320.00	Hz	50.00		111	Find the value fn on the rating plate of the motor.
P2.1.8 *	Nominal speed of the motor	24	20 000	rpm	1440		112	Find the value nn on the rating plate of the motor.
P2.1.9 *	Nominal current of the motor	0.1 x I_H	2 X I_H	A	I_H		113	Find the value In on the rating plate of the motor.

Table 85: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.10 *	Motor cos phi	0.30	1.00		0.85		120	Find the value on the rating plate of the motor.
P2.1.11 *	PID controller reference signal (Place A)	0	6		4		332	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = PID ref from Keypad control page, P3.4 5 = PID ref. from fieldbus (FBProcessDataIN1) 6 = Motor potentiometer
P2.1.12	PID controller gain	0.0	1000.0	%	100.0		118	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%.
P2.1.13	PID controller I-time	0.00	320.00	s	1.00		119	If this parameter is set to 1.00 s, a change of 10% in the error value causes the controller output to change by 10.00%/s.
P2.1.14	PID controller D-time	0.00	10.00	s	0.00		132	If this parameter is set to 1.00 s, a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%.
P2.1.15	Sleep frequency	0	P2.1.2	Hz	10.00		1016	The drive goes to sleep mode when the output frequency stays below this limit for a longer time than set by Sleep Delay.

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Table 85: Basic parameters G2.1

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.1.16	Sleep delay	0	3600	s	30		1017	The minimum quantity of time during which the frequency has to stay below the sleep level before the drive stops.
P2.1.17	Wake up level	0.0	1000.0	%	25.0		1018	Gives the level for the PID feedback value wake-up supervision. Uses the set process units.
P2.1.18	Wake up function	0	3		0		1019	0 = Wake-up at fall below wake up level (P2.1.17) 1 = Wake-up at exceeded wake up level (P2.1.17) 2 = Wake-up at fall below wake up level (P3.4/3.5) 3 = Wake-up at exceeded wake up level (P3.4/3.5)
P2.1.19	Jogging speed reference	0.00	P2.1.2	Hz	10.00		124	

* = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

7.4.3 INPUT SIGNALS

Table 86: Basic Settings (Control keypad: Menu M2 -> G2.2.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1.1 *	I/O B frequency reference selection	0	7		0		343	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = Keypad reference 5 = Fieldbus reference (FB SpeedReference) 6 = Motor potentiometer 7 = PID controller
P2.2.1.2 *	Keypad control reference selection	0	7		4		121	As in P2.2.1.1
P2.2.1.3 *	Fieldbus control reference selection	0	7		5		122	As in P2.2.1.1
P2.2.1.4 *	PID Reference 2	0	7		7		371	0 = AI1 1 = AI2 2 = AI3 3 = AI4 4 = PID reference 1 from keypad 5 = Fieldbus reference (FBProcessDataIN3) 6 = Motor potentiometer 7 = PID reference 2 from keypad
P2.2.1.5	PID error value inversion	0	1		0		340	0 = No inversion 1 = Inversion
P2.2.1.6	PID reference rising time	0.1	100.0	s	5.0		341	Time for reference value to change from 0% to 100%
P2.2.1.7	PID reference falling time	0.1	100.0	s	5.0		342	Time for reference value to change from 100% to 0%

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Table 86: Basic Settings (Control keypad: Menu M2 -> G2.2.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1.8 *	PID 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 (Act2) See P2.2.1.9 and P2.2.1.10
P2.2.1.9 *	Actual value 1 selection	0	5		2		334	0 = Not used 1 = AI1 (control board) 2 = AI2 (control board) 3 = AI3 4 = AI4 5 = Fieldbus (FBProcessDataIN2)
P2.2.1.10 *	Actual value 2 input	0	5		0		335	0 = Not used 1 = AI1 (control board) 2 = AI2 (control board) 3 = AI3 4 = AI4 5 = Fieldbus (FBProcessDataIN3)
P2.2.1.11	Actual value 1 minimum scale	-1600.0	1600.0	%	0.0		336	0 = No minimum scaling
P2.2.1.12	Actual value 1 maximum scale	-1600.0	1600.0	%	100.0		337	100 = No maximum scaling
P2.2.1.13	Actual value 2 minimum scale	-1600.0	1600.0	%	0.0		338	0 = No minimum scaling
P2.2.1.14	Actual value 2 maximum scale	-1600.0	1600.0	%	100.0		339	100 = No maximum scaling

Table 86: Basic Settings (Control keypad: Menu M2 -> G2.2.1)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.1.15	Motor potentiometer ramp time	0.1	2000.0	Hz/s	10.0		331	
P2.2.1.16	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
P2.2.1.17	Motor potentiometer PID reference memory reset	0	2		0		370	0 = No reset 1 = Reset if stopped or powered down 2 = Reset if powered down
P2.2.1.18	B reference scale, minimum	0.00	320.00	Hz	0.00		344	0 = Scaling off >0 = Scaled min. value
P2.2.1.19	B reference scale, maximum	0.00	320.00	Hz	0.00		345	0 = Scaling off >0 = Scaled min. value

* = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

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Table 87: Analogue input 1 (Control keypad: Menu M2 -> G2.2.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.2.1 **	AI1 signal selection	0.1	E.10		A.1		377	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.2.2	AI1 filter time	0.00	10.00	s	0.10		324	0 = No filtering
P2.2.2.3	AI1 signal range	0	2		0		320	0 = 0-10 V (0-20 mA*) 1 = 2-10 V (4-20 mA*) 2 = Customised *
P2.2.2.4	AI1 custom minimum setting	-160.00	160.00	%	0.00		321	
P2.2.2.5	AI1 custom maximum setting	-160.00	160.00	%	100.00		322	
P2.2.2.6	AI1 signal inversion	0	1		0		323	0 = Not inverted 1 = Inverted

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

Table 88: Analogue input 2 (Control keypad: Menu M2 -> G2.2.3)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.3.1 **	AI2 signal selection	0.1	E.10		A.2		388	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.3.2	AI2 filter time	0.00	10.00	s	0.10		329	0 = No filtering
P2.2.3.3	AI2 signal range	0	2		1		325	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 2 = Customised *
P2.2.3.4	AI2 custom minimum setting	-160.00	160.00	%	0.00		326	
P2.2.3.5	AI2 custom maximum setting	-160.00	160.00	%	100.00		327	
P2.2.3.6	AI2 inversion	0	1		0		328	0 = Not inverted 1 = Inverted

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

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Table 89: Analogue input 3 (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.4.1 **	AI3 signal selection	0.1	E.10		0.1		141	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.4.2	AI3 filter time	0.00	10.00	s	0.10		142	0 = No filtering
P2.2.4.3	AI3 signal range	0	2		1		143	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 1 = Customised *
P2.2.4.4	AI3 custom minimum setting	-160.00	160.00	%	0.00		144	% of input signal range. e.g. 2 mA = 10 %
P2.2.4.5	AI3 custom maximum setting	-160.00	160.00	%	100.00		145	e.g. 18 mA = 90 %
P2.2.4.6	AI3 signal inversion	0	1		0		151	0 = Not inverted 1 = Inverted

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

Table 90: Analogue input 4 (Control keypad: Menu M2 -> G2.2.5)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.2.5.1 **	AI4 signal selection	0.1	E.10		0.1		152	TTF programming. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.2.5.2	AI4 filter time	0.00	10.00	s	0.00		153	0 = No filtering
P2.2.5.3	AI4 signal range	0	2		1		154	0 = 0-10 V (0-20mA*) 1 = 2-10 V (4-20 mA*) 2 = Customised *
P2.2.5.4	AI4 custom minimum setting	-160.00	160.00	%	0.00		155	% of input signal range. e.g. 2 mA = 10 %
P2.2.5.5	AI4 custom maximum setting	-160.00	160.00	%	100.00		156	e.g. 18 mA = 90 %
P2.2.5.6	AI4 signal inversion	0	1		0		162	0 = Not inverted 1 = Inverted

* = Remember to place jumpers of block X2 accordingly. See the product's User Manual.

** = Apply the Terminal to Function method (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*)

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Table 91: Digital inputs (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.2.6.1 *	Start A signal	0.1	A.1		423	
P2.2.6.2 *	Start B signal	0.1	A.4		424	
P2.2.6.3 *	Control place A/B selection	0.1	A.6		425	Control place A (oc) Control place B (cc)
P2.2.6.4 *	External fault (cc)	0.1	0.1		405	Ext. fault F51 displayed (cc)
P2.2.6.5 *	External fault (oc)	0.1	0.2		406	Ext. fault F51 displayed (oc)
P2.2.6.6 *	Run enable	0.1	0.2		407	Motor start enabled (cc)
P2.2.6.7 *	Acc/Dec time selection	0.1	0.1		408	Acc/Dec time 1 (oc) Acc/Dec time 2 (cc)
P2.2.6.8 *	Control from I/O terminal	0.1	0.1		409	Force control place to I/O terminal (cc)
P2.2.6.9 *	Control from key-pad	0.1	0.1		410	Force control place to keypad (cc)
P2.2.6.1 *	Control from fieldbus	0.1	0.1		411	Force control place to fieldbus (cc)
P2.2.6.11 *	Reverse	0.1	0.1		412	Direction forward (oc) Direction reverse (cc)
P2.2.6.12 *	Jogging speed	0.1	A.5		413	Jogging speed selected for frequency reference (cc)
P2.2.6.13 *	Fault reset	0.1	0.1		414	All faults reset (cc)
P2.2.6.14 *	Acc/Dec prohibit	0.1	0.1		415	Acc/Dec prohibited (cc)
P2.2.6.15 *	DC braking	0.1	0.1		416	DC braking active (cc)
P2.2.6.16 *	Motor potentiom-eter reference DOWN	0.1	0.1		417	Mot.pot. reference decreases (cc)
P2.2.6.17 *	Motor potentiom-eter reference UP	0.1	0.1		418	Mot.pot. reference increases (cc)
P2.2.6.18 *	Autochange 1 Interlock	0.1	A.2		426	Activated if cc

Table 91: Digital inputs (Control keypad: Menu M2 -> G2.2.4)

Index	Parameter	Min	Default	Cust	ID	Description
P2.2.6.19 *	Autochange 2 Interlock	0.1	A.3		427	Activated if cc
P2.2.6.20 *	Autochange 3 Interlock	0.1	0.1		428	Activated if cc
P2.2.6.21 *	Autochange 4 Interlock	0.1	0.1		429	Activated if cc
P2.2.6.22 *	Autochange 5 Interlock	0.1	0.1		430	Activated if cc
P2.2.6.23 *	PID reference 2	0.1	0.1		431	Selected with P2.1.11 (oc) Selected with P2.2.1.4 (cc)

cc = closing contact
oc = opening contact

* Apply the Terminal to Function method (TTF) to these parameters (see chapter *8.9 "Terminal to function" (TTF) programming principle*).

7.4.4 OUTPUT SIGNALS

Use TTF method to program for all Digital output signal parameters.

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Table 92: Digital output signals (Control keypad: Menu M2 -> G2.3.1)

Index	Parameter	Min	Default	Cust	ID	Description
P2.3.1.1	Ready	0.1	0.1		432	Ready to run
P2.3.1.2	Run	0.1	0.1		433	Running
P2.3.1.3	Fault	0.1	A.1		434	Drive in Fault state
P2.3.1.4	Inverted fault	0.1	0.1		435	Drive not in Fault state
P2.3.1.5	Warning	0.1	0.1		436	Warning active
P2.3.1.6	External fault	0.1	0.1		437	External fault active
P2.3.1.7	Reference fault/ warning	0.1	0.1		438	4 mA fault active
P2.3.1.8	Overtemperature warning	0.1	0.1		439	Drive overtemperature active
P2.3.1.9	Reverse	0.1	0.1		440	Output frequency < 0 Hz
P2.3.1.10	Unrequested direction	0.1	0.1		441	Ref <> Output frequency
P2.3.1.11	At speed	0.1	0.1		442	Ref = Output frequency
P2.3.1.12	Jogging speed	0.1	0.1		443	Jogging or preset speed command active
P2.3.1.13	External control place	0.1	0.1		444	IO control active
P2.3.1.14	External brake control	0.1	0.1		445	See ID445 in Chapter *8 Parameter descriptions*.
P2.3.1.15	External brake control, inverted	0.1	0.1		446	
P2.3.1.16	Output frequency limit 1 supervision	0.1	0.1		447	See ID315 in Chapter *8 Parameter descriptions*.
P2.3.1.17	Output frequency limit 2 supervision	0.1	0.1		448	See ID346 in Chapter *8 Parameter descriptions*.
P2.3.1.18	Reference limit supervision	0.1	0.1		449	See ID350 in Chapter *8 Parameter descriptions*.
P2.3.1.19	Drive temperature limit supervision	0.1	0.1		450	Drive temperature supervision. See ID354 in Chapter *8 Parameter descriptions*.
P2.3.1.20	Torque limit supervision	0.1	0.1		451	See ID348 in Chapter *8 Parameter descriptions*.
P2.3.1.21	Motor thermal protection	0.1	0.1		452	Thermistor fault or warning

Table 92: Digital output signals (Control keypad: Menu M2 -> G2.3.1)

Index	Parameter	Min	Default	Cust	ID	Description
P2.3.1.22	Analogue input supervision limit	0.1	0.1		463	
P2.3.1.23	Motor regulator activation	0.1	0.1		454	A limit controller is active
P2.3.1.24	Fieldbus DIN 1	0.1	0.1		455	
P2.3.1.25	Fieldbus DIN 2	0.1	0.1		456	
P2.3.1.26	Fieldbus DIN 3	0.1	0.1		457	
P2.3.1.27	Autochange 1/Aux 1 control	0.1	B.1		458	
P2.3.1.28	Autochange 2/Aux 2 control	0.1	B.2		459	
P2.3.1.29	Autochange 3/Aux 3 control	0.1	0.1		460	
P2.3.1.30	Autochange 4/Aux 4 control	0.1	0.1		461	
P2.3.1.31	Autochange 5	0.1	0.1		462	

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.

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Table 93: Limit settings (Control keypad: Menu M2 -> G2.3.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.2.1	Output frequency limit 1 supervision	0	2		0		315	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.2.2	Output frequency limit 1; Supervised value	0.00	320.00	Hz	0.00		316	
P2.3.2.3	Output frequency limit 2 supervision	0	2		0		346	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.2.4	Output frequency limit 2; Supervised value	0.00	320.00	Hz	0.00		347	
P2.3.2.5	Torque limit supervision	0	2		0		348	0 = Not used 1 = Low limit supervision 2 = High limit supervision
P2.3.2.6	Torque limit supervision value	-300.0	300.0	%	100.0		349	Absolute values are used for brake control.
P2.3.2.7	Reference limit supervision	0	2		0		350	0 = Not used 1 = Low limit 2 = High limit
P2.3.2.8	Reference limit supervision value	0.0	100.0	%	0.0		351	
P2.3.2.9	External brake-off delay	0.0	100.0	s	0.5		352	From brake-off limits
P2.3.2.10	External brake-on delay	0.0	100.0	s	1.5		353	From Run request. Use time longer than P2.1.4.
P2.3.2.11	FC temperature supervision	0	2		0		354	0 = Not used 1 = Low limit 2 = High limit

Table 93: Limit settings (Control keypad: Menu M2 -> G2.3.2)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.2.12	FC temperature supervised value	-10	100	°C	40		355	
P2.3.2.13	Supervised analogue input	0	1		0		372	0 = AI1 1 = AI2
P2.3.2.14	Analogue input limit supervision	0	2		0		373	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P2.3.2.15	Analogue input supervised value	0.00	100.00	%	0.00		374	

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Table 94: Analogue output 1 (Control keypad: Menu M2 -> G2.3.3)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.3.1 *	Analogue output 1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.3.2	Analogue output function	0	14		1		307	0 = Not used (20 mA / 10 V) 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 link volt (0-1000V) 9 = PID controller ref. value 10 = PID contr. act.value 1 11 = PID contr. act.value 2 12 = PID contr. error value 13 = PID controller output 14 = PT100 temperature
P2.3.3.3	Analogue output filter time	0.00	10.00	s	1.00		308	0 = No filtering
P2.3.3.4	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.3.5	Analogue output minimum	0	1		0		310	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.3.6	Analogue output scale	10	1000	%	100		311	

Table 94: Analogue output 1 (Control keypad: Menu M2 -> G2.3.3)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.3.7	Analogue output offset	-100.00	100.00	%	0.00		375	

* = Use TTF method to program these parameters.

Table 95: Analogue output 2 (Control keypad: Menu M2 -> G2.3.4)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.6.1 *	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.6.2	Analogue output 2 function	0	14		0		472	See P2.3.3.2
P2.3.6.3	Analogue output 2 filter time	0.00	10.00	s	1.00		473	0 = No filtering
P2.3.6.4	Analogue output 2 inversion	0	1		0		474	0 = Not inverted 1 = Inverted
P2.3.6.5	Analogue output 2 minimum	0	1		0		475	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.6.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.6.7	Analogue output 2 offset	-100.00	100.00	%	0.00		477	

* = Use TTF method to program these parameters.

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Table 96: Analogue output 3 (Control keypad: Menu M2 -> G2.3.7)

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.3.5.1 *	Analogue output 3 signal selection	0.1	E.10		0.1		478	TTF programming method used. See Chapter *8.9 "Terminal to function" (TTF) programming principle*.
P2.3.5.2	Analogue output 3 function	0	4		4		479	See P2.3.5.2
P2.3.5.3	Analogue output 3 filter time	0.00	10.00	s	1.00		480	0 = No filtering
P2.3.5.4	Analogue output 3 inversion	0	1		0		481	0 = Not inverted 1 = Inverted
P2.3.5.5	Analogue output 2 minimum	0	1		0		482	0 = 0 mA (0 V) 1 = 4 mA (2 V)
P2.3.5.6	Analogue output 3 scale	10	1000	%	100		483	
P2.3.5.7	Analogue output 3 offset	-100.00	100.00	%	0.00		484	

* = Use TTF method to program these parameters.

7.4.5 DRIVE CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.4

Table 97: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.1	Ramp 1 shape	0.0	10.0	s	0.1		500	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.2	Ramp 2 shape	0.0	10.0	s	0.0		501	Smooth ratio for S-curves. 0 = Linear 100 = full acc/dec inc/dec tmes
P2.4.3	Acceleration time 2	0.1	3000.0	s	1.0		502	
P2.4.4	Deceleration time 2	0.1	3000.0	s	1.0		503	
P2.4.5	Brake chopper	0	4		0		504	0 = Disabled 1 = Used when running 2 = External brake chopper 3 = Used when stopped/running 4 = used when running (no testing)
P2.4.6	Start function	0	2		0		505	0 = Ramp 1 = Flying start 2 = Conditional flying start
P2.4.7	Stop function	0	3		0		506	0 = Coasting 1 = Ramp 2 = Ramp+Run enable coast 3 = Coast+Run enable ramp
P2.4.8	DC braking current	0.00	I_L	A	0.7 x I_H		507	

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Table 97: Drive control parameters, G2.4

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.4.9	DC braking time at stop	0.00	600.00	s	0.00		508	0 = DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0.10	10.00	Hz	1.50		515	
P2.4.11	DC braking time at start	0.00	600.00	s	0.00		516	0 = DC brake is off at start
P2.4.12 *	Flux brake	0	1		0		520	0 = Off 0 = On
P2.4.13	Flux braking current	0.00	I_L	A	I_H		519	

7.4.6 PROHIBIT FREQUENCY PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.5)

Table 98: Prohibit frequency parameters, G2.5

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.5.1	Prohibit frequency range 1 low limit	-1.00	320.00	Hz	0.00		509	0 = Not used
P2.5.2	Prohibit frequency range 1 high limit	0.00	320.00	Hz	0.00		510	0 = Not used
P2.5.3	Prohibit frequency range 2 low limit	0.00	320.00	Hz	0.00		511	0 = Not used
P2.5.4	Prohibit frequency range 2 high limit	0.00	320.00	Hz	0.00		512	0 = Not used
P2.5.5	Prohibit frequency range 3 low limit	0.00	320.00	Hz	0.00		513	0 = Not used
P2.5.6	Prohibit frequency range 3 high limit	0.00	320.00	Hz	0.00		514	0 = Not used
P2.5.7	Prohibit acc./dec. ramp	0.1	10.0	x	1.0		518	

7.4.7 MOTOR CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.6)

Table 99: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.1 *	Motor control mode	0	1		0		600	0 = Frequency control 1 = Speed control
P2.6.2 *	U/f optimisation	0	1		0		109	0 = Not used 1 = Automatic torque boost
P2.6.3 *	U/f ratio selection	0	3		0		108	0 = Linear 1 = Squared 2 = Programmable 3 = Linear with flux optim
P2.6.4 *	Field weakening point	8.00	320.00	Hz	50.00		602	The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.
P2.6.5 *	Voltage at field weakening point	10.00	200.00	%	100.00		603	n% x Unmot
P2.6.6 *	U/f curve midpoint frequency	0.00	P2.6.4	Hz	50.00		604	If the value of P2.6.3 is programmable, this parameter gives the middle point frequency of the curve.
P2.6.7 *	U/f curve midpoint voltage	0.00	100.00	%	100.00		605	n% x Unmot Parameter max. value = P2.6.5
P2.6.8 *	Output voltage at zero frequency	0.00	40.00	%	Varies		606	n% x Unmot
P2.6.9	Switching frequency	1	Varies	kHz	Varies		601	See *Table 158 Size-dependent switching frequencies* for exact values.

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Table 99: Motor control parameters, G2.6

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.6.10	Overvoltage controller	0	2		1		607	0 = Not used 1 = Used (no ramping) 2 = Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	0 = Not used 1 = Used
P2.6.12	Identification						631	0 = No action 1 = Identification w/o run

* = Apply the Terminal to Function (TTF) to these parameters (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

7.4.8 PROTECTIONS (CONTROL KEYPAD: MENU M2 -> G2.7

Table 100: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.1	Response to 4 mA reference fault	0	5		4		700	0 = No response 1 = Warning 2 = Warning+Previous Freq. 3 = Wrng+PresetFreq 2.7.2 4 = Fault, stop acc. to 2.4.7 5 = Fault, stop by coasting
P2.7.2	4 mA reference fault frequency	0.00	P2.1.2	Hz	0.00		728	
P2.7.3	Response to external fault	0	3		2		701	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	0 = Fault stored in history Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	-100.0	100.0	%	0.0		705	
P2.7.10	Motor cooling factor at zero speed	0.0	150.0	%	40.0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	

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Table 100: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.13	Stall protection	0	3		1		709	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.14	Stall current	0.00	2 x I_H	A	1_H		710	
P2.7.15	Stall time limit	1.00	120.00	s	15.00		711	
P2.7.16	Stall frequency limit	1.00	P2.1.2	Hz	25.00		712	
P2.7.17	Underload protection	0	3		0		713	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.18	UP fnom Torque	10.0	150.0	%	50.0		714	
P2.7.19	Zero frequency load	5.0	150.0	%	10.0		715	
P2.7.20	Underload protection time limit	2.00	600.00	s	20.00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	0 = No response 1 = Warning 2 = Fault, stop acc. to 2.4.7 3 = Fault, stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	

Table 100: Protections, G2.7

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.7.25	Response to PT100 fault	0	3		0		740	0 = No response 1 = Warning 2 = Fault,stop acc. to 2.4.7 3 = Fault,stop by coasting
P2.7.26	PT100 warning limit	-30.0	200.0	ºC	120.0		741	
P2.7.27	PT100 fault limit	-30.0	200.0	ºC	130.0		742	

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7.4.9 AUTORESTART PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.8)

Table 101: Autorestart parameters, G2.8

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.8.1	Wait time	0.10	10.00	s	0.50		717	The wait time before the first reset is done.
P2.8.2	Trial time	0.00	60.00	s	30.00		718	When the trial time is over, and the fault is still active, the drive will trip.
P2.8.3	Start function	0	2		0		719	The selection of the start mode for Automatic reset. 0 = Ramp 1 = Flying start 2 = According to P2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		1		720	
P2.8.5	Number of tries after overvoltage trip	0	10		1		721	
P2.8.6	Number of tries after overcurrent trip	0	3		1		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		1		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		1		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		1		738	

7.4.10 PUMP AND FAN CONTROL PARAMETERS (CONTROL KEYPAD: MENU M2 -> G2.9)

Table 102: Pump and fan control parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.1	Number of auxiliary drives	0	4		1		1001	
P2.9.2	Start frequency, auxiliary drive 1	P2.9.3	320.00	Hz	51.00		1002	
P2.9.3	Stop frequency, auxiliary drive 1	P2.1.1	P2.9.2	Hz	10.00		1003	
P2.9.4	Start frequency, auxiliary drive 2	P2.9.5	320.00	Hz	51.00		1004	
P2.9.5	Stop frequency, auxiliary drive 2	P2.1.1	P2.9.4	Hz	10.00		1005	
P2.9.6	Start frequency, auxiliary drive 3	P2.9.7	320.00	Hz	51.00		1006	
P2.9.7	Stop frequency, auxiliary drive 3	P2.1.1	P2.9.6	Hz	10.00		1007	
P2.9.8	Start frequency, auxiliary drive 4	P2.9.9	320.00	Hz	51.00		1008	
P2.9.9	Stop frequency, auxiliary drive 4	P2.1.1	P2.9.8	Hz	10.00		1009	
P2.9.10	Start delay, auxiliary drives	0.0	300.0	s	4.0		1010	
P2.9.11	Stop delay, auxiliary drives	0.0	300.0	s	2.0		1011	
P2.9.12	Reference step, auxiliary drive 1	0.00	100.00	%	0.00		1012	
P2.9.13	Reference step, auxiliary drive 2	0.00	100.00	%	0.00		1013	
P2.9.14	Reference step, auxiliary drive 3	0.00	100.00	%	0.00		1014	
P2.9.15	Reference step, auxiliary drive 4	0.00	100.00	%	0.00		1015	
P2.9.16	PID controller bypass	0	1		0		1020	1 = PID contr. bypassed

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Table 102: Pump and fan control parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.17	Analogue input selection for input pressure measurement	0	5		0		1021	0 = Not used 1 = AI1 2 = AI2 3 = AI3 4 = AI4 5 = Fieldbus signal (FBProcessDataIN3)
P2.9.18	Input pressure high limit	0.0	100.0	%	30.0		1022	
P2.9.19	Input pressure low limit	0.0	100.0	%	20.0		1023	
P2.9.20	Output pressure drop	0.0	100.0	%	30.0		1024	
P2.9.21	Frequency drop delay	0.0	300.0	s	0.0		1025	0 = No delay 300 = No frequency drop nor increase
P2.9.22	Frequency increase delay	0.0	300.0	s	0.0		1026	0 = No delay 300 = No frequency drop nor increase
P2.9.23	Interlock selection	0	2		1		1032	0 = Interlocks not used 1 = Set new interlock last; update order after value of P2.9.26 or Stop state 2 = Stop and update order immediately
P2.9.24	Autochange	0	1		1		1027	0 = Not used 1 = Autochange used
P2.9.25	Autoch. and interl. automatics selection	0	1		1		1028	0 = Auxiliary drives only 1 = All drives

Table 102: Pump and fan control parameters

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P2.9.26	Autochange interval	0.0	3000.0	h	48.0		1029	0.0 = TEST=40 s
P2.9.27	Autochange; Maximum number of auxiliary drives	0	4		1		1030	
P2.9.28	Autochange frequency limit	0.00	P2.1.2	Hz	25.00		1031	
P2.9.29	Actual value special display minimum	0	30000		0		1033	
P2.9.30	Actual value special display maximum	0	30000		100		1034	
P2.9.31	Actual value special display decimals	0	4		1		1035	
P2.9.32	Actual value special display unit	0	28		4		1036	See ID1036 in Chapter *8 Parameter descriptions*.

7.4.11 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User Manual.

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Table 103: Keypad control parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	1 = I/0 terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1.1	P2.1.2	Hz	0.00			
P3.3	Direction (on keypad)	0	1		0		123	0 = Forward 1 = Reverse
P3.4	PID reference 1	0.00	100.00	%	0.00		167	
P3.5	PID reference 2	0.00	100.00	%	0.00		168	
R3.6	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

7.4.12 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User Manual.

7.4.13 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7

The M7 menu shows the expander and option boards attached to the control board and board related information. For more information, see the product's User Manual.

8 PARAMETER DESCRIPTIONS

On the following pages you find the parameter descriptions arranged according to the individual ID number of the parameter. An asterisk after the parameter ID number (e.g. 418 Motor potentiometer UP *) indicates that the TTF programming method must be applied to this parameter (see Chapter *8.9 "Terminal to function" (TTF) programming principle*).

Some parameter names are followed by a number code indicating the "All in One" applications in which the parameter is included. If no code is shown the parameter is available in all applications. See below. The parameter numbers under which the parameter appears in different applications are also given.

1. Basic Application
2. Standard Application
3. Local/Remote Control Application
4. Multi-Step Speed Control Application
5. PID Control Application
6. Multi-Purpose Control Application
7. Pump and Fan Control Application

101 MINIMUM FREQUENCY (2.1, 2.1.1)

102 MAXIMUM FREQUENCY (2.2, 2.1.2)

Defines the frequency limits of the AC drive. The maximum value for these parameters is 320 Hz.

Minimum and maximum frequencies set limits to other frequency related parameters (e.g. Preset Speed 1 (ID105), Preset Speed 2 (ID106) and 4 mA fault preset speed (ID728).

103 ACCELERATION TIME 1 (2.3, 2.1.3)

Gives the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.

104 DECELERATION TIME 1 (2.4, 2.1.4)

Gives the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.

105 PRESET SPEED 1 1246 (2.18, 2.1.14, 2.1.15)

106 PRESET SPEED 2 1246 (2.19, 2.1.15, 2.1.16)

These parameters can be used to determine frequency references that are applied when the appropriate digital inputs are activated

Parameter values are automatically limited to the maximum frequency (ID102).

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NOTE!

The use of TTF-programming method in the Multi-purpose Control Application. Because all digital inputs are programmable you first have to assign two DINs for the Preset Speed functions (parameters ID419 and ID420).

Table 104: Preset speed

Speed	Preset speed 1 (DIN4/ID419)	Preset speed 2 (DIN5/ID420)
Basic reference	0	0
ID105	1	0
ID106	0	1

107 CURRENT LIMIT (2.5, 2.1.5)

This parameter tells the maximum motor current from the AC drive. The range of values for the parameter is different for each frame size of the drive. When the current limit is changed the stall current limit (ID710) is internally calculated to 90% of current limit.

When the current limit is active, the drive output frequency decreases.

NOTE!

The Current Limit is not an overcurrent trip limit.

108 U/F RATIO SELECTION 234567 (2.6.3)

Table 105: Selections for parameter ID108

Selection number	Selection name	Description
0	Linear	The voltage of the motor changes linearly as a function of the output frequency. The voltage changes from the value of Zero Frequency Voltage (ID606) to the value of Voltage at Field Weakening Point (ID603) at a frequency set in Field Weakening Point Frequency (ID602). Use this default setting if a different setting is not necessary.
1	Squared	The voltage of the motor changes from the value of Zero Frequency Voltage (ID606) to the value of Field Weakening Point Frequency (ID603) at a squared curve. The motor operates undermagnetised below the field weakening point and produces less torque. You can use the squared U/f ratio in applications where the torque demand is in relation to the square of the speed, for example in centrifugal fans and pumps. See *Fig. 24*.
2	Programmable	It is possible to program the U/f curve with 3 different points: the zero frequency voltage (P1), the midpoint voltage/ frequency (P2), and the field weakening point (P3). You can use the programmable U/f curve at low frequencies if it is necessary to have more torque. You can find the optimal settings automatically with an identification run (ID631). See *Fig. 25*.
3	Linear with flux optimisation	The AC drive starts to search for the minimum motor current in order to save energy and to lower the motor noise. This function can be used in applications such as fans, pumps etc.

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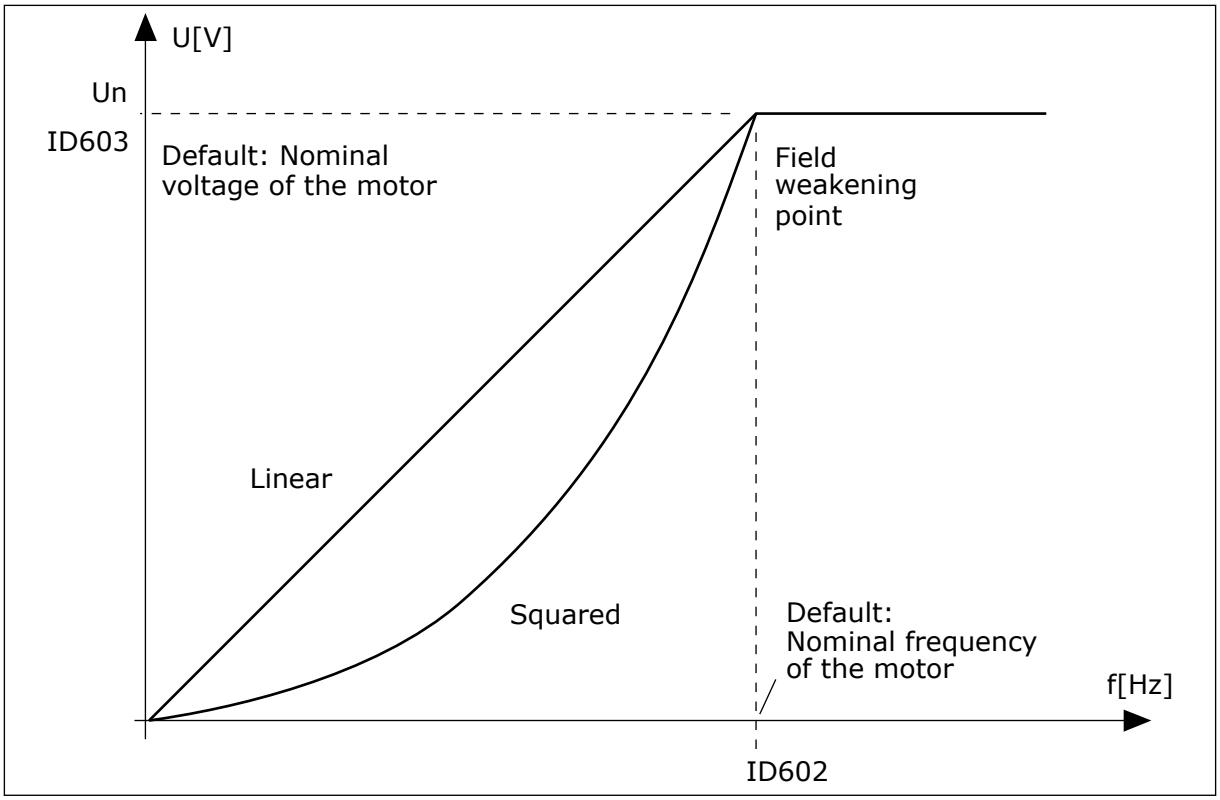

Fig. 24: Linear and squared change of the motor voltage

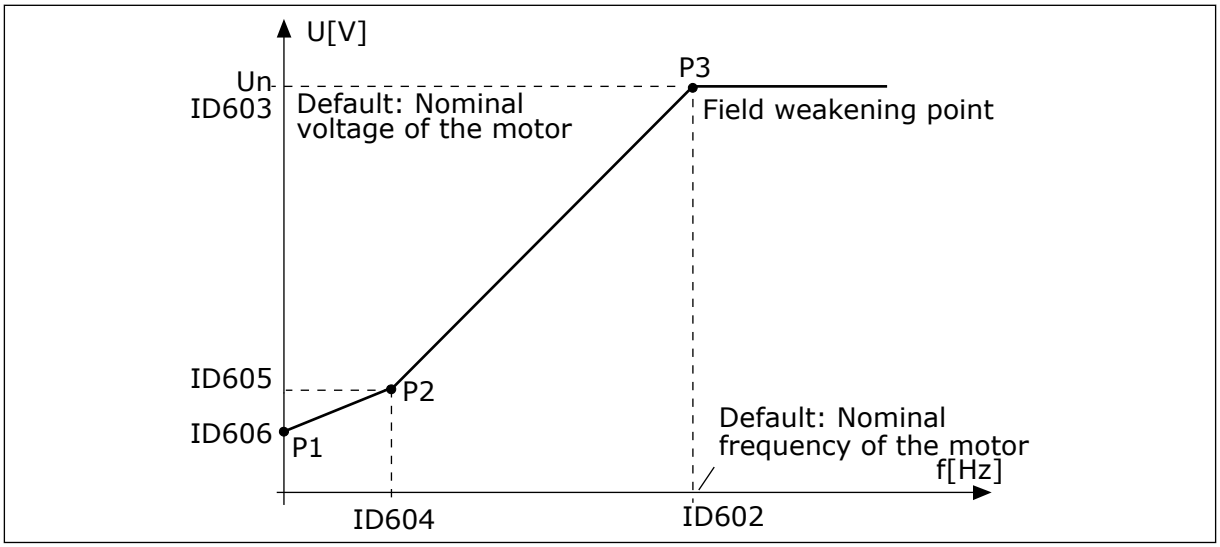

Fig. 25: The programmable U/f curve

109 U/F OPTIMISATION (2.13, 2.6.2)

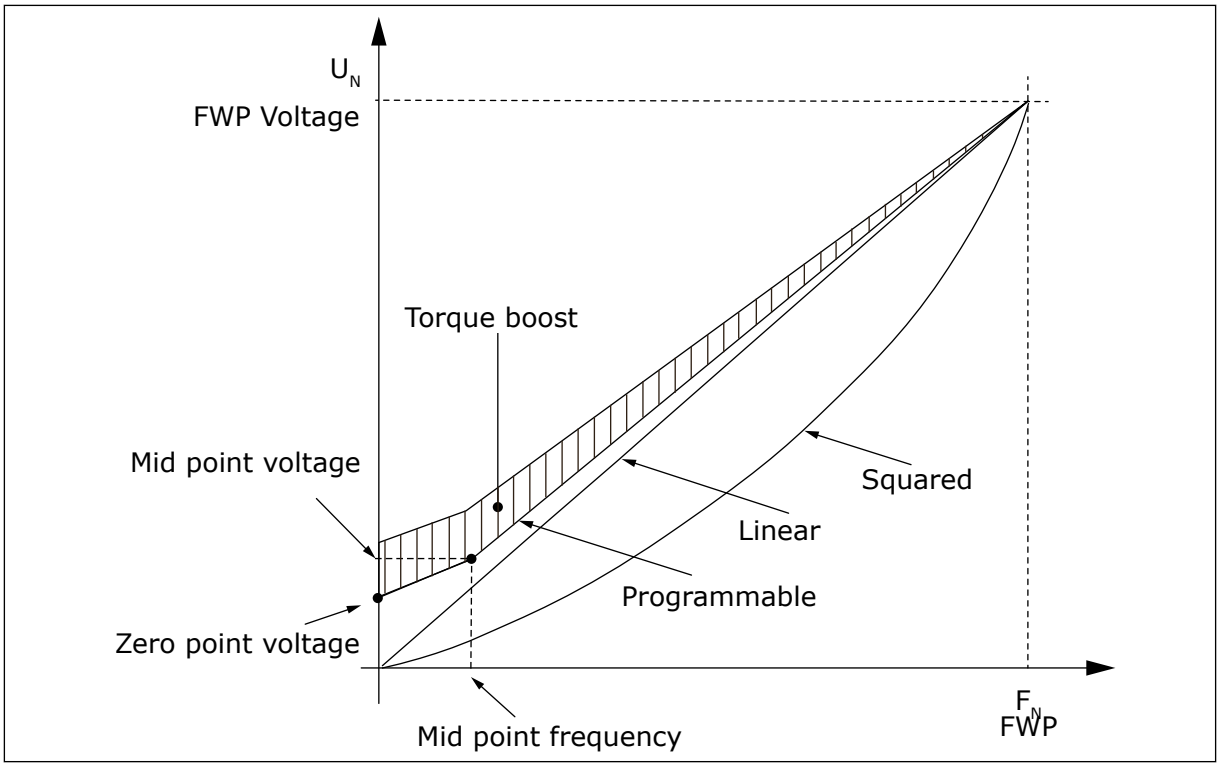

Fig. 26: U/f optimisation

The voltage to the motor changes in proportion to required torque which makes the motor produce more torque at start and when running at low frequencies. Automatic torque boost can be used in applications where starting torque due to starting friction is high, for example, in conveyors.

To start with high torque from 0 Hz, set the motor nominal values (Parameter group 2.1) either automatically or manually.

Setting the motor nominal values with automatic functions

1. Make identification run (ID631) with rotating motor.
2. If needed, activate the speed control or U/f optimization (Torque boost).
3. If needed, activate both the speed control and U/f optimization.

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Setting the motor nominal values by manual tuning

1. Set the motor magnetizing current:
   1. Run the motor using 2/3 of motor nominal frequency as the frequency reference.
   2. Read the motor current in the monitoring menu or use NCDrive for monitoring.
   3. Set this current as the motor magnetizing current (ID612).
2. Set the U/f ration selection (ID108) to value 2 (programmable U/f curve).
3. Run the motor with zero frequency reference and increase the motor zero point voltage (ID606) until the motor current is approximately same as the motor magnetising current. If the motor is in a low frequency area for only short periods, it is possible to use up to 65% of the motor nominal current.
4. Set the midpoint voltage (ID605) to 1.4142*ID606 and midpoint frequency (ID604) to value ID606/100%*ID111.
5. If needed, activate the speed control or U/f optimization (Torque boost).
6. If needed, activate both the speed control and U/f optimization.

NOTE!

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.

110 NOMINAL VOLTAGE OF THE MOTOR (2.6, 2.1.6)

Find this value U_n on the rating plate of the motor. This parameter sets the voltage at the field weakening point (ID603) to 100% * U_{nMotor}.

NOTE!

Find out if the motor connection is Delta or Star.

111 NOMINAL FREQUENCY OF THE MOTOR (2.7, 2.1.7)

Find this value f_n on the rating plate of the motor. This parameter sets the field weakening point (ID602) to the same value.

112 NOMINAL SPEED OF THE MOTOR (2.8, 2.1.8)

Find this value n_n on the rating plate of the motor.

113 NOMINAL CURRENT OF THE MOTOR (2.9, 2.1.9)

Find this value I_n on the rating plate of the motor. If magnetization current is provided set also parameter ID612 before making the Identification run (NXP only).

114 STOP BUTTON ACTIVATED (3.4, 3.6)

If you wish to make the Stop button a "hotspot" which always stops the drive regardless of the selected control place, give this parameter the value 1.

See also parameter ID125.

117 I/O FREQUENCY REFERENCE SELECTION 12346 (2.14, 2.1.11)

Defines which frequency reference source is selected when controlled from the I/O control place.

Table 106: Selections for parameter ID117

Applic. Sel.	1 to 4	6
0	Analogue input 1 (AI1)	Analogue input 1 (AI1). See ID377
1	Anlogue input 2 (AI2).	Anlogue input 2 (AI2). See ID388
2	Keypad reference (Menu M3)	AI1+AI2
3	Fieldbus reference	AI1–AI2
4	Potentiometer reference (Application 3 only)	AI2–AI1
5		AI1*AI2
6		AI1 joystick
7		AI2 joystick
8		Keypad reference (Menu M3)
9		Fieldbus reference
10		Potentiometer reference; controlled with ID418 (TRUE=increase) and ID417 (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, see ID422
15		Encoder 1 (AI input C.1)
16		Encoder 2 (With OPTA7 Speed Synchronization, NXP only) (AI input C.3)

118 PID CONTROLLER GAIN 57 (2.1.12)

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.

For examples, see ID132.

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119 PID CONTROLLER I-TIME 57 (2.1.13)

The parameter ID119 defines the integration time of the PID controller. If this parameter is set to 1.00 s, a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00 s, the PID controller will operate as PD controller.

For examples, see ID132.

120 MOTOR COS PHI (2.10, 2.1.10)

Find this value on the rating plate of the motor.

121 KEYPAD FREQUENCY REFERENCE SELECTION 234567 (2.1.12, 2.1.13, 2.2.6, 2.2.1.2)

Selection of the reference source when the control place is keypad.

Table 107: Selection for parameter ID121

Appl. / Sel.	2-4	5	6	7
0	Analogue input 1 (AI1)	Analogue input 1 (AI1)	Analogue input 1 (AI1)	Analogue input 1 (AI1
1	Analogue Input 2 (AI2)	Analogue Input 2 (AI2)	Analogue Input 2 (AI2)	Analogue Input 2 (AI2)
2	Keypad reference (Menu M3)	AI3	AI1+AI2	AI3
3	Fieldbus reference*	AI4	AI1–AI2	AI4
4		Keypad reference (Menu M3)	AI2–AI1	Keypad reference (Menu M3)
5		Fieldbus reference*	AI1*AI2	Fieldbus reference*
6		Potentiometer ref.	AI1 joystick	Potentiometer ref.
7		PID controller ref.	AI2 joystick	PID controller ref.
8			Keypad reference (Menu M3)	
9			Fieldbus reference*	

*FBSpeedReference. For more information, see the used fieldbus manual.

122 FIELDBUS FREQUENCY REFERENCE SELECTION 234567 (2.1.13, 2.1.14, 2.2.7, 2.2.1.3)

Selection of the reference source when the control place is Fieldbus.

For selections in different applications, see ID121.

123 KEYPAD DIRECTION (3.3)

Table 108: Selections for parameter ID123

Selection number	Selection name	Description
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 product's User manual.

124 JOGGING SPEED REFERENCE 34567 (2.1.14, 2.1.15, 2.1.19)

Defines the jogging speed reference when activated by digital input. See parameter ID301 and ID413.

The parameter value is automatically limited to Maximum frequency (ID102).

125 CONTROL PLACE (3.1)

The active control place can be changed with this parameter. For more information, see the product's User manual.

Pushing the Start button for 3 seconds selects the control keypad as the active control place and copies the Run status information (Run/Stop, direction and reference).

Table 109: Selections for parameter ID125

Selection number	Selection name	Description
0	PC Control, (activated by NCDrive)	
1	I/O terminal	
2	Keypad	
3	Fieldbus	

126 PRESET SPEED 3 46 (2.1.17)

127 PRESET SPEED 4 46 (2.1.18)

128 PRESET SPEED 5 46 (2.1.19)

129 PRESET SPEED 6 46 (2.1.20)

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130 PRESET SPEED 7 46 (2.1.21)

These parameters can be used to determine frequency references that are applied when appropriate combinations of digital inputs are activated.

In Multi-Step Speed Application (Application 4), digital inputs DIN4, DIN5 and DIN6 are assigned to Preset Speed functions. The combinations of these activated inputs select the preset speed reference.

NOTE!

The use of TTF-programming method in the Multi-purpose Control Application. Because all digital inputs are programmable you first have to assign three DINs for the Preset Speed functions (parameters ID41, ID420 and ID421.

Table 110: Preset speeds 1 to 7

Speed	DIN4/ID419	DIN5/ID420	DIN6/ID421
Basic speed	0	0	0
Preset speed 1 (ID105)	1	0	0
Preset speed 2 (ID106)	0	1	0
Preset speed 3 (ID126)	1	1	0
Preset speed 4 (ID127)	0	0	1
Preset speed 5 (ID128)	1	0	1
Preset speed 6 (ID129)	0	1	1
Preset speed 7 (ID130)	1	1	1

See also parameters ID105 and ID106.

Parameter value is automatically limited to maximum frequency (ID102).

131 I/O FREQUENCY REFERENCE SELECTION, PLACE B3 (2.1.12)

See the values of the parameter ID117 above.

132 PID CONTROLLER D-TIME 57 (2.1.14)

The parameter ID132 defines the derivation 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 AC drive output behaves as follows:

Given values:

P2.1.12, P = 0%
P2.1.13, I-time = 1.00 s
P2.1.14, D-time = 0.00 sMin freq. = 0 Hz
Error value (setpoint – process value) = 10.00%Max freq. = 50 Hz

In this example, the PID controller operates practically as I-controller only.

According to the given value of parameter 2.1.13 (I-time), the PID output increases by 5 Hz (10% of the difference between the maximum and minimum frequency) every second until the error value is 0.

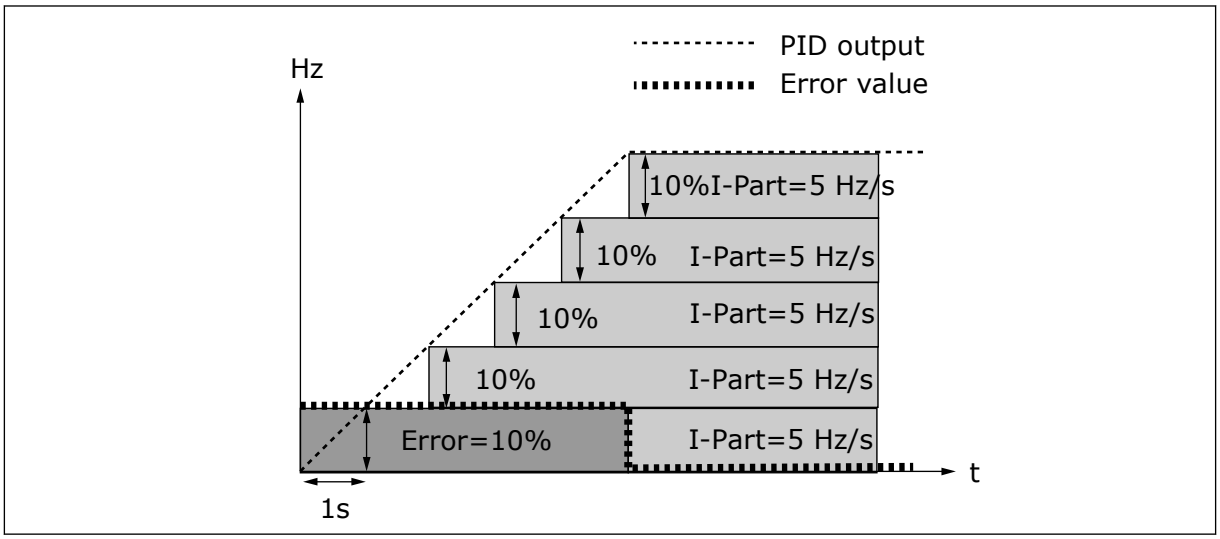

Fig. 27: PID controller function as I-controller

EXAMPLE 2

Given values:

P2.1.12, P = 100%
P2.1.13, I-time = 1.00 s
P2.1.14, D-time = 1.00 sMin freq. = 0 Hz
Error value (setpoint – process value) = ±10%Max freq. = 50 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 parameter 2.1.13.

In case the error value is negative, the AC drive reacts reducing the output correspondingly.

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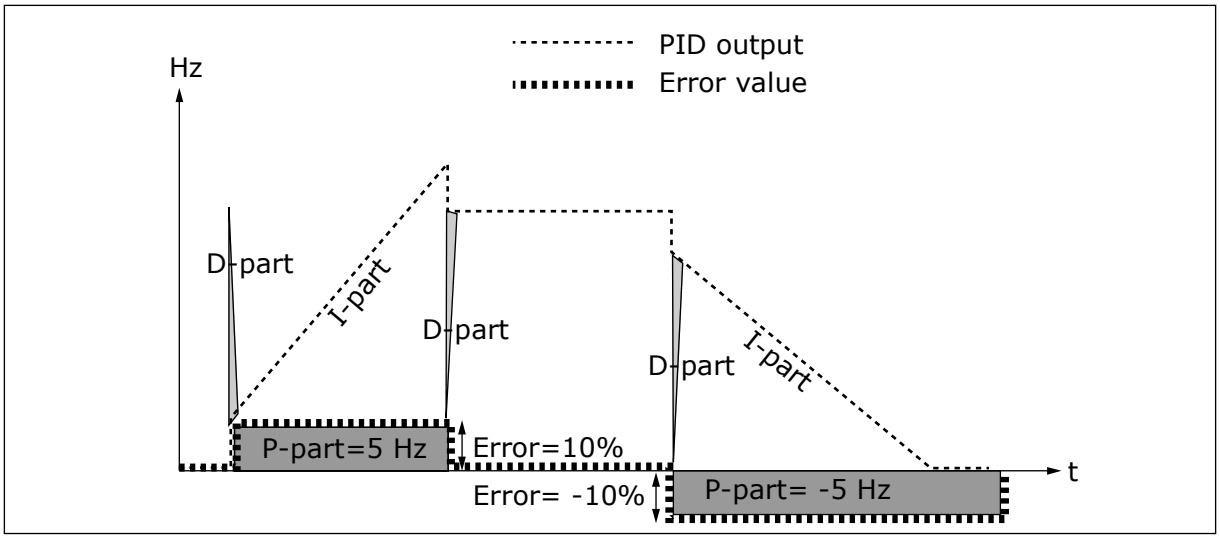

Fig. 28: PID output curve with the values of Example 2

EXAMPLE 3

Given values:

P2.1.12, P = 100%
P2.1.13, I-time = 0.00 s
P2.1.14, D-time = 1.00 sMin freq. = 0 Hz
Error value (setpoint – process value) = ±10%/sMax freq. = 50 Hz

As the error value increases, also the PID output increases according to the set values (D-time = 1.00s).

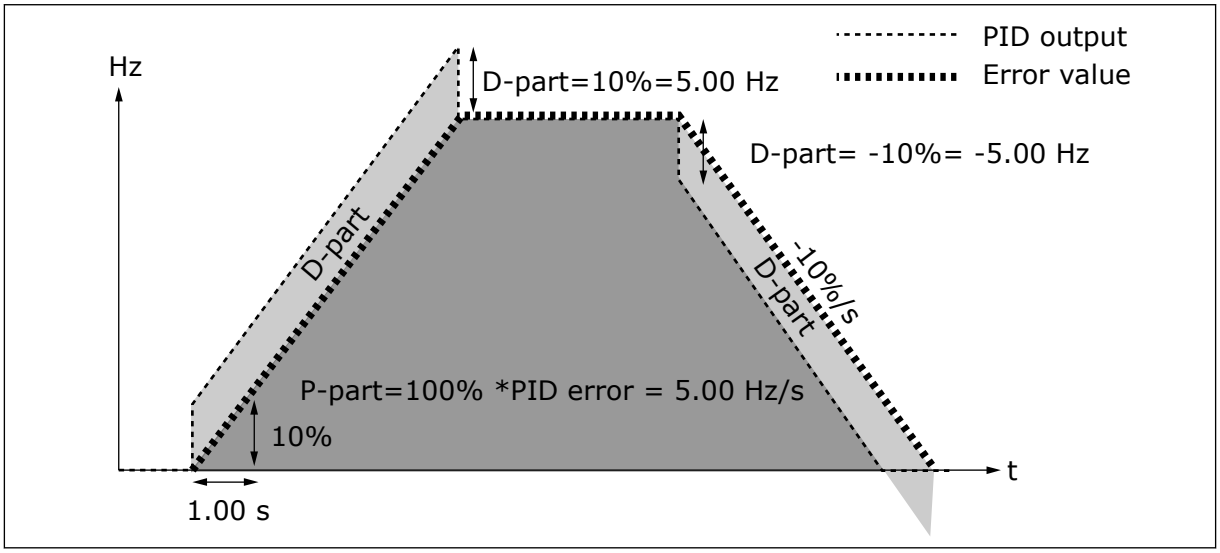

Fig. 29: PID output with the values of Example 3

133 PRESET SPEED 8 4 (2.1.22)

134 PRESET SPEED 9 4 (2.1.23)

135 PRESET SPEED 10 4 (2.1.24)

136 PRESET SPEED 11 4 (2.1.25)

137 PRESET SPEED 12 4 (2.1.26)

138 PRESET SPEED 13 4 (2.1.27)

139 PRESET SPEED 14 4 (2.1.28)

140 PRESET SPEED 15 4 (2.1.29)

To use these preset speeds in the Multi-Step Speed Application (ASFIFF04), parameter ID301 must be given the value 13. In Multi-Step Speed Application (Application 4), digital inputs DIN4, DIN5 and DIN6 are assigned to Preset Speed functions. The combinations of these activated inputs select the preset speed reference.

Table 111: Multi-step speed selections with digital inputs DIN3, DIN4, DIN5 and DIN6

Speed	Multi-step speed sel. 1 (DIN4)	Multi-step speed sel. 2 (DIN5)	Multi-step speed sel. 3 (DIN6)	Multi-step speed sel. 4 (DIN3)
P2.1.22 (8)	0	0	0	1
P2.1.23 (9)	1	0	0	1
P2.1.24 (10)	0	1	0	1
P2.1.25 (11)	1	1	0	1
P2.1.26 (12)	0	0	1	1
P2.1.27 (13)	1	0	1	1
P2.1.28 (14)	0	1	1	1
P2.1.29 (15)	1	1	1	1

141 AI3 SIGNAL SELECTION * 567 (2.2.38, 2.2.4.1)

Connect the AI3 signal to the analogue input of your choice with this parameter. For more information, see Chapter *8.9 "Terminal to function" (TTF) programming principle*.

NOTE!

If you use an NXP drive and the Multi-Purpose Control Application (Application 6), you can control AI3 from fieldbus when this input is set the value 0.1.

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142 AI3 SIGNAL FILTER TIME 567 (2.2.41, 2.2.4.2)

When this parameter is given a value greater than 0.0 the function that filters out disturbances from the incoming analogue signal is activated.

Long filtering time makes the regulation response slower. See parameter ID324.

143 AI3 SIGNAL RANGE 567 (2.2.39, 2.2.4.3)

With this parameter you can select the AI3 signal range.

Table 112: Selection for parameter ID143

Applic. / Sel.	5	6	7
0	0-100%	0-100%	0-100%
1	4 mA/20-100%	4 mA/20-100%	4 mA/20-100%
2		–10...+10V	Customised
3		Customised	

144 AI3 CUSTOM SETTING MINIMUM 67 (2.2.4.4)

145 AI3 CUSTOM SETTING MAXIMUM 67 (2.2.4.5)

Set the custom minimum and maximum levels for the AI3 signal within - 160...160%.

Example: Min 40%, Max 80% = 8-16 mA.

151 AI3 SIGNAL INVERSION 567 (2.2.40, 2.2.4.6)

Table 113: Selections for parameter ID151

Selection number	Selection name	Description
0	No inversion	
1	Signal inverted	

*152 AI4 SIGNAL SELECTION * 567 (2.2.42, 2.2.5.1)*

See ID141.

153 AI4 FILTER TIME 567 (2.2.45, 2.2.5.2)

See ID142.

154 AI4 SIGNAL RANGE 567 (2.2.43, 2.2.5.3)

See ID143.

155 AI4 CUSTOM SETTING MINIMUM 67 (2.2.5.3, 2.2.5.4)

156 AI4 CUSTOM SETTING MAXIMUM * 67 (2.2.5.4, 2.2.5.5)

See IDs 144 and 145.

162 AI4 SIGNAL INVERSION 567 (2.2.44, 2.2.5.5, 2.2.5.6)

See ID151.

164 MOTOR CONTROL MODE 1/2 6 (2.2.7.22)

Contact is open (oc) = Motor control mode 1 is selected
Contact is closed (cc) = Motor control mode 2 is selected

See parameter IDs 600 and 521.

Change from open loop to closed loop control modes and vice versa can only be made in stop state.

165 AI1 JOYSTICK OFFSET 6 (2.2.2.11)

Define the frequency zero point as follows:

With this parameter on display, place the potentiometer at the assumed zero point and press Enter on the keypad.

NOTE!

This will not, however, change the reference scaling.

Press Reset button to change the parameter value back to 0.00%.

166 AI2 JOYSTICK OFFSET 6 (2.2.3.11)

See parameter ID165.

167 PID REFERENCE 1 57 (3.4)

The PID controller keypad reference can be set between 0% and 100%. This reference value is the active PID reference if parameter ID332 = 2.

168 PID REFERENCE 2 57 (3.5)

The PID controller keypad reference 2 can be set between 0% and 100%. This reference is active if the DIN5 function = 13 and the DIN5 contact is closed.

169 FIELDBUS DIN4 (FBFIXEDCONTROLWORDK, BIT 6) 6 (2.3.3.27)

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170 FIELDBUS DIN 5 (FBFIXEDCONTROLWORD, BIT 7) 6 (2.3.3.28)

The data from the fieldbus can be led to the digital outputs of the AC drive. See the used fieldbus manual for more details.

179 SCALING OF MOTORING POWER LIMIT 6 (2.2.6.7)

The motoring power limit is equal to ID1289 if value 0 'Not used' is selected. If any of the inputs is selected the motoring power limit is scaled between zero and parameter ID1289. This parameter is available for NXP closed loop control mode only.

Table 114: Selections for parameter ID179

Selection number	Selection name	Description
0	Not used	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	FB Limit Scaling ID46 (monitoring value)	

300 START/STOP LOGIC SELECTION 2346 (2.2.1, 2.2.1.1)

Table 115: Selections for parameter ID300

Selection	DIN1	DIN2	DIN3
0	closed contact = start forward	closed contact = start reverse	
	See *Fig. 30*.		
1	closed contact = startopen contact = stop	closed contact = reverseopen contact = forward	
	See *Fig. 31*.		
2	closed contact = startopen contact = stop	closed contact = start enable-dopen contact = start disabled and drive stopped if running	can be programmed for reverse command
3 *	closed contact= start pulse	open contact = stop pulse	can be programmed for reverse command
	See *Fig. 32*.		
Applications 2 and 4:			
4	closed contact = start forward (Rising edge required to start)	closed contact = start reverse (Rising edge required to start)	
5	closed contact = start (Rising edge required to start) open contact = stop	closed contact = reverse open contact = forward	
6	closed contact = start (Rising edge required to start) open contact = stop	closed contact = start enabled open contact = start disabled and drive stopped if running	can be programmed for reverse command unless selected for DIN2
Applications 3 and 6:			
4	closed contact = start forward	closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if parameter ID117 is set to 4 [Application 4]).	
5	closed contact = start forward (Rising edge required to start)	closed contact = start reverse (Rising edge required to start)	
6	closed contact = start (Rising edge required to start) open contact = stop	closed contact = reverse open contact = forward	

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Table 115: Selections for parameter ID300

Selection	DIN1	DIN2	DIN3
7	closed contact = start (Rising edge required to start) open contact = stop	closed contact = start enabled open contact = start disabled and drive stopped if running	
Application 3:			
8	closed contact = start forward (Rising edge required to start)	closed contact = reference increases (motor potentiometer reference)	

* = 3-wire connection (pulse control)

The selections including the text 'Rising edge required to start' must 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 from I/O control. The Start/Stop contact must be opened before the motor can be started.

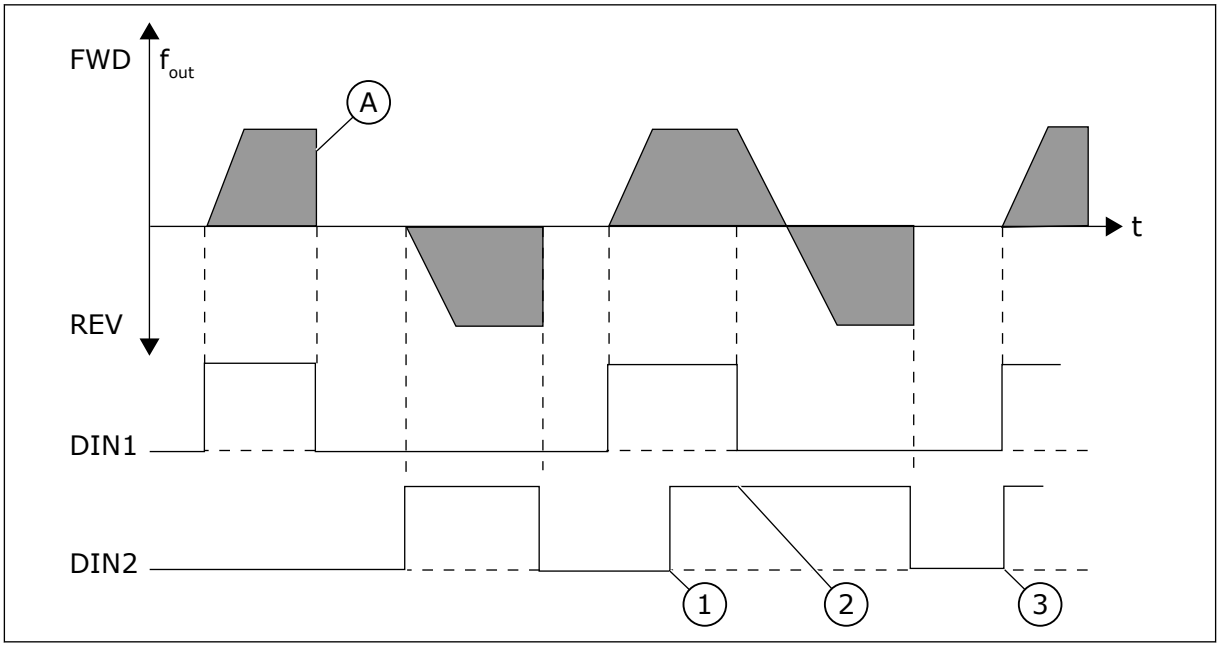

Fig. 30: Start forward/Start reverse

1. The first selected direction has the highest priority.
2. When the DIN1 contact opens the direction of rotation starts the change.
3. If Start forward (DIN1) and Start reverse (DIN2) signals are active simultaneously the Start forward signal (DIN1) has priority.

A) Stop function (ID506) = coasting

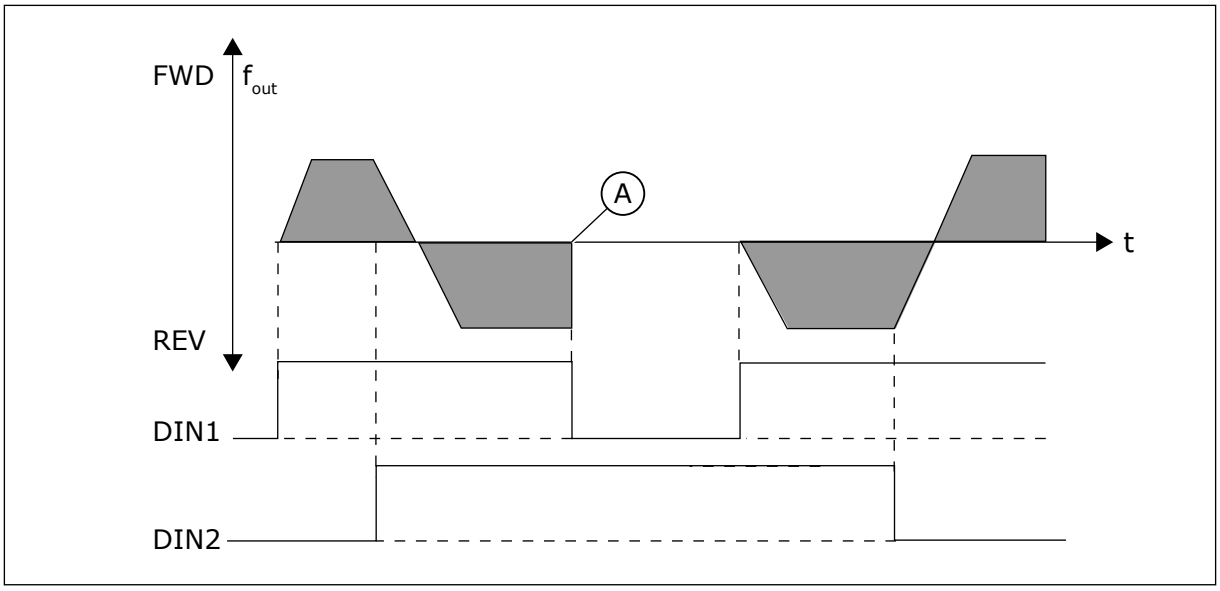

Fig. 31: Start, Stop, Reverse

A) Stop function (ID506) = coasting

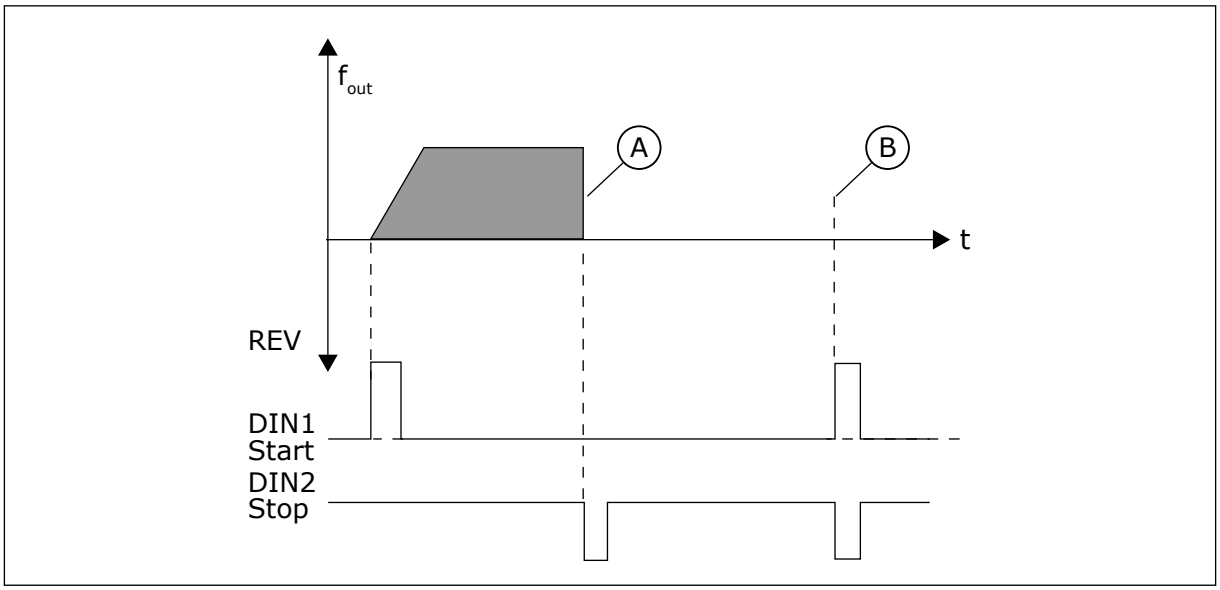

Fig. 32: Start pulse/ Stop pulse

A) Stop function (ID506) = coasting
B) If Start and Stop pulses are simultaneous the Stop pulse overrides the Start pulse

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301 DIN3 FUNCTION 12345 (2.17, 2.2.2)

Table 116: Selections for parameter ID301

Selection number	Selection name	Description	Notes
0	Not used		
1	External fault	Closing contact: Fault is shown and responded to according to ID701.	
2	External fault	Opening contact: Fault is shown and responded to according to ID701 when the input is not active.	
3	Run enable	Contact open: Motor start disabled and the motor is stopped READY signal is set to FALSE	
		Contact closed: Motor start enabled	
Application 1			
4	Run enable	Contact open: Motor start enabled	
		Contact closed: Motor start disabled and the motor is stopped	
Applications 2 to 5			
4	Acc./Dec time select.	Contact open: Acceleration/deceleration time 1 selected	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 ID117, ID121 and ID122). **NOTE!** The value of parameter ID125 Keypad Control Place does not change. When DIN3 opens the control place is selected according to parameter 3.1.
		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	
Applications 2 to 5			
8	Reverse	Contact open: Forward	Can be used for reversing if parameter ID300 value is set to either 2,3, or 6.
		Contact closed: Reverse	
Applications 3 to 5			

Table 116: Selections for parameter ID301

Selection number	Selection name	Description	Notes
9	Jogging sp.	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 30 as well as parameters ID507 and ID1080	
Applications 3 and 5			
13	Motor potentiometer down	Contact closed: Reference decreases until the contact is opened	
Application 4			
13	Preset speed		

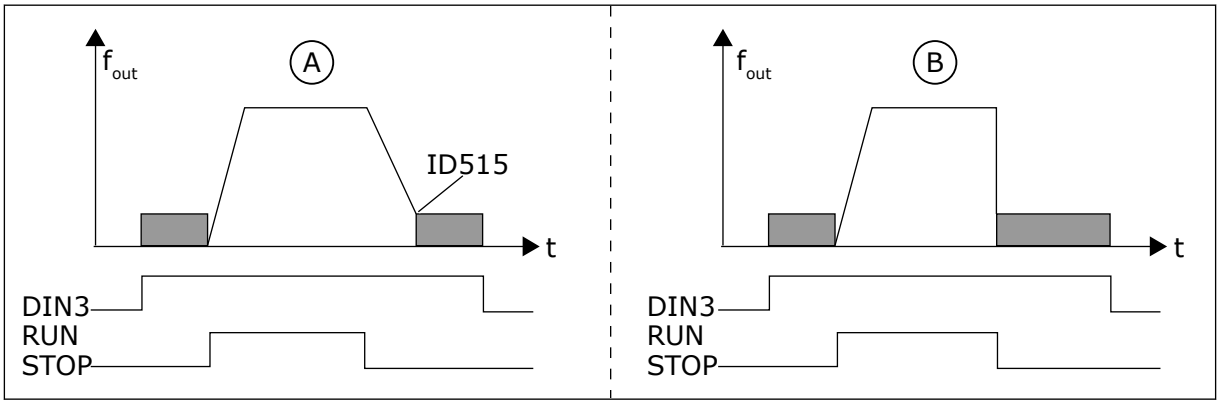

Fig. 33: DIN3 as DC-brake command input

A. Stop mode = Ramp

B. Stop mode = coasting

302 ANALOGUE INPUT 2, REFERENCE OFFSET 12 (2.15, 2.2.3)

Table 117: Selections for parameter ID302

Selection number	Selection name	Description
0	No offset: 0—20 mA	
1	Offset 4 mA ("living zero")	Provides supervision of zero level signal. In Standard Application, the response to reference fault can be programmed with parameter ID700.

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303 REFERENCE SCALING, MINIMUM VALUE 2346 (2.2.4, 2.2.16, 2.2.2.6)

304 REFERENCE SCALING, MAXIMUM VALUE 2346 (2.2.5, 2.2.17, 2.2.2.7)

Additional reference scaling. If both parameter ID303 and parameter ID304 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.

NOTE!

This scaling does not affect the fieldbus reference (scaled between Minimum frequency (parameter ID101) and Maximum frequency (parameter ID102).

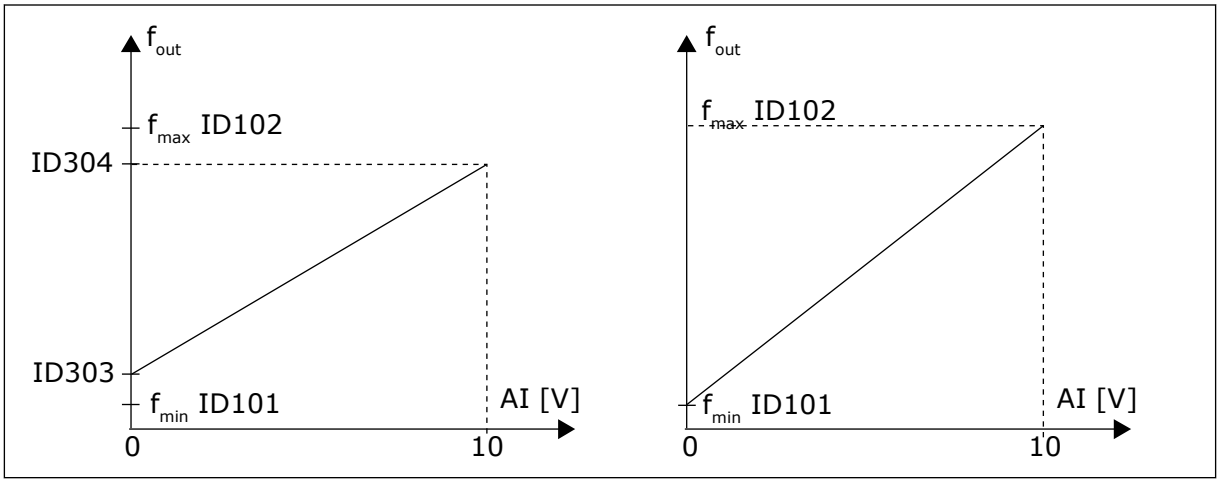

Fig. 34: Left: Reference scaling; Right: No scaling used (parameter ID303 = 0)

305 REFERENCE INVERSION 2 (2.2.6)

Inverts reference signal:
Max. input signal = Min. freq. reference
Min. input signal = Max. freq. reference

Table 118: Selections for parameter ID305

Selection number	Selection name	Description
0	No inversion	
1	Reference inverted	

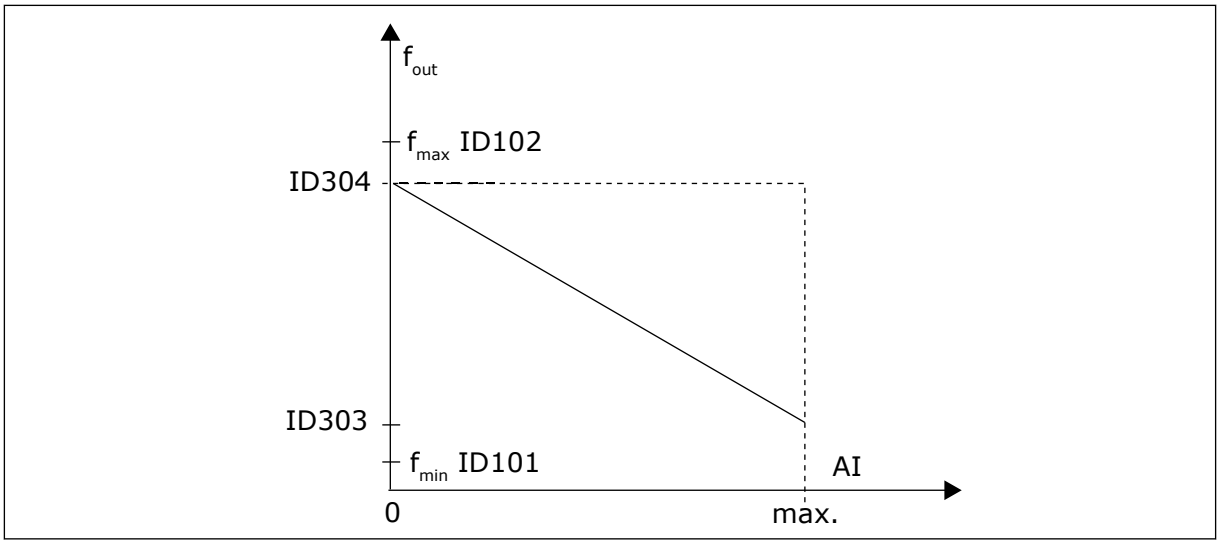

Fig. 35: Reference invert

306 REFERENCE FILTER TIME 2 (2.2.7)

Filters out disturbances from the analogue input signals AI1 and AI2. Long filtering time makes regulation response slower.

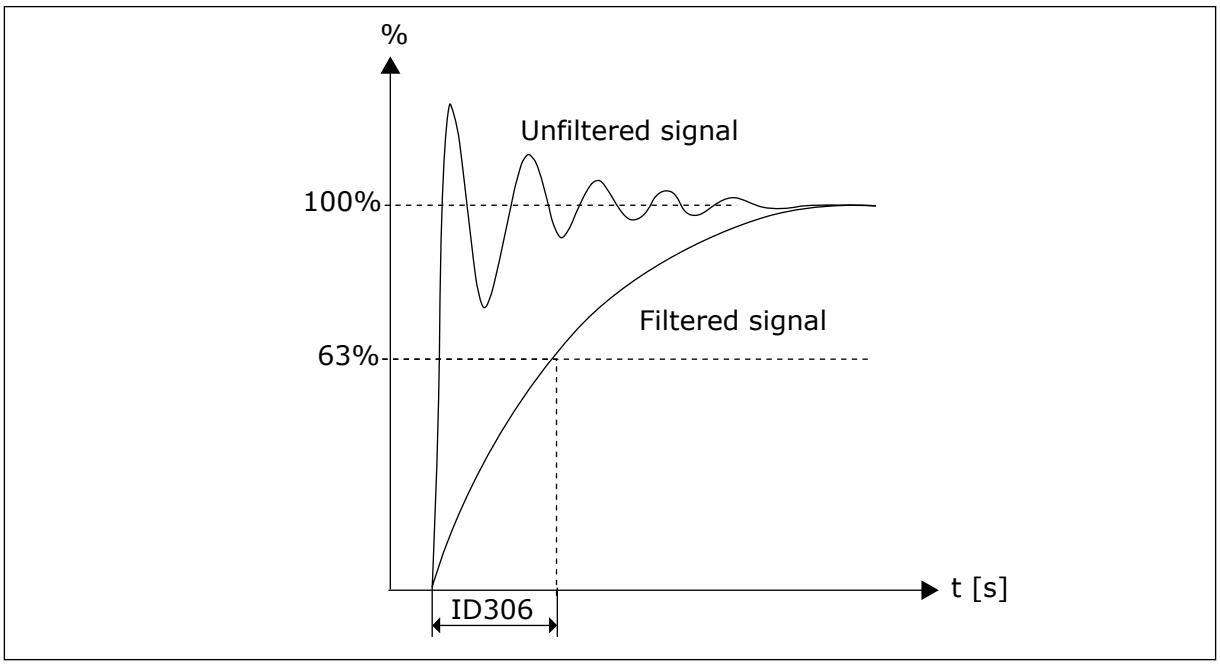

Fig. 36: Reference filtering

307 ANALOGUE OUTPUT FUNCTION (2.16, 2.3.2, 2.3.5.2, 2.3.3.2)

This parameter selects the desired function for the analogue output signal.

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Table 119: Parameter ID307 selections

Applic. / Sel.	1 to 4	5 and 7	6
0	Not used	Not used	Not used
1	Output freq. (0—fmax)	Output freq. (0—fmax)	Output freq. (0—fmax)
2	Freq. reference (0—fmax)	Freq. reference (0—fmax)	Freq. reference (0—fmax)
3	Motor speed (0—Motor nominal speed)	Motor speed (0—Motor nominal speed)	Motor speed (0—Motor nominal speed)
4	Output current (0-InMotor)	Output current (0-InMotor)	Output current (0-InMotor)
5	Motor torque (0—TnMotor)	Motor torque (0—TnMotor)	Motor torque (0—TnMotor)
6	Motor power (0—PnMotor)	Motor power (0—PnMotor)	Motor power (0—PnMotor)
7	Motor voltage (0-UnMotor)	Motor voltage (0-UnMotor)	Motor voltage (0-UnMotor)
8	DC-link volt (0—1000V)	DC-link volt (0—1000V)	DC-link volt (0—1000V)
9		PID controller ref. value	AI1
10		PID contr. act. value 1	AI2
11		PID contr. act. value 2	Output freq. (fmin - fmax)
12		PID contr. error value	Motor torque (–2...+2xTNmot)
13		PID controller output	Motor power (–2...+2xTNmot)
14		PT100 temperature	PT100 temperature
15			FB analogue output Process-Data4 (NXS)

308 ANALOGUE OUTPUT FILTER TIME 234567 (2.3.3, 2.3.5.3, 2.3.3.3)

Defines the filtering time of the analogue output signal.

Setting this parameter value 0 will deactivate filtering.

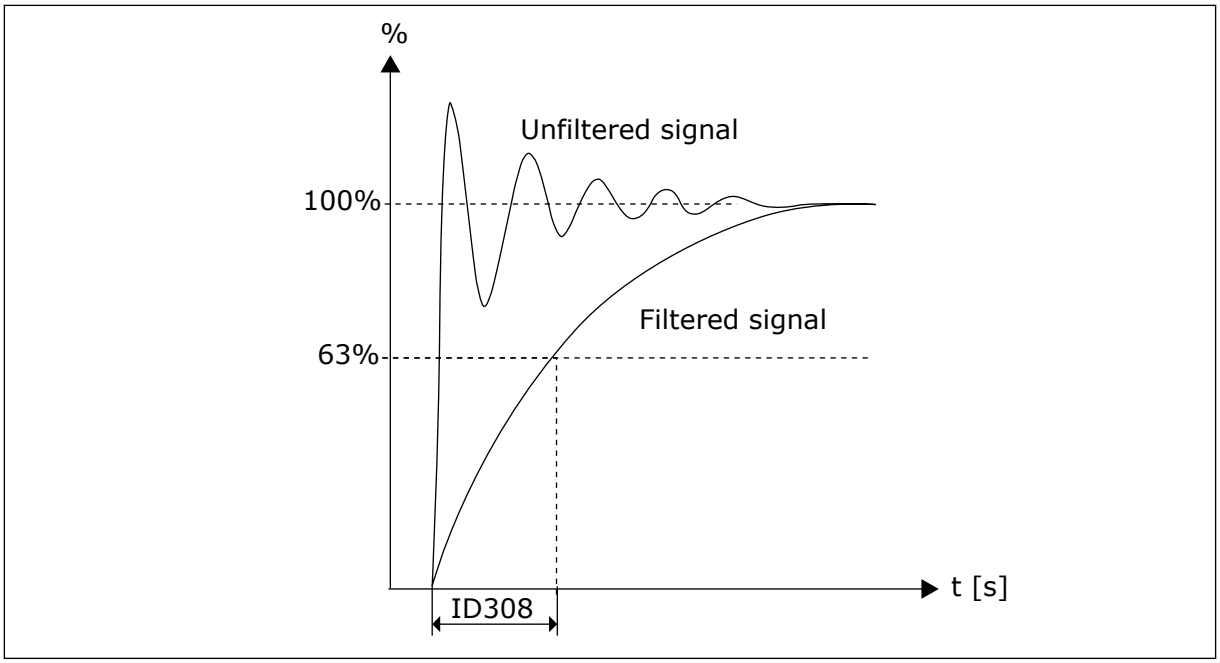

Fig. 37: Analogue output filtering

309 ANALOGUE OUTPUT INVERSION 234567 (2.3.4, 2.3.5.4, 2.3.3.4)

Inverts the analogue output signal:

Maximum output signal = Minimum set value
Minimum output signal = Maximum set value

See parameter ID311 below.

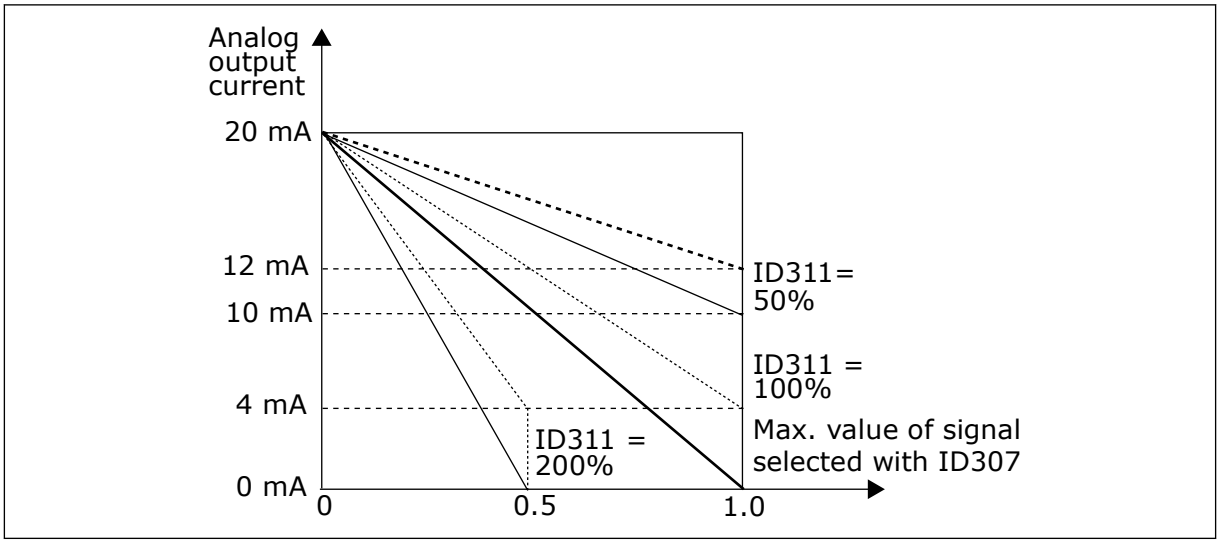

Fig. 38: Analogue output invert

310 ANALOGUE OUTPUT MINIMUM 234567 (2.3.5, 2.3.5.5, 2.3.3.5)

Defines the signal minimum to either 0 mA or 4 mA (living zero). Note the difference in analogue output scaling in parameter ID311 (8-15).

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Table 120: Selections for parameter ID310

Selection number	Selection name	Description
0	Set minimum value to 0 mA/0 V	
1	Set minimum value to 4 mA/2 V	

311 ANALOGUE OUTPUT SCALE 234567 (2.3.6, 2.3.5.6, 2.3.3.6)

Scaling factor for analogue output. Use the given formula to calculate the values.

Table 121: Analogue output scaling

Signal	Max. value of the signal
Output frequency	Max frequency (parameter ID102)
Freq. Reference	Max frequency (parameter ID102)
Motor speed	Motor nom. speed 1xn_{nMotor}
Output current	Motor nom. current 1xI_{nMotor}
Motor torque	Motor nom. torque 1xT_{nMotor}
Motor power	Motor nom. power 1xP_{nMotor}
Motor voltage	100% x U_{nmotor}
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.

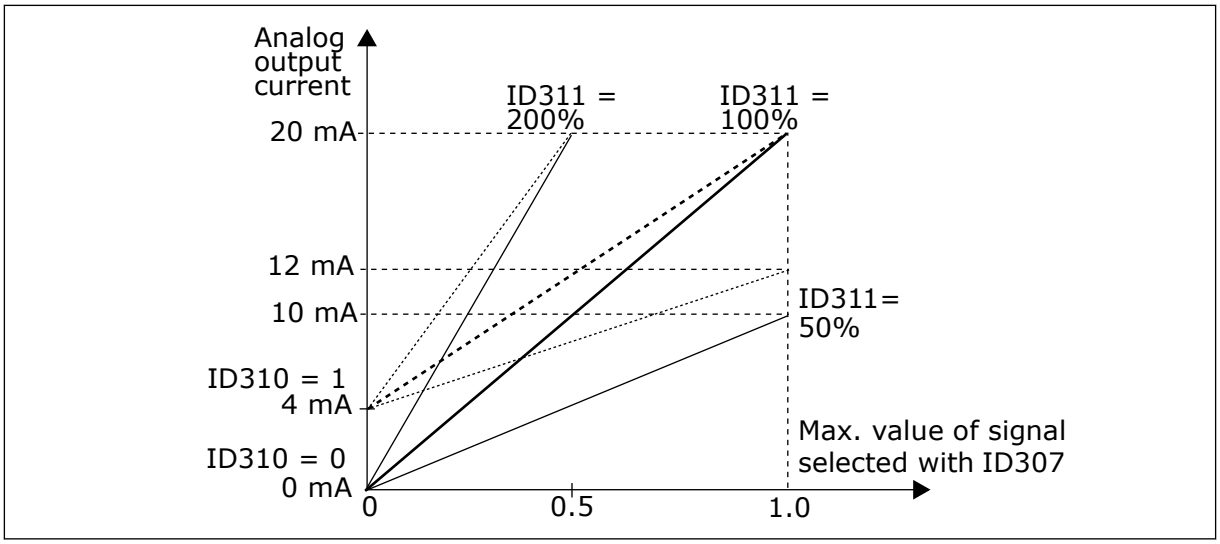

Fig. 39: Analogue output scaling

$$OutputSignal = \frac{Signal * Analogue\ OutputScale\%}{100\%}$$

312 DIGITAL OUTPUT FUNCTION 23456 (2.3.7, 2.3.1.2)

313 RELAY OUTPUT 1 FUNCTION 2345 (2.3.8, 2.3.1.3)

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314 RELAY OUTPUT 2 FUNCTION 2345 (2.3.9)

Table 122: Output signals via DO1 and output relays RO1 and RO2

Setting value	Signal content
0 = Not used	Out of operation
	Digital output DO1 sinks the current and programmable relay (RO1, RO2) is activated when:
1 = Ready	The AC drive is ready to operate
2 = Run	The AC drive operates (motor is running)
3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip not occurred
5 = Frequency converter overheat warning	The heat-sink temperature exceeds +70 °C
6 = External fault or warning	Fault or warning depending on parameter ID701
7 = Reference fault or warning	Fault or warning depending on parameter ID700 - if analogue 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 (Applications 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	One of the limit regulators (e.g. current limit, torque limit) is activated.
13 = Output frequency limit 1 supervision	The output frequency goes outside the set supervision low limit/ high limit (see parameters ID315 and ID316 below).
14 = Control from I/O terminals (Appl. 2) 14 = Output frequency limit 2 supervision (Applications 3456)	I/O control mode selected (in menu M3) The output frequency goes outside the set supervision low limit/ high limit (see parameters ID346 and ID347 below).
15 = Thermistor fault or warning (Appl.2) 15 = Torque limit supervision (Appl.3456)	The thermistor input of option board indicates motor overtemperature. Fault or warning depending on parameter ID732. The motor torque goes beyond the set supervision low limit/high limit (parameters ID348 and ID349).

Table 122: Output signals via DO1 and output relays RO1 and RO2

Setting value	Signal content
16 = Fieldbus DIN1 (Application 2) 16 = Reference limit supervision	Fieldbus digital input 1. See fieldbus manual. Active reference goes beyond the set supervision low limit/high limit (parameters ID350 and ID351).
17 = External brake control (Appl. 3456)	External brake ON/OFF control with programmable delay (parameters ID352 and ID353)
18 = Control from I/O terminals (Appl. 3456)	External control mode (Menu M3; ID125)
19 = Frequency converter temperature limit supervision (Appl. 3456)	The AC drive heatsink temperature goes beyond the set supervision limits (parameters ID354 and ID355).
20 = Unrequested rotation direction (Appl. 345) 20 = Reference inverted (Appl. 6)	Rotation direction is different from the requested one.
21 = External brake control inverted (Appl. 3456)	External brake ON/OFF control (parameters ID352 and ID353); Output active when brake control is OFF
22 = Thermistor fault or warning (Appl. 3456)	The thermistor input of option board indicates motor overtemperature. Fault or warning depending on parameter ID732.
23 = Fieldbus DIN1 (Application 5) 23 = Analogue input supervision (Application 6)	Fieldbus digital input 1. See fieldbus manual. Selects the analogue input to be monitored. See parameters ID356, ID357, ID358 and ID463.
24 = Fieldbus DIN1 (Application 6)	Fieldbus digital input 1. See fieldbus manual.
25 = Fieldbus DIN2 (Application 6)	Fieldbus digital input 2. See fieldbus manual.
26 = Fieldbus DIN3 (Application 6)	Fieldbus digital input 3. See fieldbus manual.

315 OUTPUT FREQUENCY LIMIT SUPERVISION FUNCTION 234567 (2.3.10, 2.3.4.1, 2.3.2.1)

Table 123: Selections for parameter ID315

Selection number	Selection name	Description
0	No supervision	
1	Low limit supervision	
2	High limit supervision	
3	Brake-on control	(Application 6 only, see Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*.)

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If the output frequency goes under/over the set limit (ID316) this function generates a message via digital output depending

1. on the settings of parameters ID312 to ID314 (applications 3,4,5) or
2. on to which output the supervision signal 1 (ID447) is connected (applications 6 and 7).

Brake control uses different output functions. See ID445 & ID446.

316 OUTPUT FREQUENCY LIMIT SUPERVISION VALUE 234567 (2.3.11, 2.3.4.2, 2.3.2.2)

Selects the frequency value supervised by parameter ID315.

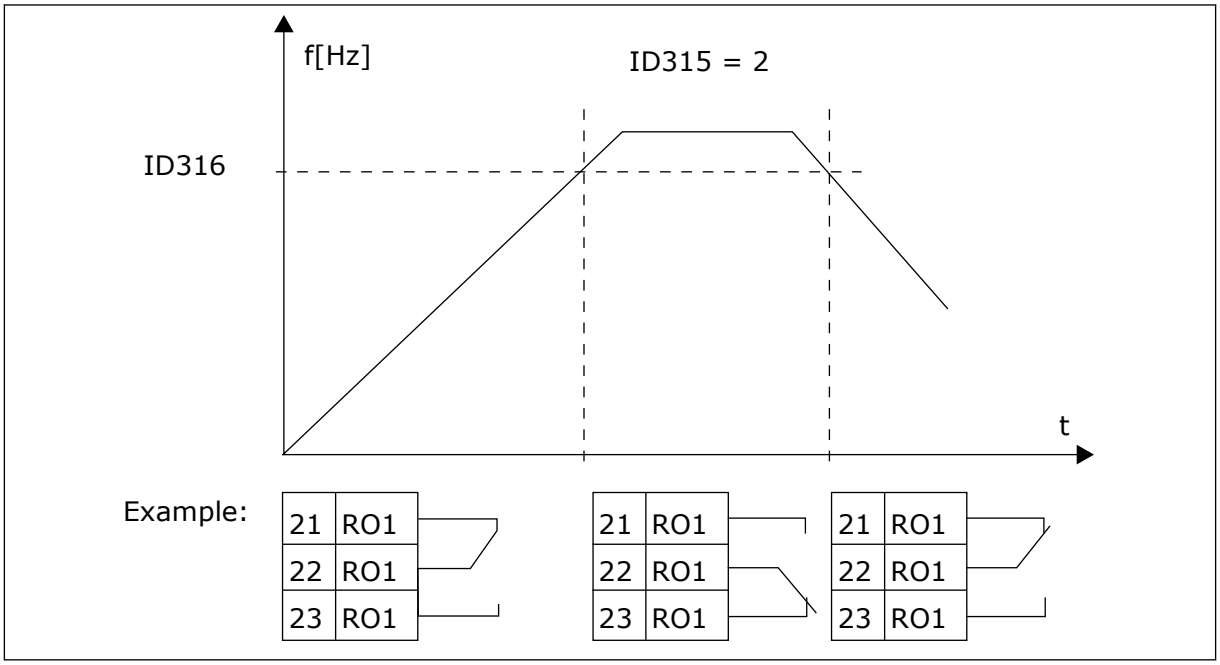

Fig. 40: Output frequency supervision

319 DIN2 FUNCTION 5 (2.2.1)

This parameter has 14 selections. If digital input DIN2 need not be used, set the parameter value to 0.

Table 124: Selections for parameter ID319

Selection number	Selection name	Description	Notes
1	External fault, normally open	Contact closed: Fault is displayed and motor stopped when the input is active	
2	External fault, normally closed	Contact open: Fault is displayed and motor stopped when the input is not active.	
3	Run enable	Contact open, Start of motor disabled.	
		Contact closed: Start of motor enabled	
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	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 ID343, ID121 and ID122). **NOTE!** The value of ID125 (Keypad Control Place) does not change. When DIN2 opens the control place is selected according to keypad control place selection.
6	Closing contact	Force control place to keypad	
7	Closing contact	Force control place to fieldbus	
8	Reverse	Contact open:Forward	If several inputs are programmed to reverse, one active contact is enough to set the direction to reverse.
		Contact closed:Reverse	
9	Jogging speed (see par. ID124)	Contact closed: Jogging speed selected for frequency reference	
10	Fault reset	Contact closed: Resets all faults	
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 *Fig. 41 DC braking command (selection 12) selected for DIN2*	

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Table 124: Selections for parameter ID319

Selection number	Selection name	Description	Notes
13	Motor potentiometer UP	Contact closed: Reference increases until the contact is opened.	

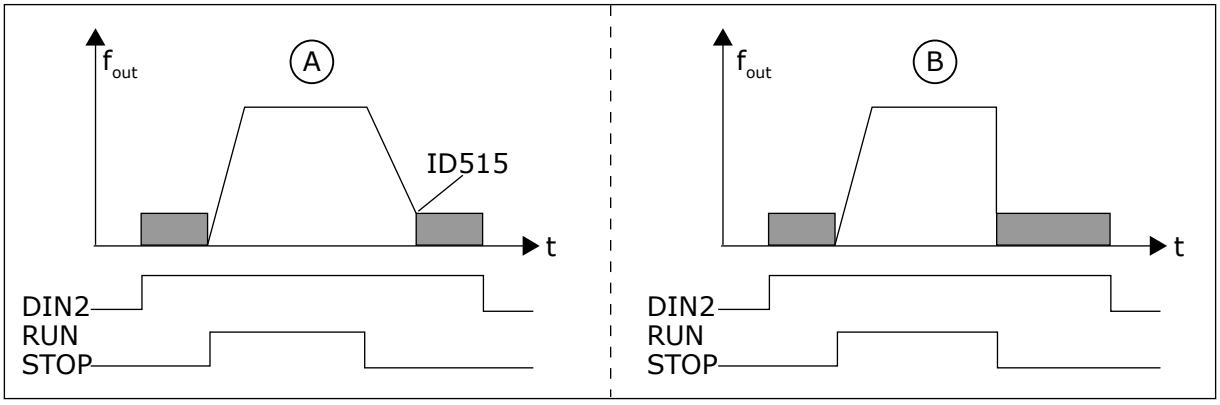

Fig. 41: DC braking command (selection 12) selected for DIN2

A. Stop mode = Ramp B. Stop mode = Coasting

320 AI1 SIGNAL RANGE 34567 (2.2.4, 2.2.16, 2.2.2.3

Table 125: Selections for parameter ID320

Applic. / Sel.	3, 4, 5	6	7
0	0-100%	0-100%	0-100%
1	4 mA/20-100%	4 mA/20-100%	4 mA/20-100%
2	Customised	–10...+10 V	Customised
3		Customised	

For selection 'Customised', see parameters ID321 and ID322.

321 AI1 CUSTOM SETTING MINIMUM 34567 (2.2.5, 2.2.17, 2.2.2.4)

322 AI1 CUSTOM SETTING MAXIMUM 34567 (2.2.6, 2.2.18, 2.2.2.5)

The parameters let you adjust the range of the analogue input signal between -160 and 160% freely.

For example, you can use the analogue input signal as frequency reference, and set these 2 parameters between 40 and 80%. In these conditions, the frequency reference changes between the Minimum frequency reference (ID101) and the Maximum frequency reference(ID102), and the analogue input signal changes between 8 and 16 mA.

323 AI1 SIGNAL INVERSION 3457 (2.2.7, 2.2.19, 2.2.2.6)

If this parameter = 0, no inversion of analogue input signal takes place

NOTE!

In application 3, AI1 is place B frequency reference if parameter ID131= 0 (default).

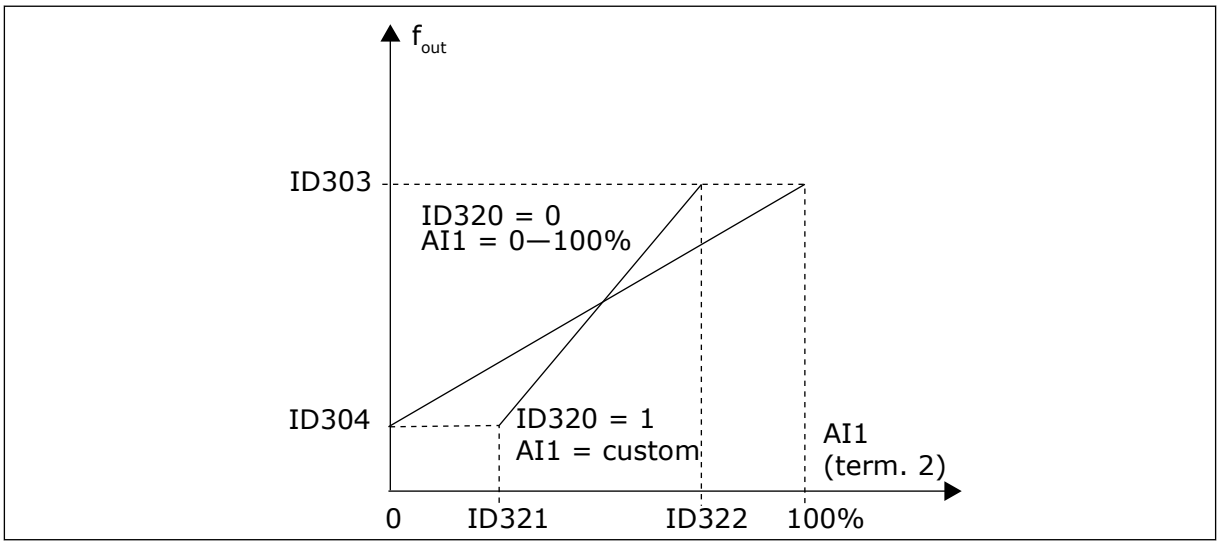

Fig. 42: AI1 no signal inversion

If this parameter = 1 inversion of analogue input signal takes place.

Max. AI1 signal = minimum frequency ref.
Min. AI1 signal = maximum frequency ref.

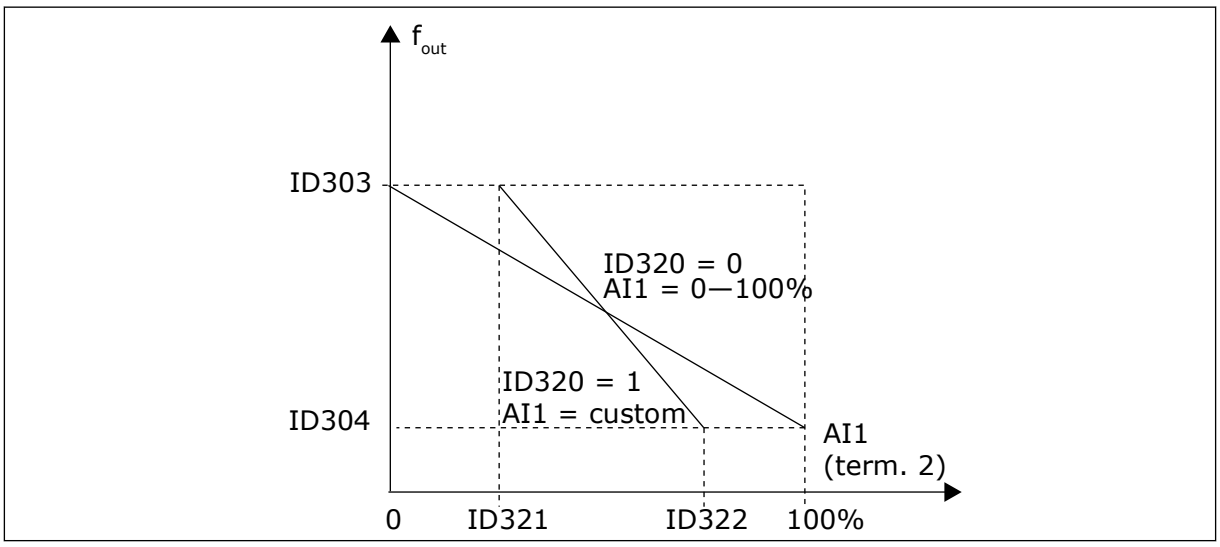

Fig. 43: AI1 signal inversion

324 AI1 SIGNAL FILTER TIME 34567 (2.2.8, 2.2.20, 2.2.2.2)

This parameter filters out disturbances in the analogue input signal. To activate this parameter, give it a value that is bigger than 0.

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NOTE!

Long filtering time makes the regulation response slower.

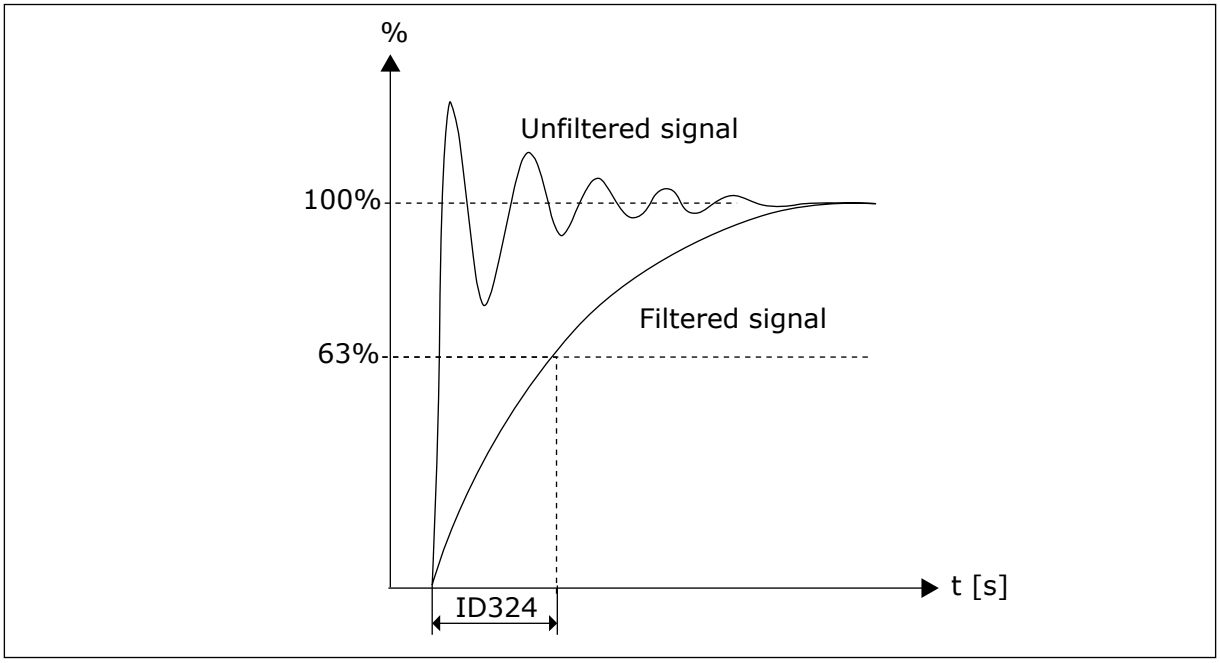

Fig. 44: AI1 signal filtering

325 ANALOGUE INPUT AI2 SIGNAL RANGE 34567 (2.2.10, 2.2.22, 2.2.3.3

Table 126: Selections for parameter ID325

Applic. / Sel.	3, 4	5	6	7
0	0-20 mA	0-20 mA	0-100%	0-100%
1	4-20 mA	4 mA/20-100%	4 mA/20-100%	4 mA/20-100%
2	Customised	Customised	–10...+10 V	Customised
3			Customised	

326 ANALOGUE INPUT AI2 CUSTOM SETTING MIN. 34567 (2.2.11, 2.2.23, 2.2.3.4)

327 ANALOGUE INPUT AI2 CUSTOM SETTING MAX. 34567 (2.2.12, 2.2.24, 2.2.3.5)

The parameters let you adjust the range of the analogue input signal between -160 and 160% freely. See ID322.

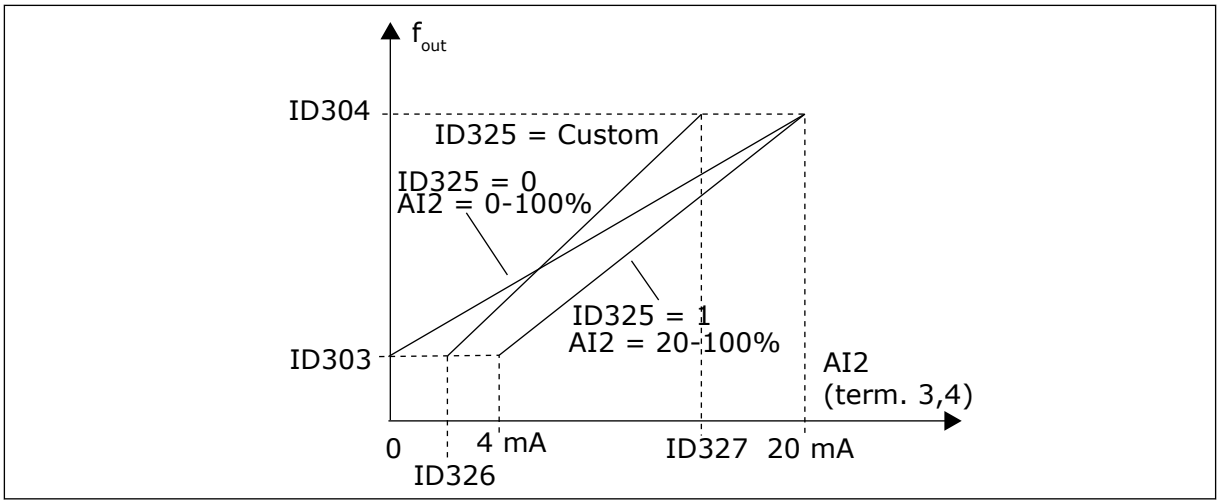

Fig. 45: Analogue input AI2 scaling

328 ANALOGUE INPUT 2 INVERSION 3457 (2.2.13, 2.2.25, 2.2.3.6)

See ID323.

NOTE!

In application 3, AI2 is the place A frequency reference, if parameter ID117 = 1 (default)

329 ANALOGUE INPUT 2 FILTER TIME 34567 (2.2.14, 2.2.26, 2.2.3.2)

See ID324.

330 DIN5 FUNCTION 5 (2.2.3)

The digital input DIN5 has 14 possible functions. If it need not be used, set the value of this parameter to 0.

The selections are the same as in parameter ID319 except:

13 Enable PID reference 2
Contact open: PID controller reference selected with parameter ID332.
Contact closed: PID controller keypad reference 2 selected with parameter R3.5.

331 MOTOR POTENTIOMETER RAMP TIME 3567 (2.2.22, 2.2.27, 2.2.1.2, 2.2.1.15)

Defines the speed of change of the motor potentiometer reference value (Hz/s). Motor control ramp times are still active.

332 PID CONTROLLER REFERENCE SIGNAL (PLACE A) 57 (2.1.11)

Defines which frequency reference place is selected for the PID controller.

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Table 127: Selection for parameter ID332

Applic. / Sel.	5	7
0	Analogue input 1	Analogue input 1
1	Analogue input 2	Analogue input 2
2	PID ref. from menu M3, parameter P3.4	AI3
3	Fieldbus ref. (FBProcessDataIN1) See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.	AI4
4	Motor potentiometer reference	PID ref. from menu M3, parameter P3.4
5		Fieldbus ref. (FBProcessDataIN1) See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.
6		Motor potentiometer reference

333 PID CONTROLLER ACTUAL VALUE SELECTION 57 (2.2.8, 2.2.1.8)

This parameter selects the PID controller actual value.

Table 128: Selections for parameter ID333

Selection number	Selection name	Description
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	Smaller one of Actual value 1 and Actual value 2	
5	Greater 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	

334 ACTUAL VALUE 1 SELECTION 57 (2.2.9, 2.2.1.9)

335 ACTUAL VALUE 2 SELECTION 57 (2.2.10, 2.2.1.10)

Table 129: Selections forparameter IDs 334 and 335

Selection number	Selection name	Description
0	Not used	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	Fieldbus	(Actualvalue 1: FBProcessDataIN2; Actual value 2: FBProcessDataIN3). See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.
Application 5		
6	Motor torque	
7	Motor speed	
8	Motor current	
9	Motor power	
10	Encoder frequency (for Actual value 1 only)	

336 ACTUAL VALUE 1 MINIMUM SCALE 57 (2.2.11, 2.2.1.11)

Sets the minimum scaling point for Actual value 1. See *Fig. 46 Examples of actual value signal scaling*.

337 ACTUAL VALUE 1 MAXIMUM SCALE 57 (2.2.12, 2.2.1.12)

Sets the maximum scaling point for Actual value 1. See *Fig. 46 Examples of actual value signal scaling*.

338 ACTUAL VALUE 2 MINIMUM SCALE 57 (2.2.13, 2.2.1.13)

Sets the minimum scaling point for Actual value 2. See Chapter *339 Actual value 2 maximum scale 57 (2.2.14, 2.2.1.14)*.

339 ACTUAL VALUE 2 MAXIMUM SCALE 57 (2.2.14, 2.2.1.14)

Sets the maximum scaling point for Actual value 2. See *Fig. 46 Examples of actual value signal scaling*.

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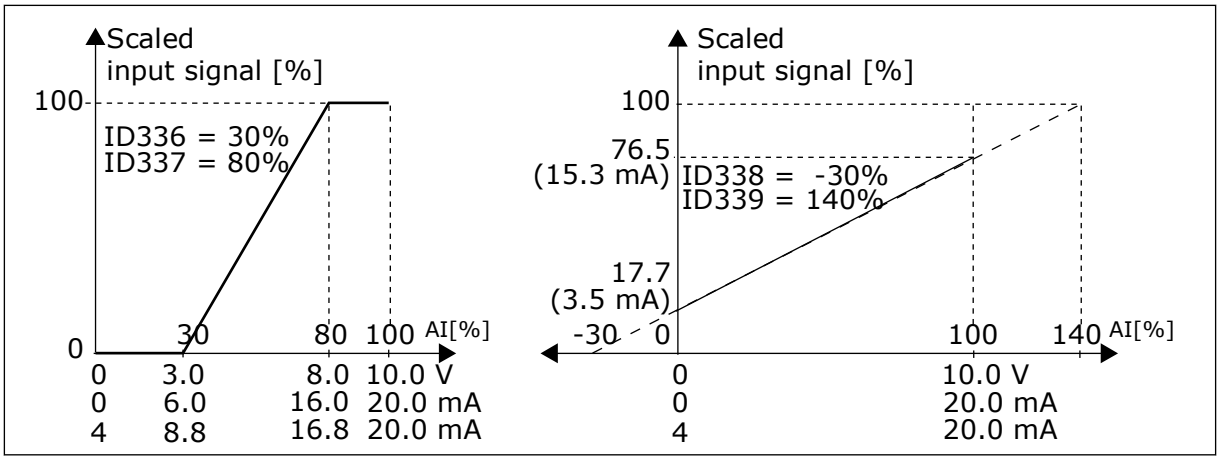

Fig. 46: Examples of actual value signal scaling

340 PID ERROR VALUE INVERSION 57 (2.2.32, 2.2.1.5)

This parameter allows you to invert the error value of the PID controller (and thus the operation of the PID controller).

Table 130: Selections for parameter ID340

Selection number	Selection name	Description
0	No inversion	
1	Inverted	

341 PID REFERENCE RISE TIME 57 (2.2.33, 2.2.1.6)

Defines the time during which the PID controller reference rises from 0% to 100%.

342 PID REFERENCE FALL TIME 57 (2.2.34, 2.2.1.7)

Defines the time during which the PID controller reference falls from 100% to 0%.

343 I/O REFERENCE FALL TIME 57 (2.2.34, 2.2.1.7)

Defines the selected frequency reference place when the drive is controlled from the I/O terminal and reference place B is active (DIN6=closed).

Table 131: Selections for parameter ID343

Selection number	Selection name	Description
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	Keypad reference (parameter R3.2)	
5	Reference from Fieldbus (FBSpeedReference)	
6	Motor potentiometer reference	
7	PID controller reference	

Select actual value (parameter ID333 to ID339) and the PID control reference (parameter ID332). If value 6 is selected for this parameter in Application 5, the values of parameters ID319 and ID301 are automatically set to 13.

In Application 7, the functions Motorpotentiometer DOWN and Motorpotentiometer UP must be connected to digital inputs (parameters ID417 and ID418), if value 6 is selected for this parameter.

344 REFERENCE SCALING MINIMUM VALUE, PLACE B 57 (2.2.35, 2.2.1.18)

345 REFERENCE SCALING MAXIMUM VALUE, PLACE B 57 (2.2.36, 2.2.1.19)

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.

In figures below, input AI1 with signal range 0-100% is selected for Place B reference.

NOTE!

This scaling does not affect the fieldbus reference (scaled between Minimum frequency (parameter ID101) and Maximum frequency (parameter ID102).

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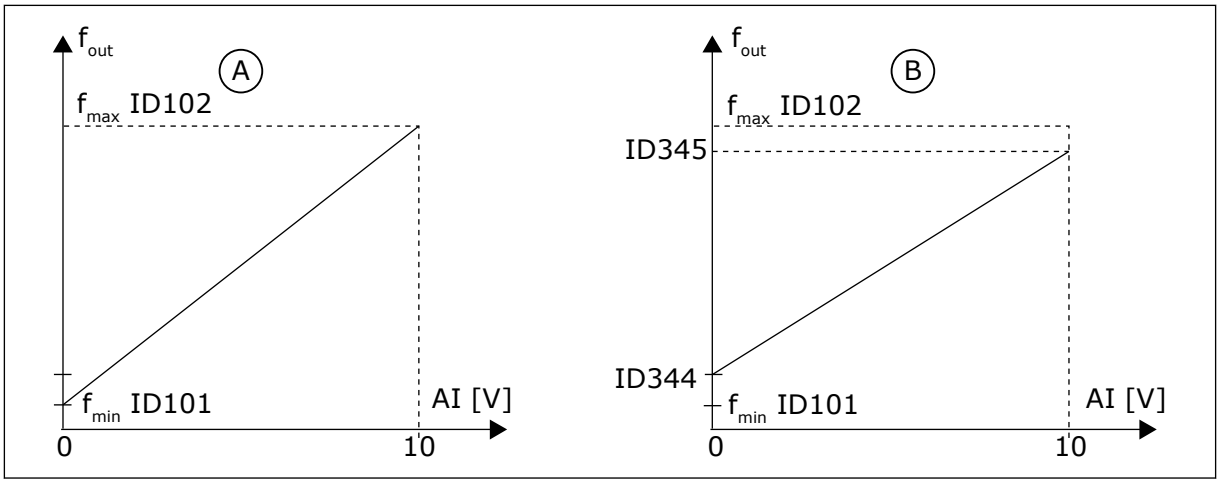

Fig. 47: Reference scaling maximum value

A. Par. ID344=0 (No reference scaling) B. Reference scaling

346 OUTPUT FREQ. LIMIT 2 SUPERVISION FUNCTION 34567 (2.3.12, 2.3.4.3, 2.3.2.3)

Table 132: Selections for parameter ID346

Selection number	Selection name	Description
0	No supervision	
1	Low limit supervision	
2	High limit supervision	
3	Brake-on control	(Application 6 only, see Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*.)
4	Brake-on/off control	(Application 6 only, see Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*.)

If the output frequency goes under/over the set limit (ID347) this function generates a warning message through a digital output depending on

1. the settings of parameters ID312 to ID314 (applications 3,4,5) or
2. to which output the supervision signal 2 (ID448) is connected (applications 6 and 7).

Brake control uses different output functions. See parameters ID445 & ID446.

347 OUTPUT FREQUENCY LIMIT 2 SUPERVISION VALUE 34567 (2.3.13, 2.3.4.4, 2.3.2.4)

Selects the frequency value supervised by parameter ID346. See *Fig. 40 Output frequency supervision*.

348 TORQUE LIMIT, SUPERVISION FUNCTION 34567 (2.3.14, 2.3.4.5, 2.3.2.5)

Table 133: Selections for parameter ID348

Selection number	Selection name	Description
0	No supervision	
1	Low limit supervision	
2	High limit supervision	
3	Brake-off control	(Application 6 only, see Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*.)

If the calculated torque value falls below or exceeds the set limit (ID349) this function generates a message through a digital output depending on

1. the settings of parameters ID312 to ID314 (applications 3,4,5) or
2. to which output the torque limit supervision signal (parameter ID451) is connected (applications 6 and 7).

349 TORQUE LIMIT, SUPERVISION VALUE 34567 (2.3.15, 2.3.4.6, 2.3.2.6)

Set here the torque value to be supervised by parameter ID348.

APPLICATIONS 3 AND 4:

Torque supervision value can be reduced below the setpoint with external free analogue input signal selection and selected function, see parameters ID361 and ID362.

350 REFERENCE LIMIT, SUPERVISION FUNCTION 34567 (2.3.16, 2.3.4.7, 2.3.2.7)

Table 134: Selections for parameter ID350

Selection number	Selection name	Description
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 through a digital output depending on

1. the settings of parameters ID312 to ID314 (applications 3,4,5) or
2. to which output the reference limit supervision signal (parameter ID449) is connected (applications 6 and 7).

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The supervised reference is the current active reference. It can be place A or B reference depending on DIN6 input, I/O reference, panel reference or fieldbus reference.

351 REFERENCE LIMIT, SUPERVISION VALUE 34567 (2.3.17, 2.3.4.8, 2.3.2.8)

The frequency value to be supervised with the parameter ID350. Give the value in percent of the scale between the minimum and maximum frequencies.

352 EXTERNAL BRAKE-OFF DELAY 34567 (2.3.18, 2.3.4.9, 2.3.2.9)

353 EXTERNAL BRAKE-ON DELAY 34567 (2.3.19, 2.3.4.10, 2.3.2.10)

The function of the external brake can be timed to the start and stop control signals with these parameters. See *Fig. 48 External brake control* and Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*.

The brake control signal can be programmed via the digital output DO1 or via one of the relay outputs RO1 and RO2, see parameters ID312 to ID314 (applications 3,4,5) or ID445 (applications 6 and 7). The brake-on delay is ignored when the unit is reaching a stop state after a rampdown or if stopped by coasting.

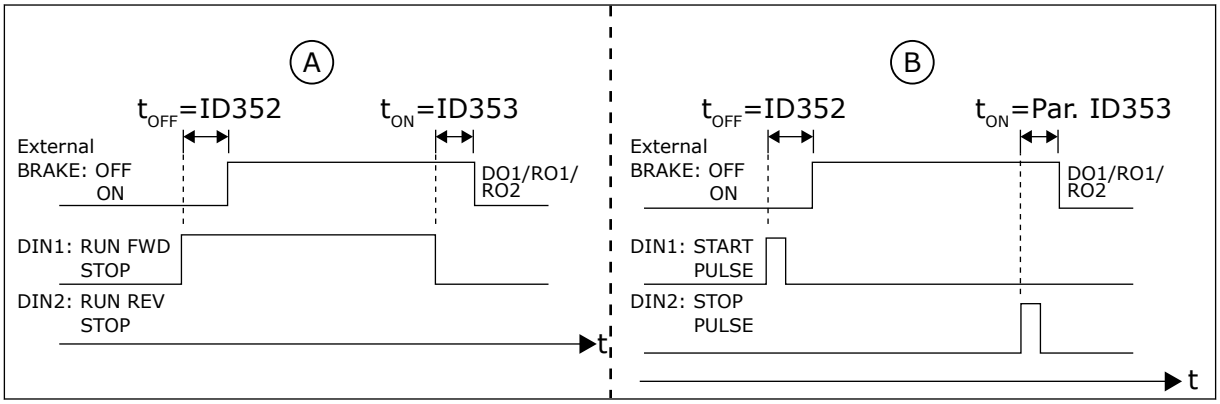

Fig. 48: External brake control

A. Start/Stop logic selection, ID300 = 0, 1 or 2

B. Start/Stop logic selection, ID300= 3

354 FREQUENCY CONVERTER TEMPERATURE LIMIT SUPERVISION 34567 (2.3.20, 2.3.4.11, 2.3.2.11)

Table 135: Selections for parameter ID354

Selection number	Selection name	Description
0	No supervision	
1	Low limit supervision	
2	High limit supervision	

If the temperature of the AC drive unit falls below or exceeds the set limit (ID355), this function generates a message through a digital output depending on

1. the settings of parameters ID312 to ID314 (applications 3,4,5) or
2. to which output the temperature limit supervision signal (parameter ID450) is connected (applications 6 and 7).

355 FREQUENCY CONVERTER TEMPERATURE LIMIT VALUE 34567 (2.3.21, 2.3.4.12, 2.3.2.12)

This temperature value is supervised by parameter ID354.

356 ANALOGUE SUPERVISION SIGNAL 6 (2.3.4.13)

With this parameter you can select the analogue input to be monitored.

Table 136: Selections for parameter ID356

Selection number	Selection name	Description
0	Not used	
1	AI1	
2	AI2	
3	AI3	
4	AI4	

357 ANALOGUE SUPERVISION LOW LIMIT 6 (2.3.4.14)

358 ANALOGUE SUPERVISION HIGH LIMIT 6 (2.3.4.15)

These parameters set the low and high limits of the signal selected with parameter ID356.

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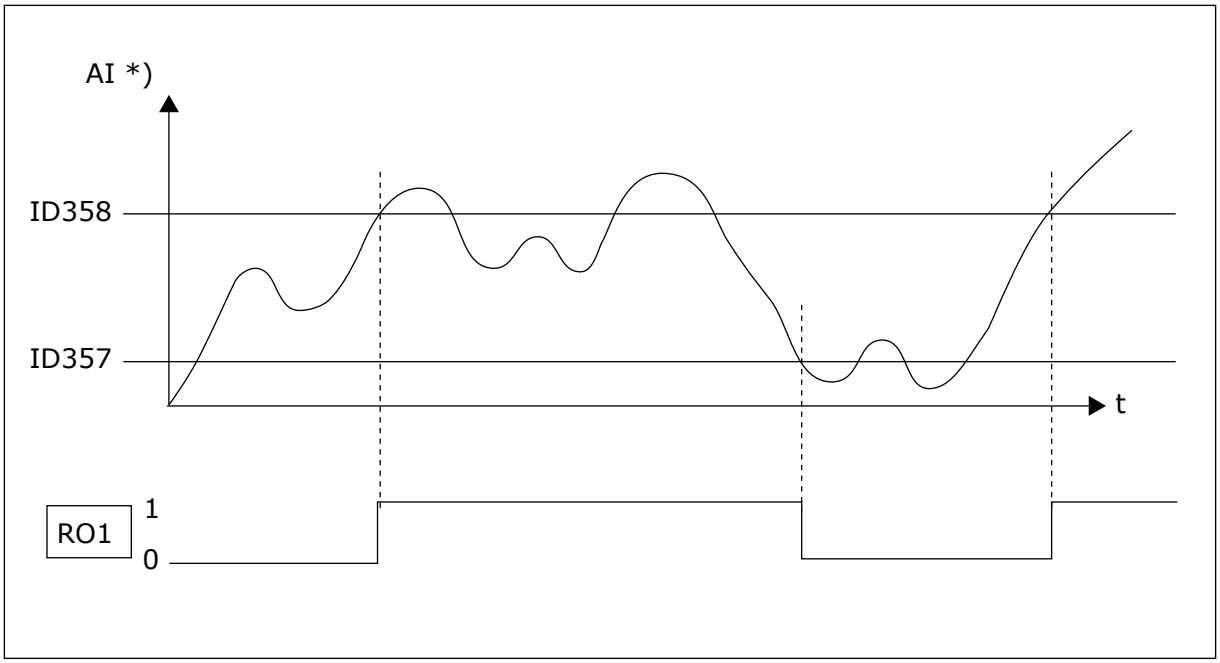

Fig. 49: An example of On/Off-control

*) Selected with par. ID356

NOTE!

In this example the programming of par. ID463 = B.1

359 PID CONTROLLER MINIMUM LIMIT 5 (2.2.30)

360 PID CONTROLLER MAXIMUM LIMIT 5 (2.2.31)

With these parameters you can set the minimum and maximum limits for the PID controller output.

Limit setting: –1600.0% (of f_{max}) < par. ID359 < par. ID360 < 1600.0% (of f_{max}).

These limits are of importance for example when you define the gain, I-time and Dtime for the PID controller.

361 FREE ANALOGUE INPUT, SIGNAL SELECTION 34 (2.2.20, 2.2.17)

Selection of input signal of a free analogue input (an input not used for reference signal):

Table 137: Selections for parameter ID361

Selection number	Selection name	Description
0	Not in use	
1	Analogue input 1 (AI1)	
2	Analogue input 2 (AI2)	

362 FREE ANALOGUE INPUT, FUNCTION 34 (2.2.21, 2.2.18)

This parameter is used for selecting a function for a free analogue input signal:

Table 138: Selections for parameter ID362

Selection number	Selection name	Description
0	Function is not in use	
1	Reduces motor current limit (ID107)	This signal will adjust the maximum motor current between 0 and max. limit set with ID107. See *Fig. 50*.
2	Reduces DC braking current	DC braking current can be reduced with the free analogue input signal between zero current and the current set with the parameter ID507. See *Fig. 51*.
3	Reduces acceleration and deceleration times	Acceleration and deceleration times can be reduced with the free analogue input signal according to the following formulas: Reduced time = set acc./deceler. time (parameters ID103, ID104; ID502, ID503) divided by the factor R in *Fig. 52*.
4	Reduces torque supervision limit	Set supervision limit can be reduced with the free analogue input signal between 0 and set torque limit supervision value (ID349), see *Fig. 53*.

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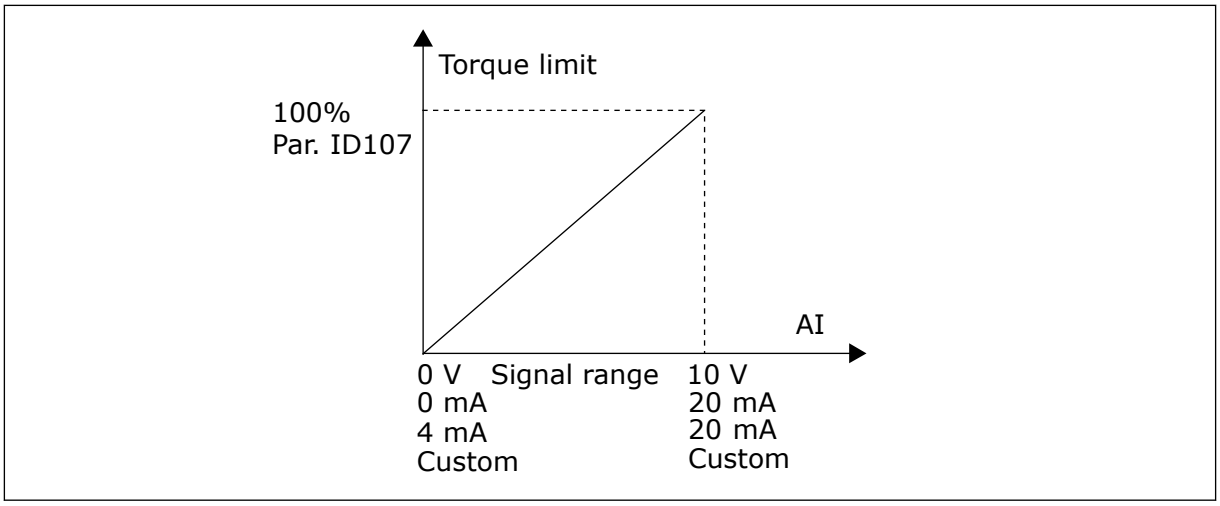

Fig. 50: Scaling of max. motor current

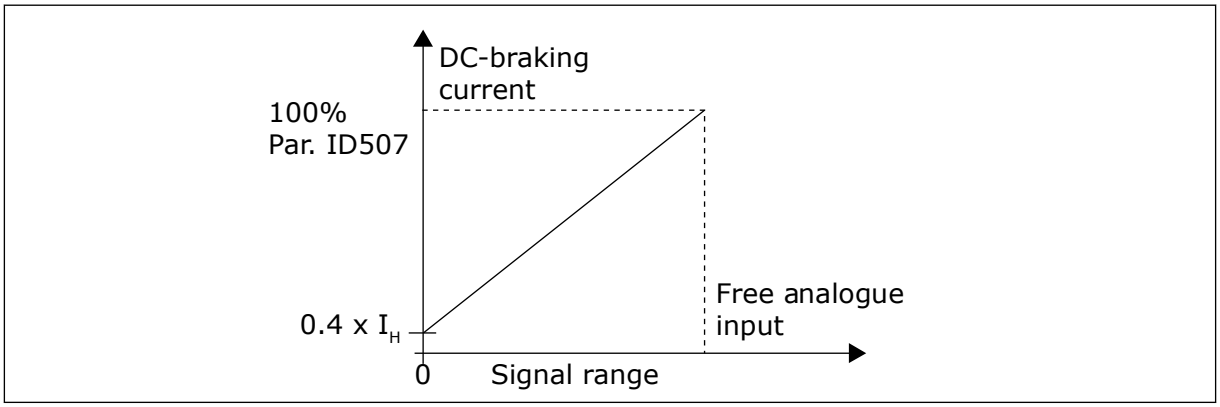

Fig. 51: Reduction of DC braking current

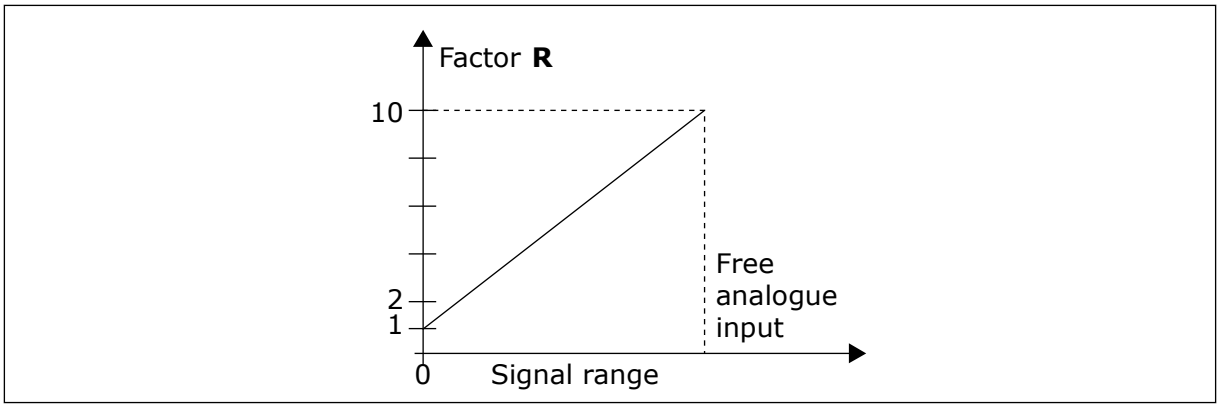

Fig. 52: Reduction of acceleration and deceleration times

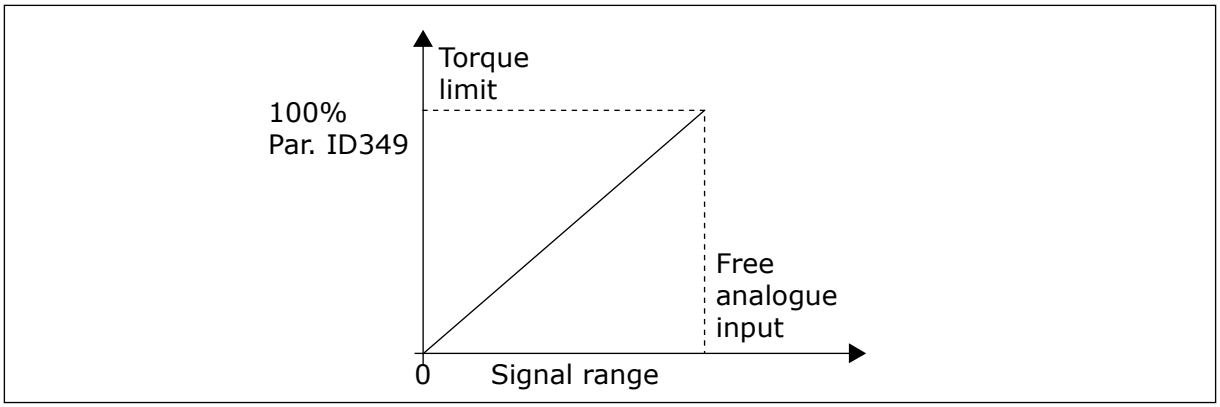

Fig. 53: Reduction of torque supervision limit

363 START/STOP LOGIC SELECTION, PLACE B3 (2.2.15)

Table 139: Selections for parameter ID363

Selection	DIN3	DIN4	DIN5
0		closed contact = start forward	closed contact = start reverse
	See *Fig. 54*.		
1		closed contact = startopen contact = stop	closed contact = reverseopen contact = forward
	See *Fig. 55*.		
2		closed contact = start, open contact = stop	closed contact = start enabled, open contact = start disabled and drive stopped if running
3 *	Can be programmed for reverse command	closed contact= start pulse	open contact = stop pulse
	See *Fig. 56*.		
4 **		closed contact = start forward (Rising edge required to start)	closed contact = start reverse (Rising edge required to start)
5 **		closed contact = start (Rising edge required to start) open contact = stop	closed contact = reverse open contact = forward
6 **		closed contact = start (Rising edge required to start) open contact = stop	closed contact = start enabled open contact = start disabled and drive stopped if running

* = 3-wire connection (pulse control)

** = The 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

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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.

The selections including the text 'Rising edge required to start' 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 from I/O control. The Start/Stop contact must be opened before the motor can be started.

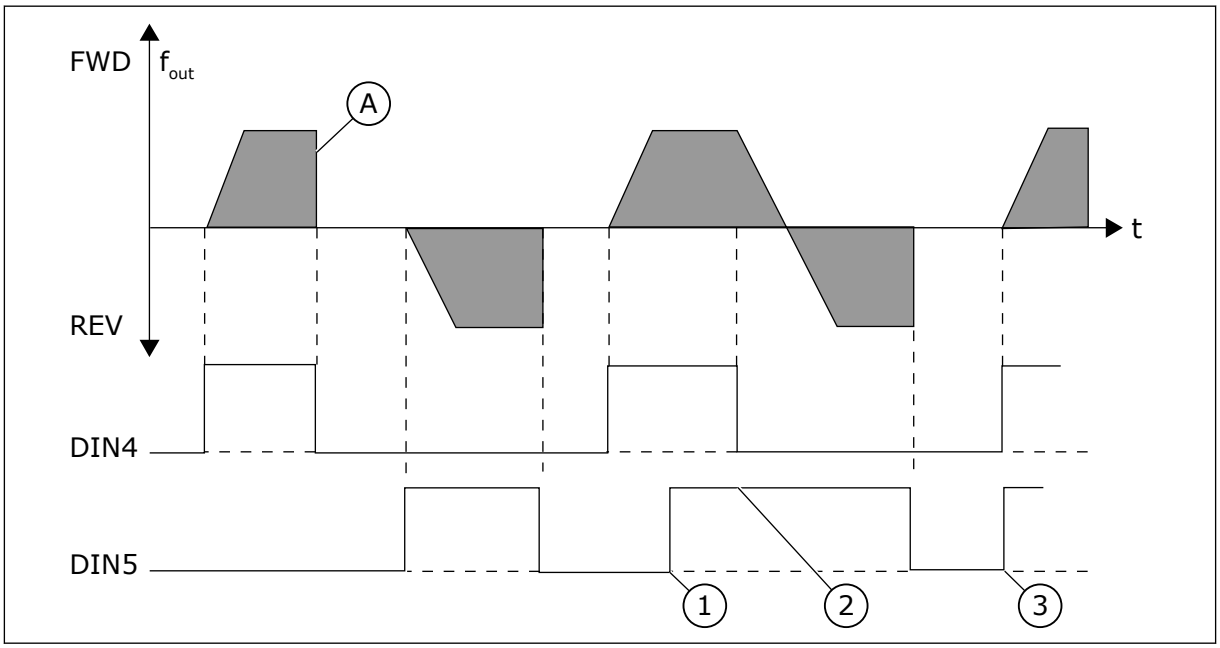

Fig. 54: Start forward/Start reverse

1. The first selected direction has the highest priority.
2. When the DIN4 contact opens the direction of rotation starts the change.
3. Start pulse/ Stop pulse

A) Stop function (ID506) = coasting

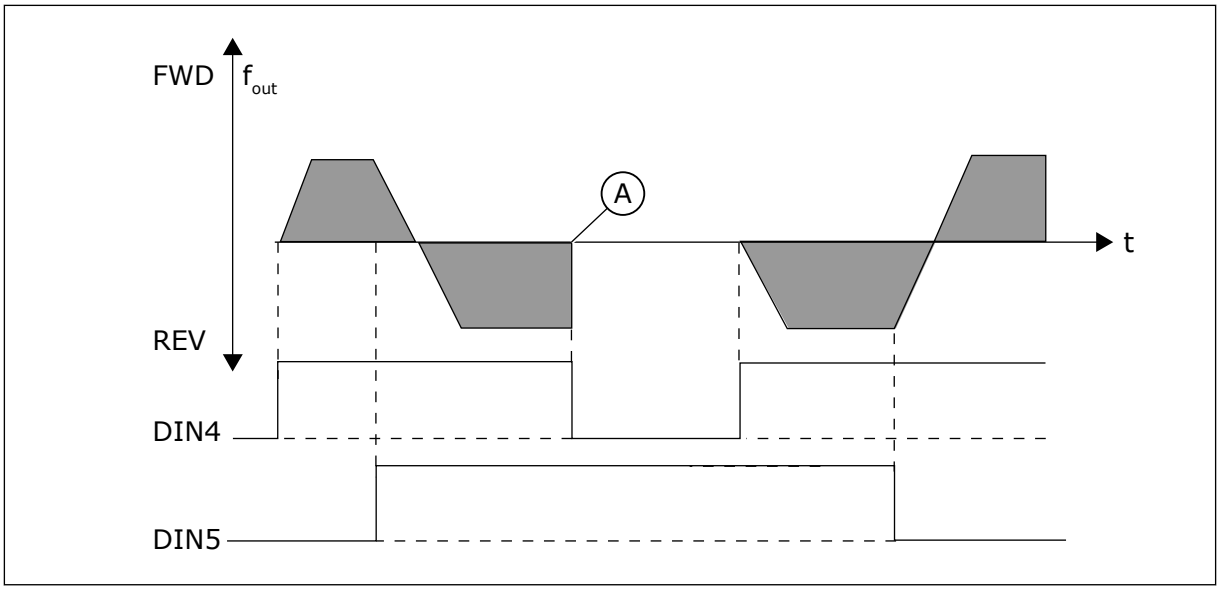

Fig. 55: Start, Stop, Reverse

A) Stop function (ID506) = coasting

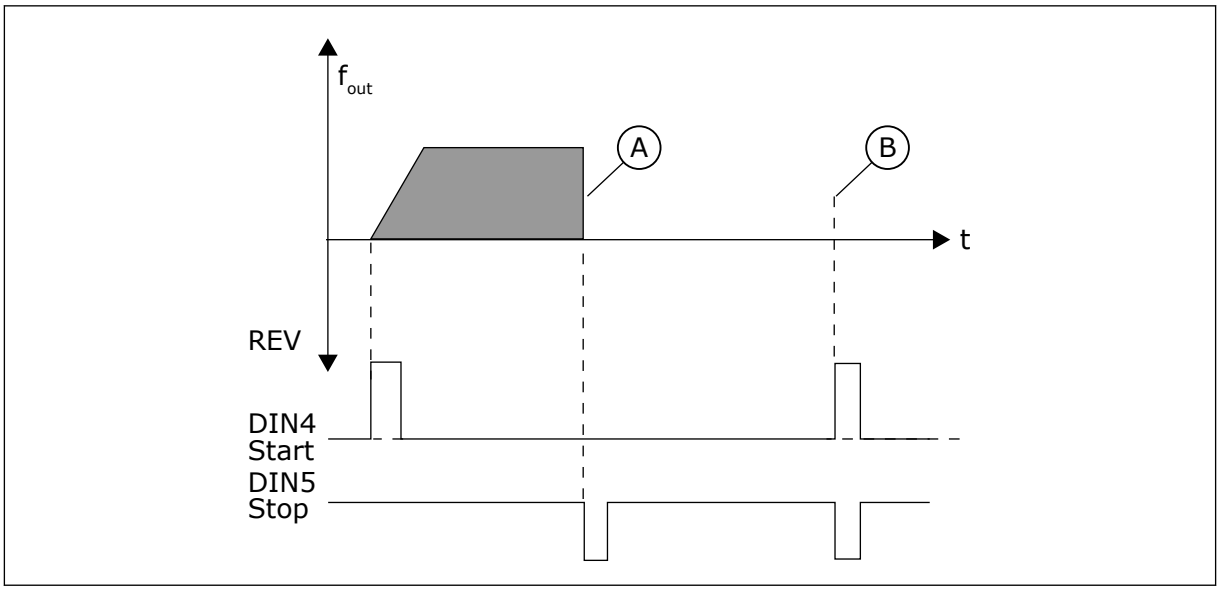

Fig. 56: Start pulse/ Stop pulse

A) Stop function (ID506) = coasting
B) If Start and Stop pulses are simultaneous the Stop pulse overrides the Start pulse

364 REFERENCE SCALING, MINIMUM VALUE, PLACE B3 (2.2.18)

365 REFERENCE SCALING, MAXIMUM VALUE, PLACE B3 (2.2.19)

See parameters ID303 and ID304 above.

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366 EASY CHANGEOVER 5 (2.2.37)

Table 140: Selections for parameter ID366

Selection number	Selection name	Description
0	Keep reference	
1	Copy reference	

If Copy reference has been selected it is possible to switch from direct control to PID control and back without scaling the reference and actual value.

For example: The process is driven with direct frequency reference (Control place I/O B, fieldbus or keypad) to some point and then the control place is switched to one where the PID controller is selected. The PID control starts to maintain that point.

It is also possible to change the control source back to direct frequency control. In this case, the output frequency is copied as the frequency reference. If the destination place is Keypad the run status (Run/Stop, Direction and Reference) will be copied.

The changeover is smooth when the reference of the destination source comes from the Keypad or an internal motor potentiometer (parameter ID332 [PID Ref.] = 2 or 4, ID343 [I/O B Ref] = 2 or 4, par. ID121 [Keypad Ref] = 2 or 4 and ID122 [Fieldbus Ref]= 2 or 4.

367 MOTOR POTENTIOMETER MEMORY RESET (FREQUENCY REFERENCE) 3567 (2.2.23, 2.2.28, 2.2.1.3, 2.2.1.16)

Table 141: Selections for parameter ID367

Selection number	Selection name	Description
0	No reset	
1	Memory reset in stop and powerdown	
2	Memory reset in powerdown	

370 MOTOR POTENTIOMETER MEMORY RESET (PID REFERENCE) 57 (2.2.29, 2.2.1.17)

Table 142: Selections for parameter ID370

Selection number	Selection name	Description
0	No reset	
1	Memory reset in stop and powerdown	
2	Memory reset in powerdown	

371 PID REFERENCE 2 (PLACE A ADDITIONAL REFERENCE) 7 (2.2.1.4)

If the PID reference 2 enable input function (ID330)= TRUE, this parameter defines which reference place is selected as PID controller reference.

Table 143: Selections for parameter ID371

Selection number	Selection name	Description
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)	see Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*
6	Motor potentiometer	If value 6 is selected for this parameter, the functions Motor potentiometer DOWN and Motor potentiometer UP must be connected to digital inputs (parameters ID417 and ID418).
7	PID reference 2 from keypad	

372 SUPERVISED ANALOGUE INPUT 7 (2.3.2.13)

Table 144: Selections for parameter ID372

Selection number	Selection name	Description
0	Analogue input 1 (AI1)	
1	Analogue input 2 (AI2)	

373 ANALOGUE INPUT LIMIT SUPERVISION 7 (2.3.2.14)

If the value of the selected analogue input goes under/over the set supervision value (parameter ID374) this function generates a message through the digital output or the relay outputs depending on to which output the analogue input supervision function (parameter ID463) is connected.

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Table 145: Selections for parameter ID373

Selection number	Selection name	Description
0	No supervision	
1	Low limit supervision	
2	High limit supervision	

374 ANALOGUE INPUT SUPERVISED VALUE 7 (2.3.2.15)

The value of the selected analogue input to be supervised by parameter ID373.

375 ANALOGUE OUTPUT OFFSET 67 (2.3.5.7, 2.3.3.7)

Add –100.0 to 100.0% to the analogue output signal.

376 PID SUM POINT REFERENCE (PLACE A DIRECT REFERENCE) 5 (2.2.4)

Defines which reference source is added to PID controller output if PID controller is used.

Table 146: Selections for parameter ID376

Selection number	Selection name	Description
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	
6	PID output + Fieldbus + PID output (ProcessDataIN3)	see Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*
7	PID output + Motor potentiometer	

If value 7 is selected for this parameter, the values of parameters ID319 and ID301 are automatically set to 13.

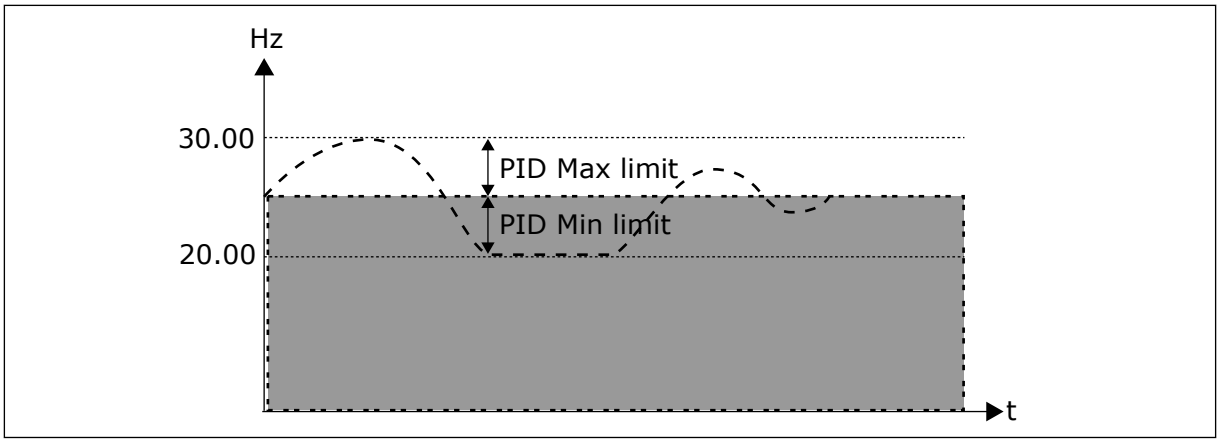

Fig. 57: PID sum point reference

NOTE!

The maximum and minimum limits illustrated in the picture limit only the PID output, no other outputs.

377 AI1 SIGNAL SELECTION * 234567 (2.2.8, 2.2.3, 2.2.15, 2.2.2.1)

Connect the AI1 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see Chapter *8.9 "Terminal to function" (TTF) programming principle*.

384 AI1 JOYSTICK HYSTERESIS 6 (2.2.2.8)

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. It depends on the amount of joystick hysteresis defined with this parameter, how much the joystick/potentiometer must be turned to start the increase of the frequency towards the selected maximum frequency.

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.

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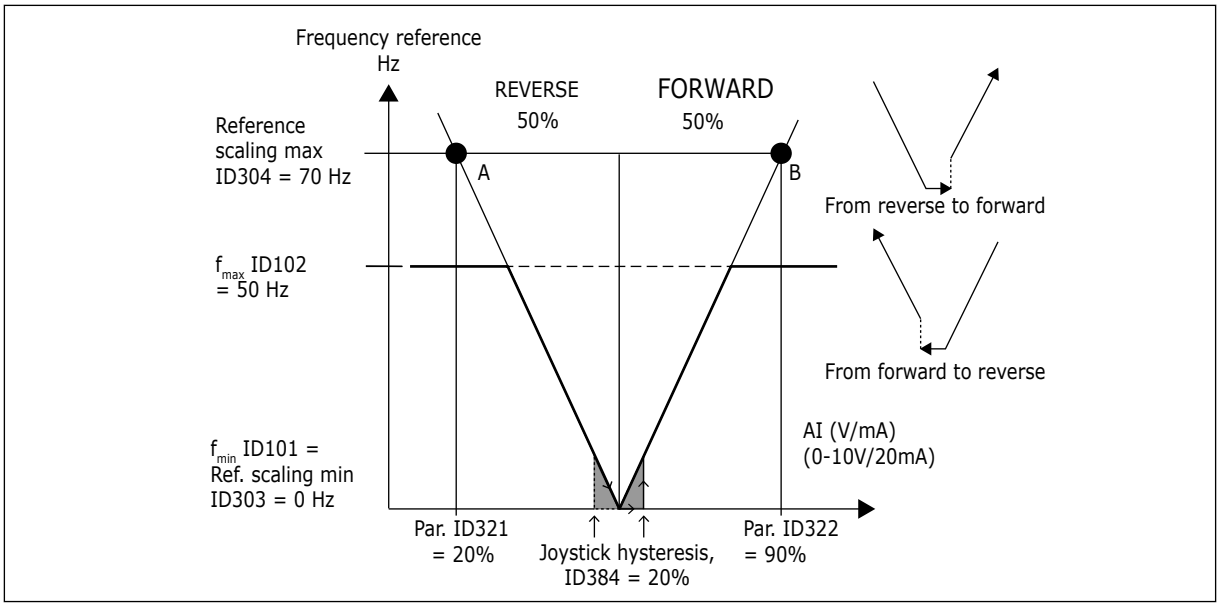

Fig. 58: An example of joystick hysteresis. In this example, the value of parameter ID385 (Sleep limit) = 0

385 AI1 SLEEP LIMIT 6 (2.2.2.9)

The AC drive is stopped if the AI signal level falls below the Sleep limit defined with this parameter. See also parameter ID386 and *Fig. 59*.

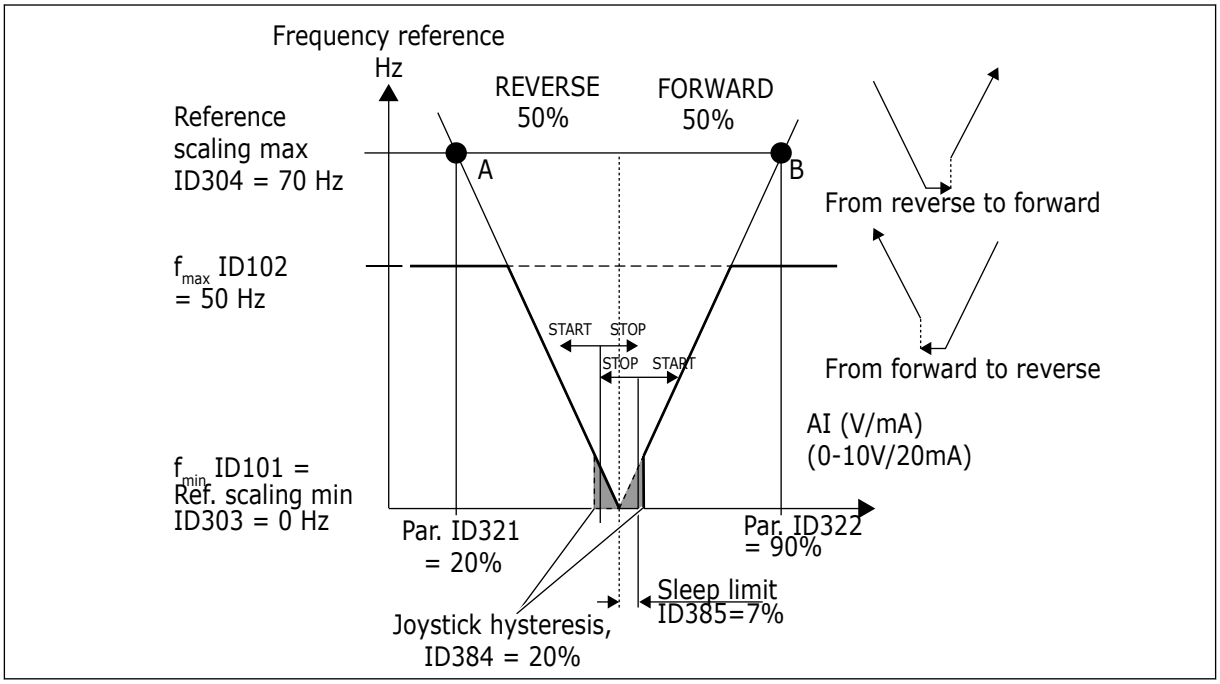

Fig. 59: Example of sleep limit function

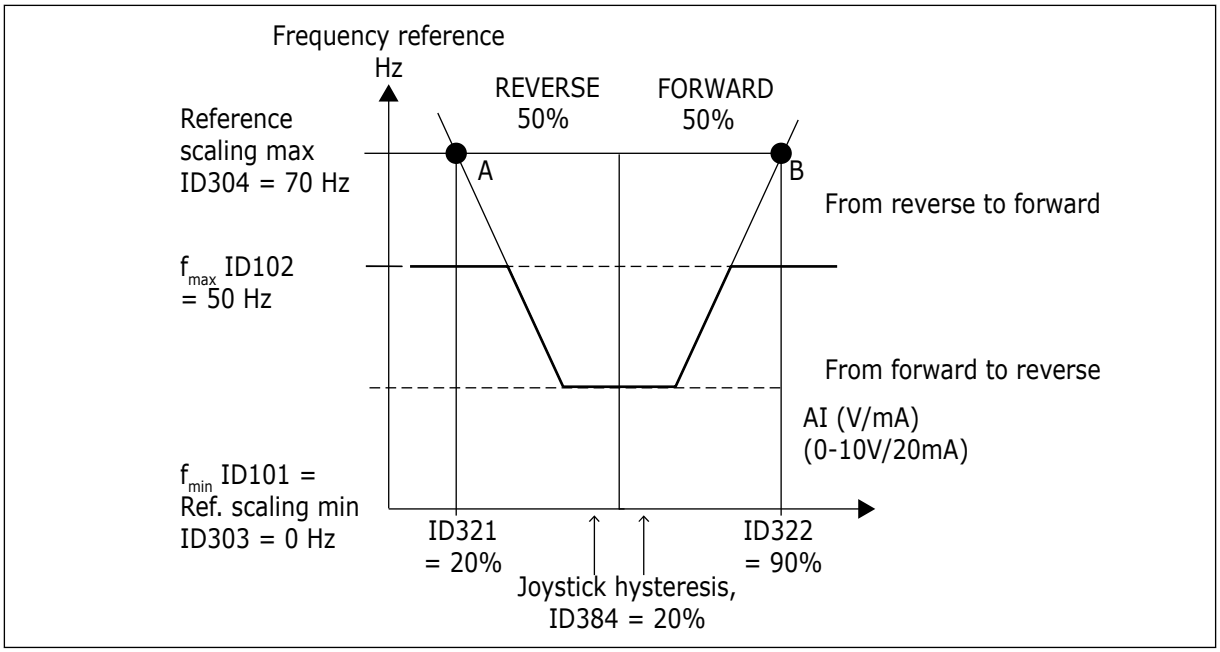

Fig. 60: Joystick hysteresis with minimum frequency at 35Hz

386 AI1 SLEEP DELAY 6 (2.2.2.10)

This parameter defines the time the analogue input signal has to stay under the sleep limit determined with parameter ID385 in order to stop the AC drive.

388 AI2 SIGNAL SELECTION * 234567 (2.2.9, 2.2.21, 2.2.3.1)

Connect the AI2 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see Chapter *8.9 "Terminal to function" (TTF) programming principle*.

393 AI2 REFERENCE SCALING, MINIMUM VALUE 6 (2.2.3.6)

394 AI2 REFERENCE SCALING, MAXIMUM VALUE 6 (2.2.3.7)

Additional reference scaling. If the values of both ID393 and ID394 are zero scaling is set off. The minimum and maximum frequencies are used for scaling. See parameters ID303 and ID304

395 AI2 JOYSTICK HYSTERESIS 6 (2.2.3.8)

This parameter defines the joystick dead zone between 0 and 20%. See ID384.

396 AI2 SLEEP LIMIT 6 (2.2.3.9)

The AC drive is stopped if the AI signal level falls below the Sleep limit defined with this parameter. See also parameter ID397 and *Fig. 60 Joystick hysteresis with minimum frequency at 35Hz*.

See ID385.

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397 AI2 SLEEP DELAY 6 (2.2.3.10)

This parameter defines the time the analogue input signal has to stay under the sleep limit determined with parameter AI2 sleep limit (ID396) in order to stop the AC drive.

399 SCALING OF CURRENT LIMIT 6 (2.2.6.1)

Table 147: Selections for parameter ID399

Selection number	Selection name	Description
0	Not used	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	Fieldbus (FBProcessDataIN2)	See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859).*

This signal will adjust the maximum motor current between 0 and Motor current limit (ID107).

400 SCALING OF DC-BRAKING CURRENT 6 (2.2.6.2)

See parameter ID399 for the selections.

DC-braking current can be reduced with the free analogue input signal between zero current and the current set with parameter ID507.

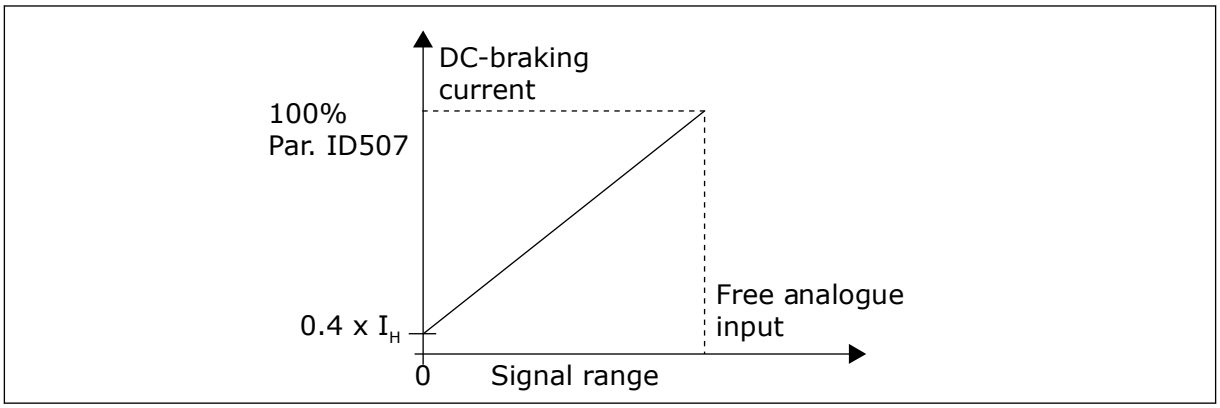

Fig. 61: Scaling of DC-braking current

401 SCALING OF ACCELERATION AND DECELERATION TIMES 6 (2.2.6.3)

See parameter ID399.

Acceleration and deceleration times can be reduced with the free analogue input signal according to the following formulas:

Reduced time = set acc./deceler. time (parameters ID103, ID104; ID502, ID503) divided by the factor R from *Fig. 62*.

Analogue input level zero corresponds to ramp times set by parameters. Maximum level means a tenth of value set by parameter.

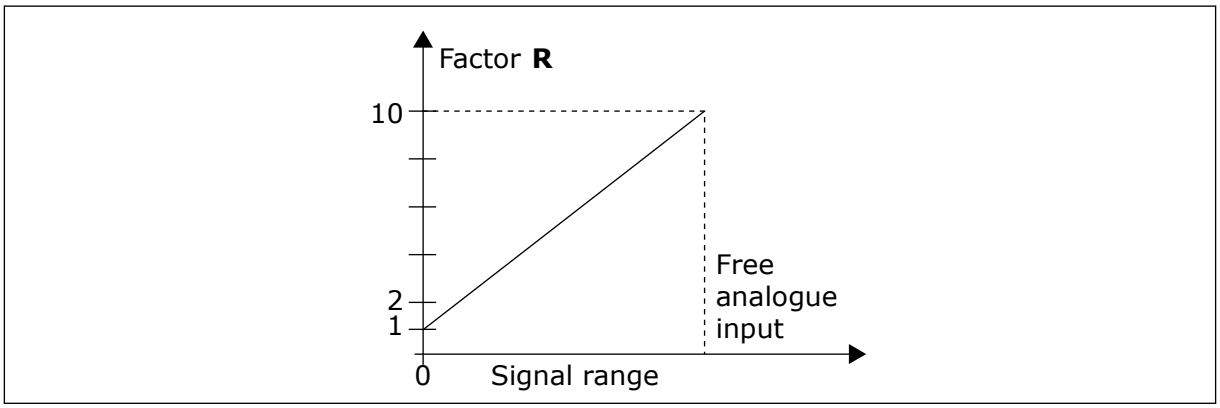

Fig. 62: Reducing of acceleration and deceleration times

402 SCALING OF TORQUE SUPERVISION LIMIT 6 (2.2.6.4)

See ID399.

The set torque supervision limit can be reduced with the free analogue input signal between 0 and the set supervision limit, ID349.

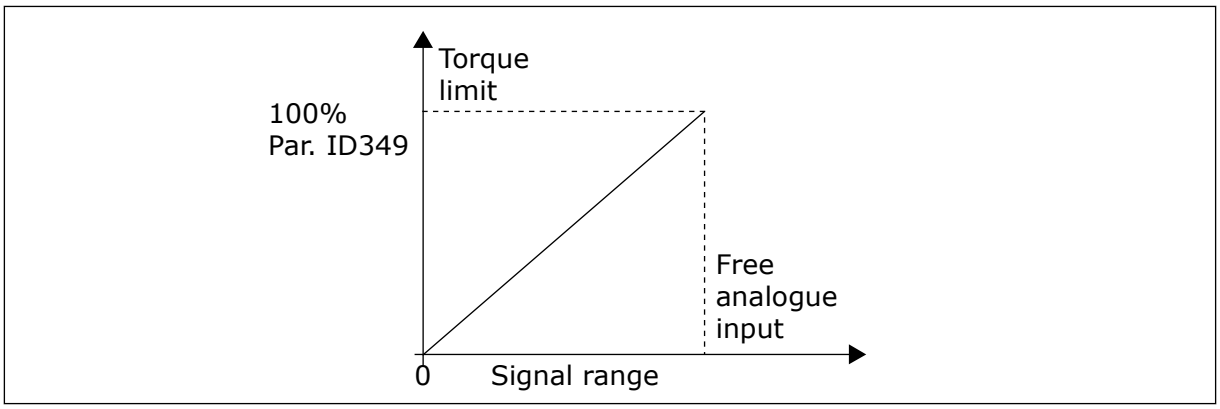

Fig. 63: Reducing torque supervision limit

403 START SIGNAL * 16 (2.2.7.1)

Signal selection 1 for the start/stop logic.

Default programming A.1.

404 START SIGNAL * 26 (2.2.7.2)

Signal selection 2 for the start/stop logic.

Default programming A.2.

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*405 EXTERNAL FAULT (CLOSE) * 67 (2.2.7.11, 2.2.6.4)*

Contact closed:Fault (F51) is displayed and motor stopped.

*406 EXTERNAL FAULT (OPEN) * 67 (2.2.7.12, 2.2.6.5)*

Contact open:Fault (F51) is displayed and motor stopped.

*407 RUN ENABLE * 67 (2.2.7.3, 2.2.6.6)*

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

To stop, the drive obeys the value of parameter ID506. The follower drive will always coast to stop.

*408 ACCELERATION/DECELERATION TIME SELECTION * 67 (2.2.7.13, 2.2.6.7)*

When the contact is OPEN, the Acceleration/Deceleration time 1 selected
When the contact is CLOSED, the Acceleration/Deceleration time 2 selected

Set Acceleration/Deceleration times with parameters ID103 and ID104 and the alternative ramp times with ID502 and ID503.

*409 CONTROL FROM I/O TERMINAL * 67 (2.2.7.18, 2.2.6.8)*

Contact closed:Force control place to I/O terminal

This input has priority over parameters ID410 and ID411.

*410 CONTROL FROM KEYPAD * 67 (2.2.7.19, 2.2.6.9)*

Contact closed:Force control place to keypad

This input has priority over parameter ID411 but preceded in priority by ID409.

*411 CONTROL FROM FIELDBUS * 67 (2.2.7.20, 2.2.6.10)*

Contact closed:Force control place to fieldbus

This input is preceded in priority by parameters ID409 and ID410.

NOTE!

When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used.
The value of parameter ID125 (Keypad Control Place) does not change.

When the input opens the control place is selected according to keypad control parameter ID125.

412 REVERSE * 67 (2.2.7.4, 2.2.6.11)

Contact open: Direction forward
Contact closed: Direction reverse

This command is active when Start signal 2 (ID404) is used for other purposes.

413 JOGGING SPEED * 67 (2.2.7.16, 2.2.6.12)

Contact closed: Jogging speed selected for frequency reference

See parameter ID124.

Default programming: A.4.

414 FAULT RESET * 67 (2.2.7.10, 2.2.6.13)

CLOSED = Resets all active faults.

415 ACCELERATION /DECELERATION PROHIBITED * 67 (2.2.7.14, 2.2.6.14)

No acceleration or deceleration is possible until the contact is open.

416 DC-BRAKING * 67 (2.2.7.15, 2.2.6.15)

Contact closed:In STOP mode, the DC braking operates until the contact is opened.

See ID1080.

417 MOTOR POTENTIOMETER DOWN * 67 (2.2.7.8, 2.2.6.16)

Contact closed: Motor potentiometer reference DECREASES until the contact is opened.

418 MOTOR POTENTIOMETER UP * 67 (2.2.7.9, 2.2.6.17)

Contact closed:Motor potentiometer reference INCREASES until the contact is opened.

419 PRESET SPEED * 16 (2.2.7.5)

420 PRESET SPEED * 26 (2.2.7.6)

421 PRESET SPEED * 36 (2.2.7.7)

Digital input selections for activating the preset speeds.

422 AI1/AI2 SELECTION * 6 (2.2.7.17)

With value 14 selected for parameter ID117, this parameter allows you to select either AI1 or AI2 signal for the frequency reference.

423 START A SIGNAL * 7 (2.2.6.1)

Start command from control place A.

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Default programming: A.1

424 START B SIGNAL * 7 (2.2.6.2)

Start command from control place B.

Default programming: A.4

425 CONTROL PLACE A/B SELECTION * 7 (2.2.6.3)

Contact open:Control place A
Contact closed:Control place B

Default programming: A.6

426 AUTOCHANGE 1 INTERLOCK * 7 (2.2.6.18)

Contact closed:Interlock of autochange drive 1 or auxiliary drive 1 activated.

Default programming: A.2.

427 AUTOCHANGE 2 INTERLOCK * 7 (2.2.6.19)

Contact closed:Interlock of autochange drive 2 or auxiliary drive 2 activated.

Default programming: A.3.

428 AUTOCHANGE 3 INTERLOCK * 7 (2.2.6.20)

Contact closed:Interlock of autochange drive 3 or auxiliary drive 3 activated.

429 AUTOCHANGE 4 INTERLOCK 7 (2.2.6.21)

Contact closed:Interlock of autochange drive 4 or auxiliary drive 4 activated.

430 AUTOCHANGE 5 INTERLOCK * 7 (2.2.6.22)

Contact closed:Interlock of autochange drive 5 activated.

431 PID REFERENCE * 27 (2.2.6.23)

Contact open: PID controller reference selected with parameter ID332.
Contact closed: PID controller keypad reference 2 selected with parameter ID371.

432 READY * 67 (2.3.3.1, 2.3.1.1)

The AC drive is ready to operate.

433 RUN * 67 (2.3.3.2, 2.3.1.2)

The AC drive operates.

434 FAULT * 67 (2.3.3.3, 2.3.1.3)

A fault trip has occurred.

435 INVERTED FAULT * 67 (2.3.3.4, 2.3.1.4)

No fault trip has occurred.

436 WARNING * 67 (2.3.3.5, 2.3.1.5)

General warning signal.

437 EXTERNAL FAULT OR WARNING * 67 (2.3.3.6, 2.3.1.6)

Fault or warning depending on parameter ID701.

438 REFERENCE FAULT OR WARNING * 67 (2.3.3.7, 2.3.1.7)

Fault or warning depending on parameter ID700.

439 DRIVE OVERTEMPERATURE WARNING * 67 (2.3.3.8, 2.3.1.8)

The heatsink temperature exceeds the warning limit.

440 REVERSE * 67 (2.3.3.9, 2.3.1.9)

The Reverse command has been selected.

441 UNREQUESTED DIRECTION * 67 (2.3.3.10, 2.3.1.10)

Motor rotation direction is different from the requested one.

442 AT SPEED * 67 (2.3.3.11, 2.3.1.11)

The output frequency has reached the set reference.

Hysteresis is equal to motor nominal slip with induction motors and to 1.00 Hz with PMS motors.

443 JOGGING SPEED * 67 (2.3.3.12, 2.3.1.12)

Jogging speed selected.

444 I/O CONTROL PLACE ACTIVE * 67 (2.3.3.13, 2.3.1.13)

I/O terminal is the active contol place.

445 EXTERNAL BRAKE CONTROL * 67 (2.3.3.14, 2.3.1.14)

External brake ON/OFF control. See Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)* for details.

Example: RO1 on OPTA2 board:

Brake function ON: Terminals 22-23 are closed (relay is energized).
Brake function OFF: Terminals 22-23 are open (relay not energized).

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NOTE!

When power from control board is removed terminals 22-23 open.

When using the Master Follower function, the follower drive will open the brake at the same time as the Master does even if the Follower's conditions for brake opening have not been met.

446 EXTERNAL BRAKE CONTROL, INVERTED * 67 (2.3.3.15, 2.3.1.15)

External brake ON/OFF control. See Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)* for details.

Example: RO1 on OPTA2 board:

Brake function ON: Terminals 22-23 are open (relay not energized).
Brake function OFF: Terminals 22-23 are closed (relay is energized).

When using the Master Follower function, the follower drive will open the brake at the same time as the Master does even if the Follower's conditions for brake opening have not been met.

447 OUTPUT FREQUENCY LIMIT 1 SUPERVISION * 67 (2.3.3.16, 2.3.1.16)

The output frequency goes outside the set supervision low limit/high limit (see parameters ID315 and ID316).

448 OUTPUT FREQUENCY LIMIT 2 SUPERVISION * 67 (2.3.3.17, 2.3.1.17)

The output frequency goes outside the set supervision low limit/high limit (see parameters ID346 and ID347).

449 REFERENCE LIMIT SUPERVISION * 67 (2.3.3.18, 2.3.1.18)

Active reference goes beyond the set supervision low limit/high limit (see parameters ID350 and ID351).

450 TEMPERATURE LIMIT SUPERVISION * 67 (2.3.3.19, 2.3.1.19)

The AC drive heatsink temperature goes beyond the set supervision limits (see parameters ID354 and ID355).

451 TORQUE LIMIT SUPERVISION * 67 (2.3.3.20, 2.3.1.20)

The motor torque goes beyond the set supervision limits (see parameters ID348 and ID349).

452 THERMISTOR FAULT OR WARNING * 67 (2.3.3.21, 2.3.1.21)

Motor thermistor initiates a overtemperature signal which can be led to a digital output.

NOTE!

This function requires a converter equipped with a thermistor input.

454 MOTOR REGULATOR ACTIVATION * 67 (2.3.3.23, 2.3.1.23)

One of the limit regulators (current limit, torque limit) has been activated.

455 FIELDBUS DIGITAL INPUT 1 * 67 (2.3.3.24, 2.3.1.24)

456 FIELDBUS DIGITAL INPUT 2 * 67 (2.3.3.25, 2.3.1.25)

457 FIELDBUS DIGITAL INPUT 3 * 67 (2.3.3.26, 2.3.1.26)

The data from the fieldbus (Fieldbus Control Word) can be led to AC drive digital outputs. See the fieldbus manual for details. See also ID169 and ID170.

458 AUTOCHANGE 1/AUXILIARY DRIVE 1 CONTROL 7 (2.3.1.27)

Control signal for autochange/auxiliary drive 1.

Default programming: B.1

459 AUTOCHANGE 2/AUXILIARY DRIVE 2 CONTROL * 7 (2.3.1.28)

Control signal for autochange/auxiliary drive 2.

Default programming: B.2

460 AUTOCHANGE 3/AUXILIARY DRIVE 3 CONTROL * 7 (2.3.1.29)

Control signal for autochange/auxiliary drive 3. If three (or more) auxiliary drives are used, we recommend to connect nr 3, too, to a relay output. 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. Vacon OPTB5).

461 AUTOCHANGE 4/AUXILIARY DRIVE 4 CONTROL * 7 (2.3.1.30)

Control signal for autochange/auxiliary drive 4. If three (or more) auxiliary drives are used, we recommend to connect nr 3 and 4, too, to a relay output. 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. Vacon OPTB5).

462 AUTOCHANGE 5 CONTROL * 7 (2.3.1.31)

Control signal for autochange drive 5.

463 ANALOGUE INPUT SUPERVISION LIMIT * 67 (2.3.3.22, 2.3.1.22)

The selected analogue input signal goes beyond the set supervision limits (see parameters ID372, ID373 and ID374).

464 ANALOGUE OUTPUT 1 SIGNAL SELECTION * 234567 (2.3.1, 2.3.5.1, 2.3.3.1)

Connect the AO1 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see Chapter *8.9 "Terminal to function" (TTF) programming principle*.

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471 ANALOGUE OUTPUT 2 SIGNAL SELECTION * 234567 (2.3.12, 2.3.22, 2.3.6.1, 2.3.4.1)

Connect the AO2 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see Chapter *8.9 "Terminal to function" (TTF) programming principle*.

472 ANALOGUE OUTPUT 2 FUNCTION 234567 (2.3.13, 2.3.23, 2.3.6.2, 2.3.4.2)

472 ANALOGUE OUTPUT 2 FILTER TIME 234567 (2.3.13, 2.3.23, 2.3.6.3, 2.3.4.3)

474 ANALOGUE OUTPUT 2 INVERSION 234567 (2.3.15, 2.3.25, 2.3.6.4, 2.3.4.4)

475 ANALOGUE OUTPUT 2 MINIMUM 234567 (2.3.16, 2.3.26, 2.3.6.5, 2.3.4.5)

476 ANALOGUE OUTPUT 2 SCALING 234567 (2.3.17, 2.3.27, 2.3.6.6, 2.3.4.6)

For more information on these five parameters, see the corresponding parameters for the analogue output 1 (IDs 307-311).

477 ANALOGUE OUTPUT 2 OFFSET 67 (2.3.6.7, 2.3.4.7)

Add –100.0 to 100.0% to the analogue output.

478 ANALOGUE OUTPUT 3, SIGNAL SELECTION * 67 (2.3.7.1, 2.3.5.1)

See ID464.

479 ANALOGUE OUTPUT 3, FUNCTION 67 (2.3.7.2, 2.3.5.2)

This parameter selects the desired function for the analogue output signal. See ID307.

480 ANALOGUE OUTPUT 3, FILTER TIME 67 (2.3.7.3, 2.3.5.3)

Defines the filtering time of the analogue output signal. Setting this parameter value 0 will deactivate filtering. See ID308.

481 ANALOGUE OUTPUT 3 INVERSION 67 (2.3.7.4, 2.3.5.4)

Inverts the analogue output signal. See ID309.

482 ANALOGUE OUTPUT 3 MINIMUM 67 (2.3.7.5, 2.3.5.5)

Defines the signal minimum to either 0 mA or 4 mA (living zero). See ID310.

483 ANALOGUE OUTPUT 3 SCALING 67 (2.3.7.6, 2.3.5.6)

Scaling factor for analogue output. Value 200% will double the output. See ID311.

484 ANALOGUE OUTPUT 3 OFFSET 67 (2.3.7.7, 2.3.5.7)

Add –100.0 to 100.0% to the analogue output signal. See ID375.

485 SCALING OF MOTORING TORQUE LIMIT 6 (2.2.6.5)

Table 148: Selections for parameter ID485

Selection number	Selection name	Description
0	Not used	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	Fieldbus (FBProcessDataIN2)	See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*

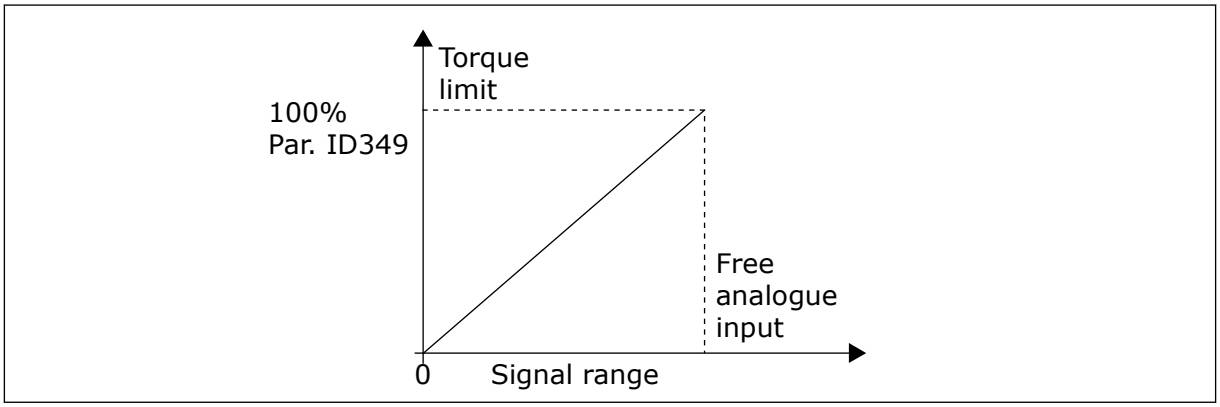

Fig. 64: Scaling of motoring torque limit

*486 DIGITAL OUTPUT 1 SIGNAL SELECTION * 6 (2.3.1.1)*

Connect the delayed DO1 signal to the digital output of your choice with this parameter. For more information about the TTF programming method, see Chapter *8.9 "Terminal to function" (TTF) programming principle*. Digital output function can be inverted by Control options, parameter ID1084.

487 DIGITAL OUTPUT 1 ON-DELAY (2.3.1.3)

488 DIGITAL OUTPUT 1 OFF-DELAY 6 (2.3.1.4)

With these parameters you can set on- and off-delays to digital outputs.

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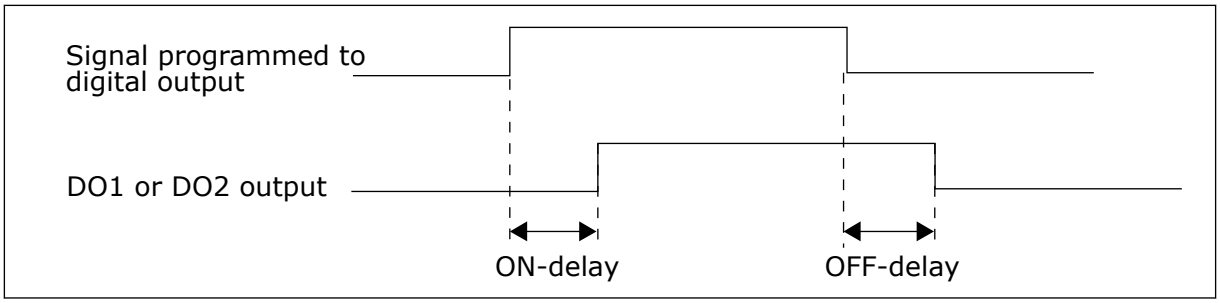

Fig. 65: Digital outputs 1 and 2, on- and off-delays

489 DIGITAL OUTPUT 2 SIGNAL SELECTION * 6 (2.3.2.1)

See ID486.

490 DIGITAL OUTPUT 2 FUNCTION 6 (2.3.2.2)

See ID312.

491 DIGITAL OUTPUT 2 ON-DELAY 6 (2.3.2.3)

492 DIGITAL OUTPUT 2 OFF-DELAY 6 (2.3.2.4)

With these parameters you can set on and off delays for the digital outputs.

See parameters ID487 and ID488.

493 ADJUST INPUT 6 (2.2.1.4)

With this parameter you can select the signal, according to which the frequency reference to the motor is fine adjusted.

Table 149: Selections for parameter ID493

Selection number	Selection name	Description
0	Not used	
1	Analogue input 1	
2	Analogue input 2	
3	Analogue input 3	
4	Analogue input 4	
5	Signal from fieldbus (FBProcessDataIN)	See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)* and parameter group G2.9

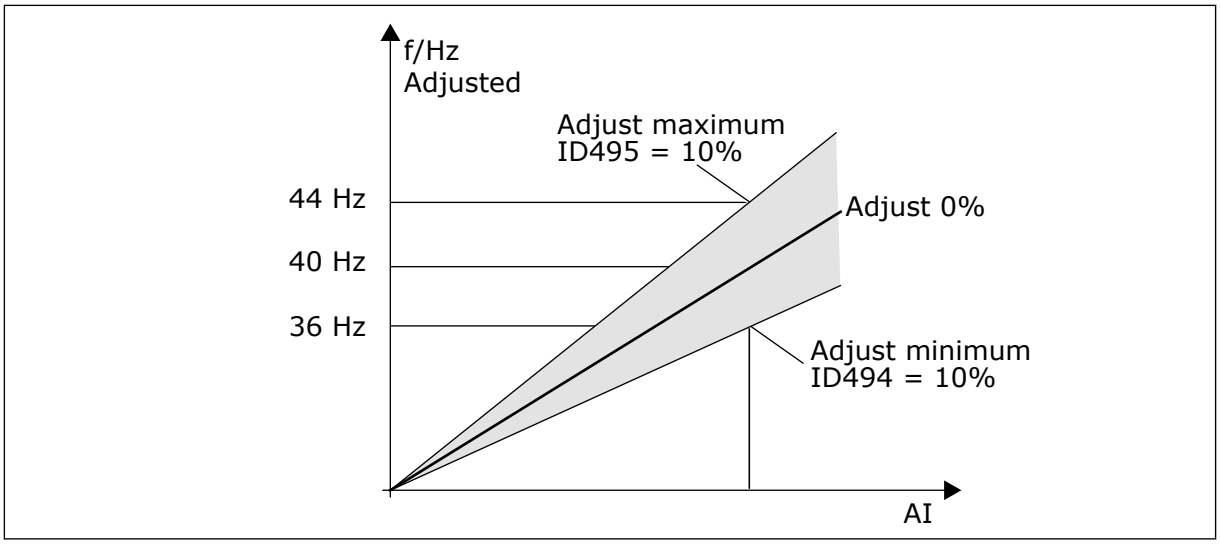

Fig. 66: An example of adjust input

494 ADJUST MINIMUM 6 (2.2.1.5)

495 ADJUST MAXIMUM 6 (2.2.1.6)

These parameters define the minimum and maximum of adjusted signals. See *Fig. 66 An example of adjust input*.

NOTE!

The adjustment is made to the basic reference signal.

496 PARAMETER SET 1/SET 2 SELECTION * 6 (2.2.7.21)

This parameter defines the digital input, which can be used to 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 product's User Manual.

Digital input = FALSE:

- Set 1 is loaded as the active set

Digital input = TRUE:

- Set 2 is loaded as the active set

NOTE!

The parameter values are stored only when selecting P6.3.1 Parameter sets Store Set 1 or Store Set 2 in System menu or from NCDrive: Drive > Parameter Sets.

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498 START PULSE MEMORY 3 (2.2.24)

Giving a value for this parameter determines if the present RUN status is copied when the control place is changed from A to B or vice versa.

Table 150: Selections for parameter ID498

Selection number	Selection name	Description
0	The RUN status is not copied	
1	The RUN status is copied	

In order for this parameter to have effect, parameters ID300 and ID363 must have been set the value 3.

500 ACCELERATION/DECELARATION RAMP 1 SHAPE 234567 (2.4.1)

501 ACCELERATION/DECELERATION RAMP 2 SHAPE 234567 (2.4.2)

With these parameters, you can make smoother the start and the end of the acceleration and deceleration ramps. If you set the value to 0.0%, you get a linear ramp shape. The acceleration and deceleration act immediately to the changes in the reference signal.

When you set the value between 1.0% and 100.0%, you get an S-shaped acceleration or deceleration ramp. Use this function to reduce mechanical erosion of the parts and current spikes when the reference changes. You can modify the acceleration time with parameters ID103/ID104 (ID502/ID503).

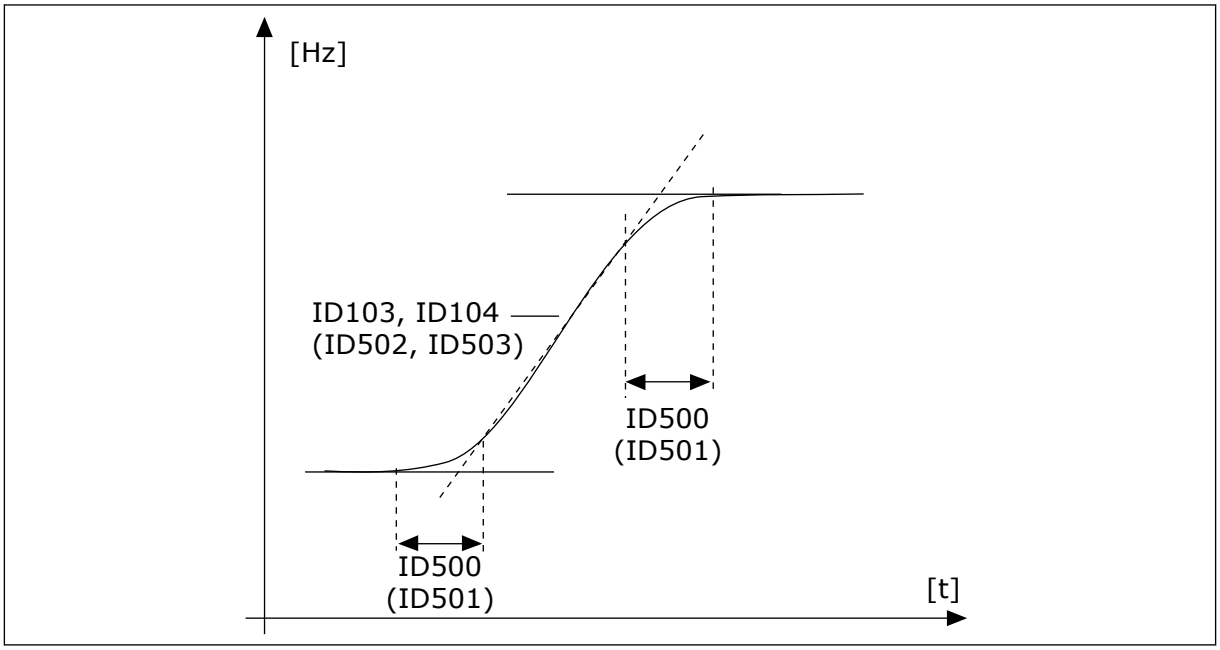

Fig. 67: Acceleration/Deceleration (S-shaped)

502 ACCELERATION TIME 2 234567 (2.4.3)

503 DECELERATION TIME 2 234567 (2.4.4)

These values correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (parameter ID102). These parameters give the possibility to set two different acceleration/ deceleration time sets for one application. The active set can be selected with the programmable signal DIN3 (parameter ID301).

504 BRAKE CHOPPER 234567 (2.4.5)

Table 151: Selections for parameter ID504

Selection number	Selection name	Description
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 AC drive is decelerating the motor, the inertia of the motor and the load are fed into an external brake resistor. This enables the AC drive to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected).

The brake chopper test mode generates a pulse to the resistor every second. If the pulse feedback is wrong (resistor or chopper is missing) fault F12 is generated.

See separate Brake resistor installation manual.

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505 START FUNCTION (2.4.6)

Table 152: Selections for parameter ID505

Selection number	Selection name	Description
0	Ramp	The AC drive 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).
1	Flying start	The AC drive is able to start into a running motor by applying small current pulses 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 start the motor from actual speed without forcing the speed to zero before ramping to reference.
2	Conditional flying start	With this mode it is possible to disconnect and connect the motor from the AC drive even when the Start command is active. On re-connecting the motor, the drive will operate as described in selection 1.

506 STOP FUNCTION (2.4.7)

Table 153: Selections for parameter ID506

Selection number	Selection name	Description
0	Coasting	The motor coasts to a halt without any control from the AC drive, after the Stop command.
1	Ramp:	After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters to zero speed. If the regenerated energy is high it may be necessary to use an external braking resistor to stop within the set deceleration time.
2	Normal stop: Ramp/ Run Enable stop: coasting	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 AC drive.
3	Normal stop: Coasting/ Run Enable stop: ramping	The motor coasts to a halt without any control from the AC drive. 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.

507 DC-BRAKING CURRENT 234567 (2.4.8)

Gives the current that is fed into the motor during DC braking. DC-brake in stop state will only use a tenth of this parameter value.

This parameter is used together with parameter ID516 to decrease the time before the motor is able to produce maximum torque at start-up.

508 DC-BRAKING TIME AT STOP 234567 (2.4.9)

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, parameter ID506.

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Table 154: Selections for parameter ID508

Selection number	Selection name	Description
0	DC-brake is not used	
>0	DC-brake is in use and its function depends on the Stop function, (parameter ID506). The DC-braking time is determined with this parameter.	

PARAMETER ID506 = 0; STOP FUNCTION = COASTING:

After the stop command, the motor coasts to a stop without control of the AC drive.

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 parameter ID508.

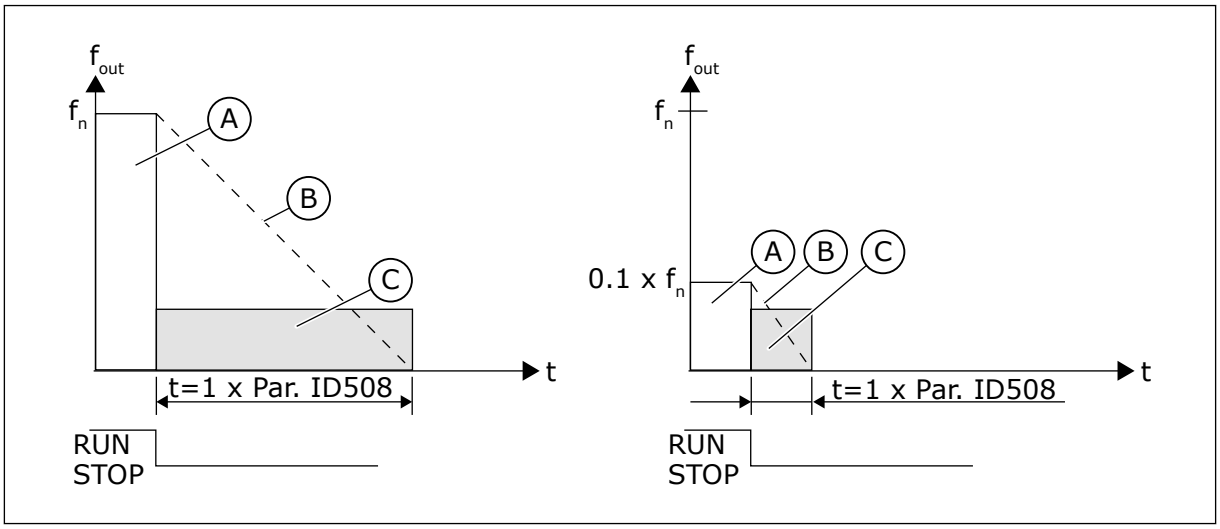

Fig. 68: DC-braking time when Stop mode = Coasting

A. Output frequency
B. Motor speed
C. DC-braking ON

PARAMETER 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 parameter ID515, where the DC-braking starts.

The braking time is defined with parameter ID508. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration.

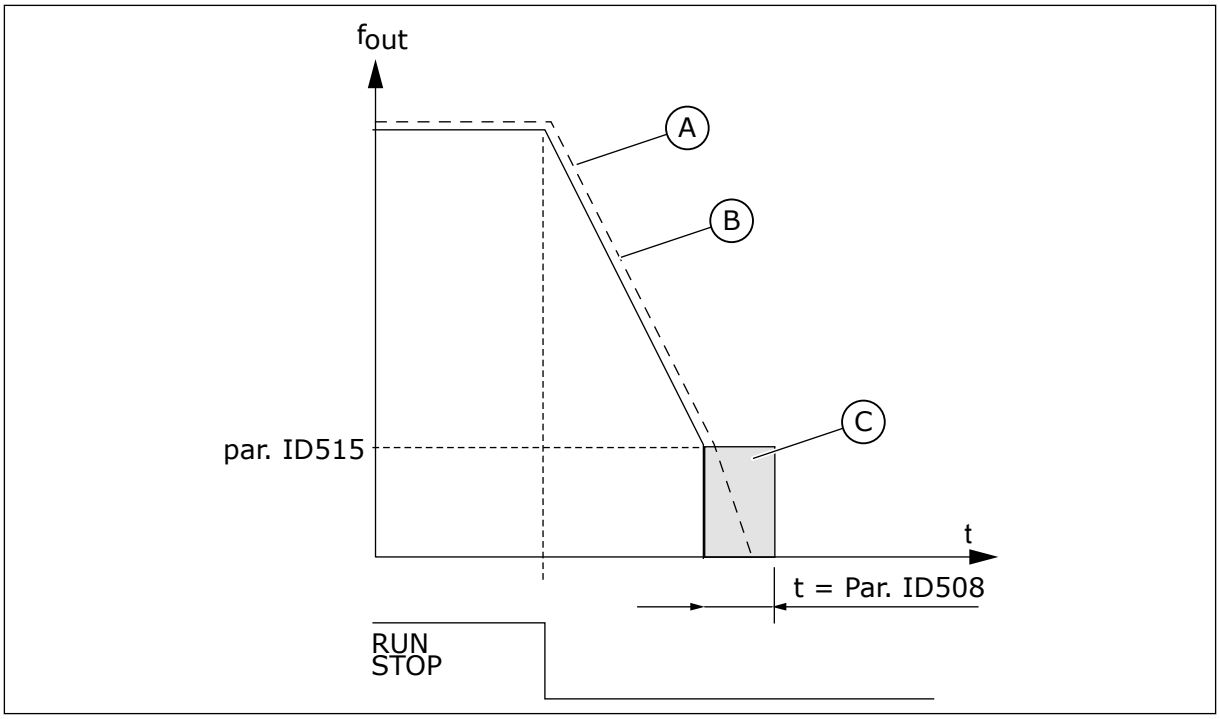

Fig. 69: DC-braking time when Stop mode = Ramp

A. Motor speed
B. Output frequency
C. DC-braking

509 PROHIBIT FREQUENCY AREA 1; LOW LIMIT 23457 (2.5.1)

510 PROHIBIT FREQUENCY AREA 1; HIGH LIMIT 23457 (2.5.2)

511 PROHIBIT FREQUENCY AREA 2; LOW LIMIT 3457 (2.5.3)

512 PROHIBIT FREQUENCY AREA 2; HIGH LIMIT 3457 (2.5.4)

513 PROHIBIT FREQUENCY AREA 3; LOW LIMIT 3457 (2.5.5)

514 PROHIBIT FREQUENCY AREA 3; HIGH LIMIT 3457 (2.5.6)

In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems. With these parameters it is possible to set limits for the "skip frequency" region.

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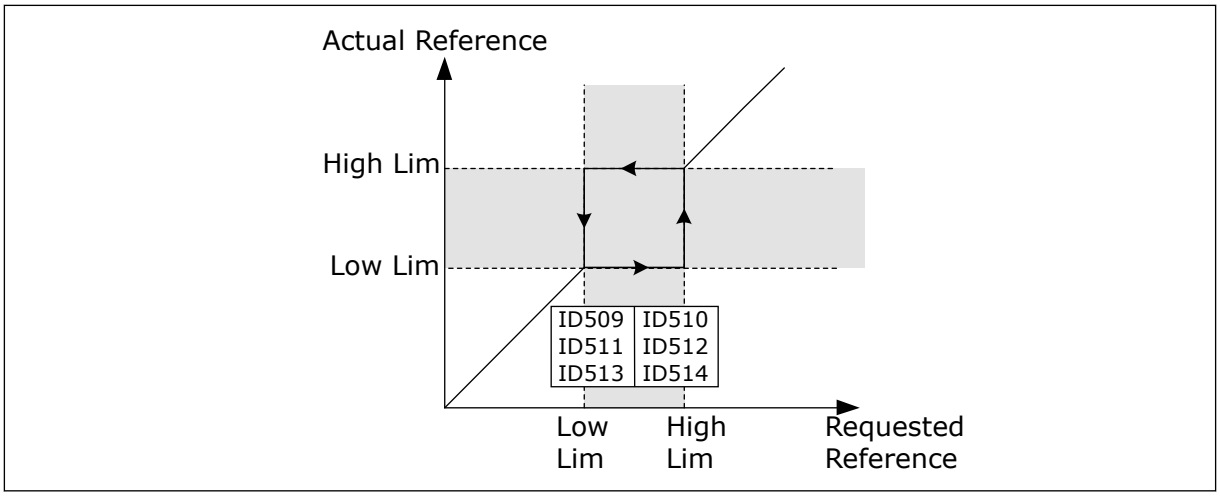

Fig. 70: Example of prohibit frequency area setting

515 DC BRAKING FREQUENCY AT STOP 234567 (2.4.10)

The output frequency at which the DC braking starts. See *Fig. 70 Example of prohibit frequency area setting*.

516 DC-BRAKING TIME AT START 234567 (2.4.11)

DC-brake is activated when the start command is given. This parameter gives the time during which the DC current is fed to the motor before the acceleration starts.

DC brake current is used at start in order to premagnetize the motor before running. This will improve the torque performance at start. Varying between 100 ms to 3 s, the time needed depends on motor size. A bigger motor requires a longer time. See parameter ID507.

NOTE!

When Flying Start (see parameter ID505) is used as start function DC braking at start is disabled.

518 ACCELERATION/DECELERATION RAMP SPEED SCALING RATIO BETWEEN PROHIBIT FREQUENCY LIMITS 23457 (2.5.3, 2.5.7)

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits (parameters ID509 to ID514). 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 prohibit frequency range limits.

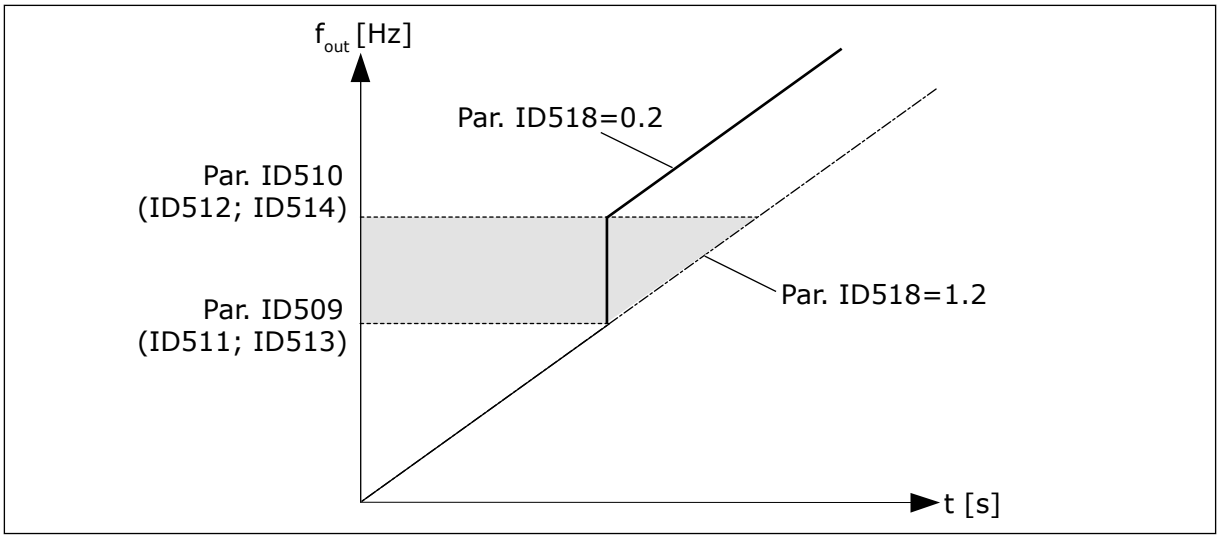

Fig. 71: Ramp speed scaling between prohibit frequencies

519 FLUX BRAKING CURRENT 234567 (2.4.13)

Gives the current level for the flux braking. The value setting range depends on the used application.

520 FLUX BRAKE 234567 (2.4.12)

As an alternative to DC braking, you can use flux braking. Flux braking increases the braking capacity in conditions where additional brake resistors are not necessary.

When braking is necessary, the system decreases the frequency and increases the flux in the motor. This increases the capacity of the motor to brake. The motor speed is controlled during braking.

You can enable and disable Flux Braking.

Table 155: Selections for parameter ID520

Selection number	Selection name	Description
0	Flux braking OFF	
1	Flux braking ON	

CAUTION!

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

521 MOTOR CONTROL MODE 26 (2.6.12)

With this parameter you can set another motor control mode. Which mode is used is determined with parameter ID164.

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For the selections, see parameter ID600.

NOTE!

Motor control mode can not be changed from Open Loop to Closed Loop and vice versa while the drive is in RUN state.

530 INCHING REFERENCE 1 6 (2.2.7.27)

531 INCHING REFERENCE 2 6 (2.2.7.28)

These inputs activate the inching reference if inching is enabled.

NOTE!

The inputs also start the drive if activated and if there is no Run Request command from anywhere else.

Negative reference is used for reverse direction (see parameters ID1239 and ID1240).

The parameter is available for NXP drives only.

532 ENABLE INCHING 6 (2.2.7.26)

Inching is a combination of a start command and preset speeds (ID1239 and ID1240) with a ramp time (ID533).

If you use the inching function the input value must be TRUE set by a digital signal or by setting the value of the parameter to 0.2. The parameter is available for NXP drives only.

600 MOTOR CONTROL MODE 234567 (2.6.1)

Table 156: Selections for motor control mode in different applications

Application / Sel	2	3	4	5	6	7
0	NXS/P	NXS/P	NXS/P	NXS/P	NXS/P	NXS
1	NXS/P	NXS/P	NXS/P	NXS/P	NXS/P	NXS
2	Not used	Not used	Not used	Not used	NXS/P	NA
3	NXP	NXP	NXP	NXP	NXP	NA
4	NA	NA	NA	NA	NXP	NA

Table 157: Selection for ID600 Motor control mode

Selection number	Selection name	Description
0	Frequency control	Drive frequency reference is set to output frequency without slip compensation. Motor actual speed is finally defined by motor load.
1	Speed control	Drive frequency reference is set to motor speed reference. The motor speed is remains the same regardless of motor load. Slip is compensated.
2	Torque control	Speed reference is used as maximum speed limit and the motor produces torque within speed limit to achieve torque reference.
3	Speed crtl (closed loop)	Drive frequency reference is set to motor speed reference. The motor speed remains the same regardless of motor load. In Closed Loop control mode, speed feedback signal is used to achieve optimum speed accuracy.
4	Torque crtl (closed loop)	Speed reference is used as the maximum speed limit that depends on the torque speed limit CL (ID1278) and motor produces torque within speed limit to achieve torque reference. In Closed Loop control mode, speed feedback signal is used to achieve optimum torque accuracy.

601 SWITCHING FREQUENCY 234567 (2.6.9)

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

The range of this parameter depends on the size of the AC drive:

Table 158: Size-dependent switching frequencies

Type	Min. [kHz]	Max. [kHz]	Default [kHz]
0003—0061 NX_5 0003—0061 NX_2	1.0	16.0	10.0
0075—0300 NX_2	1.0	10.0	3.6
0072—0520 NX_5	1.0	6.0	3.6
0041—0062 NX_6 0144—0208 NX_6	1.0	6.0	1.5

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NOTE!

The actual switching frequency might be reduced down to 1.5kHz by thermal management functions. This has to be considered when using sine wave filters or other output filters with a low resonance frequency. See parameters ID1084 and ID655.

602 FIELD WEAKENING POINT 234567 (2.6.4)

The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.

603 VOLTAGE AT FIELD WEAKENING POINT 234567 (2.6.5)

Above the frequency at the field weakening point, the output voltage stays at the set maximum value. Below the frequency at the field weakening point, the U/f curve parameters control the output voltage. See the parameters ID109, ID108, ID604 and ID605.

When you set the parameters ID110 and ID111 (nominal voltage and nominal frequency of the motor), the parameters ID602 and ID603 automatically receive related values. To have different values for the field weakening point and the maximum output voltage, change these parameters only after you set the parameters P3.1.1.1 and P3.1.1.2.

604 U/F CURVE, MIDDLE POINT FREQUENCY 234567 (2.6.6)

If the value of ID108 is programmable, this parameter gives the middle point frequency of the curve. See *Fig. 24 Linear and squared change of the motor voltage* and parameter ID605.

605 U/F CURVE, MIDDLE POINT VOLTAGE 234567 (2.6.7)

If the value of ID108 is programmable, this parameter gives the middle point voltage of the curve. See Chapter *108 U/F ratio selection 234567 (2.6.3)*.

606 OUTPUT VOLTAGE AT ZERO FREQUENCY 234567 (2.6.8)

This parameter gives the zero frequency voltage of the U/f curve. The default value is different for different unit sizes.

NOTE!

If the value of parameter ID108 is changed this parameter is set to zero. See *Fig. 25 The programmable U/f curve*.

607 OVERVOLTAGE CONTROLLER 234567 (2.6.10)

When you enable ID607 or ID608, the controllers start to monitor the changes in the supply voltage. The controllers change the output frequency if it becomes too high or too low.

To stop the operation of the undervoltage and the overvoltage controllers, disable these 2 parameters. This is useful if the supply voltage changes more than -15% to +10%, and if the application does not tolerate the operation of the controllers.

Table 159: Selections for parameter ID607

Selection number	Selection name	Description
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.

When a value other than 0 is selected also the Closed Loop overvoltage controller becomes active (in Multi-Purpose Control application).

608 UNDERVOLTAGE CONTROLLER 234567 (2.6.11)

See parameter ID607.

NOTE!

Over-/undervoltage trips may occur when controllers are switched out of operation.

Table 160: Selections for parameter ID608

Selection number	Selection name	Description
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.

When a value other than 0 is selected also the Closed Loop overvoltage controller becomes active (in Multi-Purpose Control application).

609 TORQUE LIMIT 6 (2.10.1)

With this parameter you can set the torque limit control between 0.0 – 300.0 %.

In the Multi-Purpose Control application, the torque limit is selected between the minimum of this parameter and the motoring and generating torque limits ID1287 and ID1288.

611 TORQUE LIMIT CONTROL I-GAIN 6 (2.10.3)

This parameter determines the I-gain of the torque limit controller. It is used in Open Loop control mode only.

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612 CL: MAGNETIZING CURRENT 6 (2.6.23.1)

The magnetising current (no-load current) of the motor. The magnetising current identifies the values of the U/f parameters if they are given before the identification run. If the value is set to 0, the magnetising current is calculated internally.

In NXP, the values of the U/f parameters are identified according to the magnetizing current if given before identification. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

613 CL: SPEED CONTROL P GAIN 6 (2.6.23.2)

Gain for the speed controller in closed loop motor control mode given in % per Hz. Gain value 100% means that nominal torque reference is produced at the speed controller output for a frequency error of 1Hz. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

614 CL: SPEED CONTROL I TIME 6 (2.6.23.3)

Sets the integral time constant for the speed controller. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

SpeedControl Output(k) = SPC OUT(k-1) + SPC Kp*[Speed Error(k) – Speed Error (k-1)] + Ki*Speed error(k)

where Ki = SPC Kp*Ts/SPC Ti.

615 CL: ZERO SPEED TIME AT START 6 (2.6.23.9)

After giving the start command the drive will remain at zero speed for the time de fined by this parameter. The speed will be released to follow the set frequency/ speed reference after this time has elapsed from the instant where the command is given. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

616 CL: ZERO SPEED TIME AT STOP 6 (2.6.23.10)

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. The zero speed time starts when the ramp time is expected to reach zero speed. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

617 CL: CURRENT CONTROL P GAIN 6 (2.6.23.17)

Sets the gain for the current controller. This controller is active only in closed loop control mode. The controller generates the voltage vector reference to the modulator. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

618 CL: ENCODER FILTER TIME 6 (2.6.23.15)

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 Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

619 CL: SLIP ADJUST 6 (2.6.23.6)

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. Value 100% corresponds to nominal slip at nominal load. See Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

620 LOAD DROOPING 23456 (2.6.12, 2.6.15)

The Load drooping function enables a speed drop. This parameter sets the drooping in percentage of the nominal torque of the motor.

You can use this function when a balanced load is necessary for mechanically connected motors.

If the motor has a nominal frequency of 50 Hz, the motor is loaded with the nominal load (100% of the torque), and Load Drooping is set to 10%, the output frequency is let to decrease 5 Hz from the frequency reference.

621 CL: STARTUP TORQUE 6 (2.6.23.11)

Choose here 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 Chapter *8.8 Closed loop parameters (IDs 612 to 621)*.

Table 161: Selections for parameter ID621

Selection number	Selection name	Description
0	Not Used	
1	TorqMemory	Motor will be started at the same torque as it was stopped at
2	Torque Ref	Torque reference is used at start for the startup torque
3	Torque forward/Torque reverse	See ID633 and 634

626 CL: ACCELERATION COMPENSATION 6 (2.6.23.5)

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 feature is used when the inertia of the system is known to achieve the best speed accuracy at alternating references.

$$AccelCompensationTC = J \cdot \frac{2\pi \cdot f_{nom}}{T_{nom}} = J \cdot \frac{(2\pi \cdot f_{nom})^2}{P_{nom}}$$

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J = System inertia (kg*m^2)
f_{nom} = Motor nominal frequency (Hz)
T^{nom} = Motor nominal torque
P^{nom} = Motor nominal power (kW)

627 CL: MAGNETIZING CURRENT AT START 6 (2.6.23.7)

Defines the current that is applied to motor when the start command is given (in Closed Loop control mode). At start this parameter is used together with parameter ID628 to decrease the time before the motor is able to produce maximum torque.

628 CL: MAGNETIZING TIME AT START 6 (2.6.23.8)

Defines the time for how long the magnetization current (ID627) is applied to the motor at start. The magnetizing current at start is used in order to premagnetize the motor before running. This will improve the torque performance at start. The time needed depends on the size of the motor. The parameter value varies from 100 ms to 3 seconds. The bigger the motor the more time is needed.

631 IDENTIFICATION 23456 (2.6.13,2.6.16)

The identification run calculates or measures the motor parameters that are necessary for a good control of the motor and speed.

The identification run helps you to adjust the motor-specific and the drive-specific parameters. It is a tool for the commissioning and the servicing of the drive. The goal is to find the parameter values that are optimal for the operation of the drive.

NOTE!

Before you do the identification run, you have to set the motor nameplate parameters.

ID110Nominal voltage of the motor (P2.1.6)
ID111Nominal frequency of the motor (P2.1.7)
ID112Nominal speed of the motor (P2.1.8)
ID113Nominal current of the motor (P2.1.9)
ID120Motor cos phi (P2.1.10)

Table 162: Selections for parameter ID631

Selection number	Selection name	Description
0	No action	No identification requested.
1	Identification without motor run	The drive is run without speed to identify the motor parameters. The motor is supplied with current and voltage but with zero frequency. U/f ratio is identified.
2	Identification with motor run (NXP only)	The drive is run with speed to identify the motor parameters. U/f ratio and magnetization current are identified. **NOTE!** This identification run must be performed with no load on the motor shaft for accurate results.
3	Encoder identification run	Identifies the shaft zero position when using PMS motor with absolute encoder.
4	(Reserved)	
5	Identification failed	This value is stored if identification fails.

To activate the Identification function, set this parameter and give a start command. You have to give the start command in 20 s. If there is no start command in that time, the identification run does not start. The parameter is reset to the default value and an identification alarm shows.

To stop the identification run before it is completed, give a stop command. This resets the parameter to the default value. If the identification run is not completed, an identification alarm shows.

During Identification Run, the brake control is disabled (see Chapter *8.3 External brake control with additional limits (IDs 315, 316, 346 to 349, 352, 353)*).

NOTE!

Rising edge required to start after identification.

633 CL: START-UP TORQUE, FORWARD 23456 (2.6.23.12)

Sets the start-up torque for forward direction if selected with parameter ID621.

634 CL: START-UP TORQUE, REVERSE 23456 (2.6.23.13)

Sets the start-up torque for reverse direction if selected with parameter ID621.

636 MINIMUM FREQUENCY FOR OPEN LOOP TORQUE CONTROL 6 (2.10.7)

The output frequency limit below which the drive operates in the frequency control mode.

Because of the nominal slip of the motor, the internal torque calculation is inaccurate at low speeds where is it recommended to use the frequency control mode.

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637 SPEED CONTROLLER P GAIN, OPEN LOOP 6 (2.6.13)

Defines the P gain for the speed controlled in Open Loop control mode.

638 SPEED CONTROLLER I GAIN, OPEN LOOP 6 (2.6.14)

Defines the I gain for the speed controlled in Open Loop control mode.

639 TORQUE CONTROLLER P GAIN 6 (2.10.8)

Gives the P gain for the torque controller in the open loop control mode.

640 TORQUE CONTROLLER I GAIN 6 (2.10.9)

Gives the I gain for the torque controller in the open loop control mode.

641 TORQUE REFERENCE SELECTION 6 (2.10.3)

Defines the source for torque reference. See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.

Table 163: Selections for parameter ID641

Selection number	Selection name	Description
0	Not used	
1	Analogue input 1	
2	Analogue input 2	
3	Analogue input 3	
4	Analogue input 4	
5	Analogue input 1 (joystick)	
6	Analogue input 2 (joystick)	
7	From keypad, parameter R3.5	
8	Fieldbus torque reference	See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.

642 TORQUE REFERENCE SCALING, MAXIMUM VALUE 6 (2.10.4)

643 TORQUE REFERENCE SCALING, MINIMUM VALUE 6 (2.10.5)

Scale the custom minimum and maximum levels for analogue inputs within -300.0...300.0%.

644 TORQUE SPEED LIMIT, OPEN LOOP 6 (2.10.6)

With this parameter the maximum frequency for the torque control can be selected.

Table 164: Selections for parameter ID644

Selection number	Selection name	Description
0	Maximum frequency	
1	Selected frequency reference	
2	Preset speed 7	

NXP drives have more selections for this parameter in Closed Loop control mode. See ID1278.

645 NEGATIVE TORQUE LIMIT 6 (2.6.23.21)

646 POSITIVE TORQUE LIMIT 6 (2.6.23.22)

Defines the torque limit for positive and negative directions.

649 PMS MOTOR ZERO SHAFT POSITION 6 (2.6.24.4)

Identified zero shaft position. Updated during encoder identification run with an absolute encoder.

650 MOTOR TYPE 6 (2.6.24.1)

In this parameter, you can set the type of motor in your process.

Table 165: Selections for ID650

Selection number	Selection name	Description
0	Induction motor	
1	Permanent magnet synchro-nous motor	

654 ENABLE RS IDENTIFICATION 6 (2.6.24.5)

With this parameter its possible to disable Rs identification during DC brake start. The parameter default value is 1 (Yes).

655 MODULATION LIMIT 6 (2.6.23.34)

This parameter can be used to control how the drive modulates the output voltage. Reducing this value limits the maximum output voltage. If a sinusoidal filter is used set this parameter to 96%.

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656 LOAD DROOPING TIME 6 (2.6.18)

Use load drooping to get a dynamic speed drooping when the load changes. This parameter gives the time during which the speed is restored 63% of the change.

662 MEASURED VOLTAGE DROP 6 (2.6.25.16)

The measured voltage drop at stator resistance between two phases with the nominal current of the motor. This parameter is identified during the ID run. Set this value to gain the optimum torque calculation for Open Loop low frequencies.

664 IR: ADD ZERO POINT VOLTAGE 6 (2.6.25.17)

Defines how much voltage is applied to motor at zero speed when torque boost is used.

665 IR: ADD GENERATOR SCALE 6 (2.6.25.19)

Defines how much voltage is applied to motor at zero speed when torque boost is used.

667 IR: ADD MOTORING SCALE 6 (2.6.25.20)

Scaling factor for motoring side IR-compensation when torque boost is used.

668 IU OFFSET 6 (2.6.25.21)

669 IV OFFSET 6 (2.6.25.22)

670 IW OFFSET 6 (2.6.25.23)

Offset values for phase current measurement. Identified during ID run.

700 RESPONSE TO THE 4MA REFERENCE FAULT 234567 (2.7.1)

Table 166: Selections for parameter ID700

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Warning	The frequency from 10 seconds back is set as reference
3	Warning	The 4mA fault frequency (parameter 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 3.0 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 and relay outputs RO1 and RO2.

701 RESPONSE TO EXTERNAL FAULT 234567 (2.7.3)

Table 167: Selections for parameter ID701

Selection number	Selection name	Description
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 or with parameters ID405 and ID406. The information can also be programmed into digital output DO1 and relay outputs RO1 and RO2.

702 OUTPUT PHASE SUPERVISION 234567 (2.7.6)

Table 168: Selections for parameter ID702

Selection number	Selection name	Description
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 an approximately equal current.

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703 EARTH FAULT PROTECTION 234567 (2.7.7)

Table 169: Selections for parameter ID703

Selection number	Selection name	Description
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 AC drive from earth faults with high currents.

704 MOTOR THERMAL PROTECTION 234567 (2.7.8)

Table 170: Selections for parameter ID704

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to ID506	
3	Fault, stop mode after fault always by coasting	

Deactivating the protection, i.e. setting parameter to 0, will reset the thermal stage of the motor to 0%. See Chapter *8.4 Parameters of motor thermal protection (IDs 704 to 708)*.

Motor overtemperature sensing is required if the parameter is set to 0.

705 MOTOR THERMAL PROTECTION: MOTOR AMBIENT TEMP. FACTOR 234567 (2.7.9)

The factor can be set between -100.0%...100.0% where

-100.0 % = 0 °C
0.0 % = 40 °C
100.0 % = 80 °C

See Chapter *8.4 Parameters of motor thermal protection (IDs 704 to 708)*.

706 MOTOR THERMAL PROTECTION: MOTOR COOLING FACTOR AT ZERO SPEED 234567 (2.7.10)

Gives the cooling factor at zero speed in relation to the point where the motor operates at nominal speed without an external cooling. See *Fig. 72 The motor thermal current IT curve*.

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

If you change parameter Motor Nominal Current, this parameter is automatically set to its default value.

Although you change this parameter, it does not have an effect on the maximum output current of the drive. See Chapter *8.4 Parameters of motor thermal protection (IDs 704 to 708)*.

The corner frequency for the thermal protection is 70% of the value of the parameter Motor Nominal Frequency (ID111).

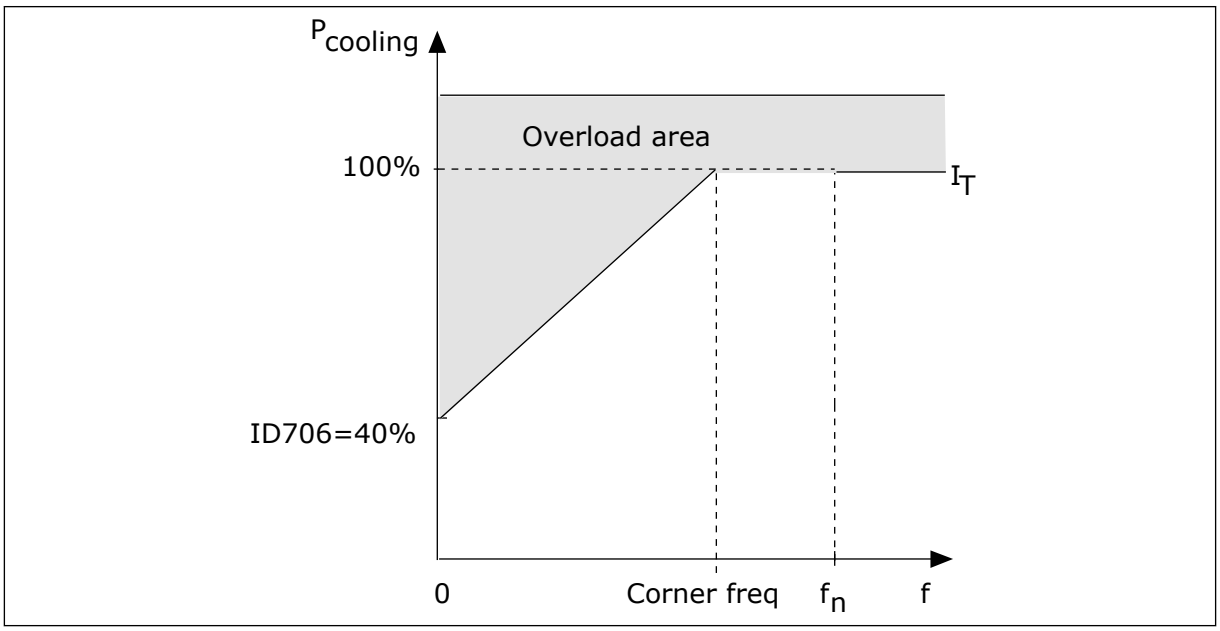

Fig. 72: The motor thermal current I_T curve

707 MOTOR THERMAL PROTECTION: TIME CONSTANT 234567 (2.7.11)

This time can be set between 1 and 200 minutes.

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

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

The t6-time is the time in seconds that the motor can safely operate at 6 times the rated current. It is possible that the motor manufacturer gives the data with the motor. If you know the t6 of the motor, you can set the time constant parameter with its help. Usually, the motor thermal time constant in minutes is 2*t6. When the drive is in the STOP state, the time

constant is internally increased to 3 times the set parameter value, because the cooling operates based on convection.

See also *Fig. 73 The motor thermal time constant*.

708 MOTOR THERMAL PROTECTION: MOTOR DUTY CYCLE 234567 (2.7.12)

The value can be set to 0%-150%. See Chapter *8.4 Parameters of motor thermal protection (IDs 704 to 708)*.

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

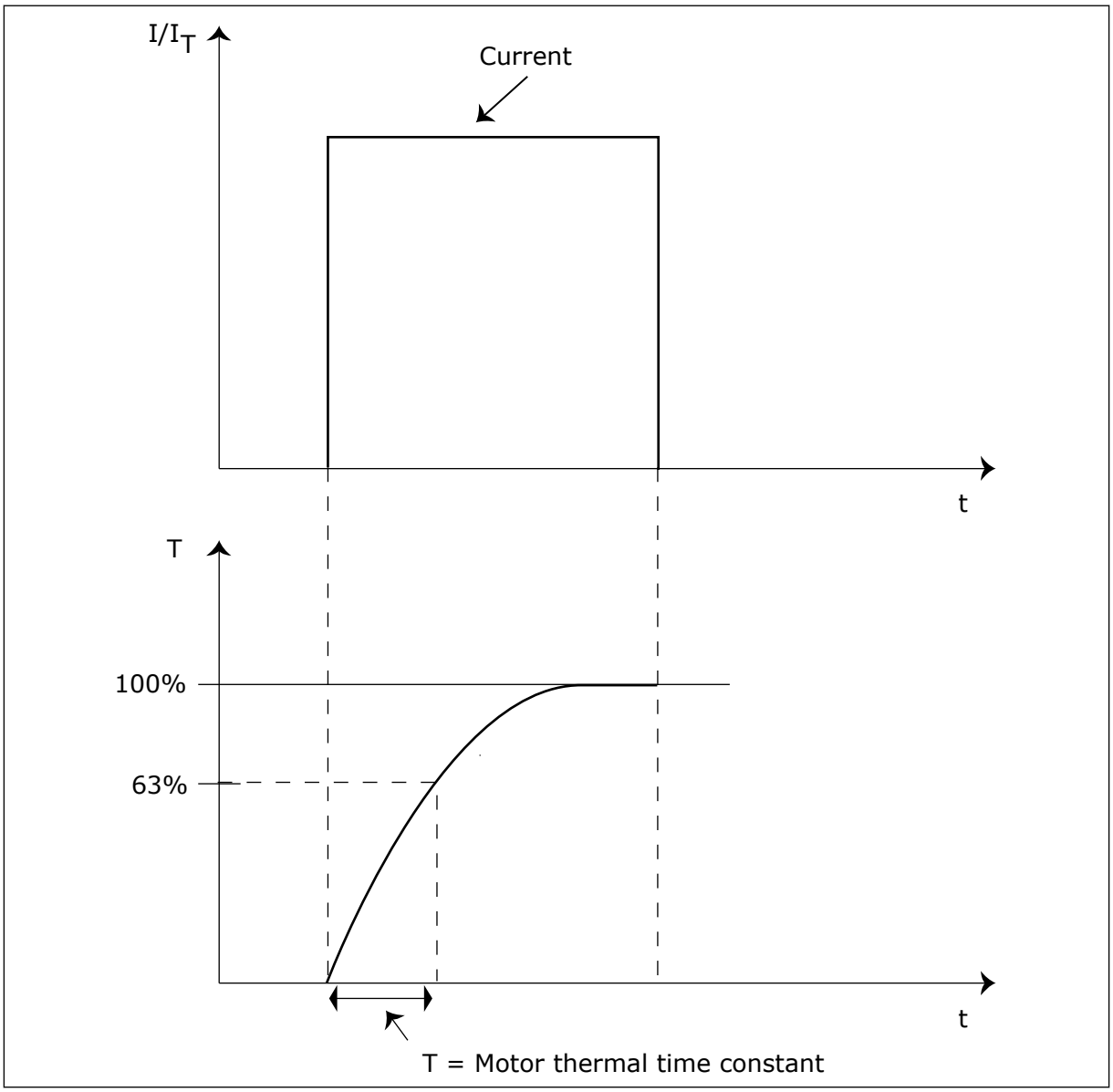

Fig. 73: The motor thermal time constant

709 STALL PROTECTION 234567 (2.7.13)

Table 171: Selections for parameter ID709

Selection number	Selection name	Description
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 time counter. See Chapter *8.5 Parameters of stall protection (IDs 709 to 712)*.

710 STALL CURRENT LIMIT 234567 (2.7.14)

You can set the value of this parameter between 0.0 and 2*I_H. For a stall status to occur, the current must be higher than this limit. If parameter ID107 Nominal current limit of motor changes, this parameter is automatically calculated to 90% of the current limit. See Chapter *8.5 Parameters of stall protection (IDs 709 to 712)*.

NOTE!

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

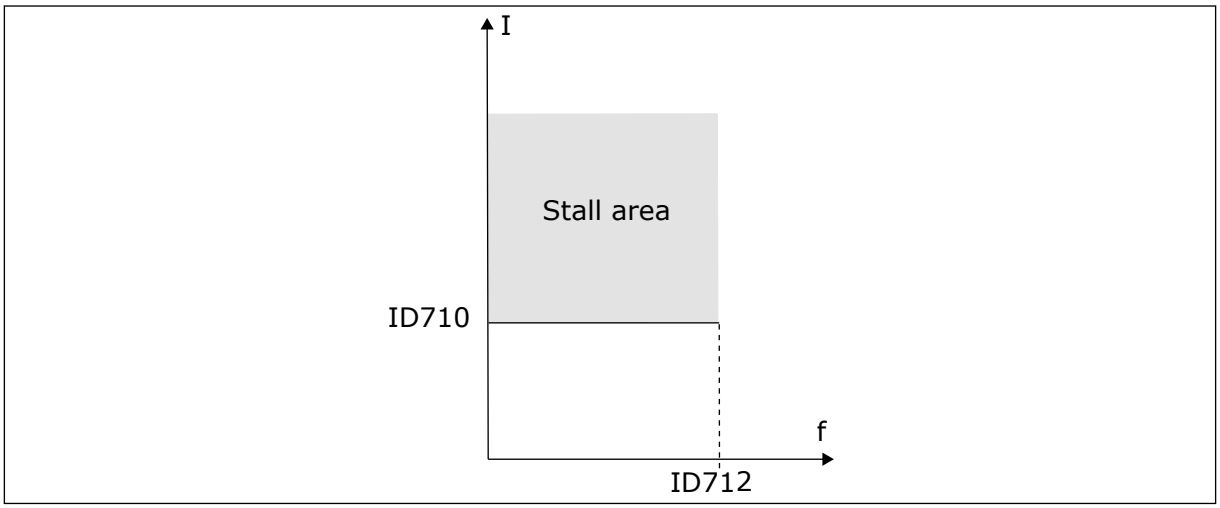

Fig. 74: The stall characteristics settings

711 STALL TIME 234567 (2.7.15)

You can set the time limit between 1.0 and 120.0 s.

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This is the maximum time for a stall stage. An internal counter counts the stall time. If the value of the counter goes above this limit, the protection causes the drive to trip (see ID709). See Chapter *8.5 Parameters of stall protection (IDs 709 to 712)*.

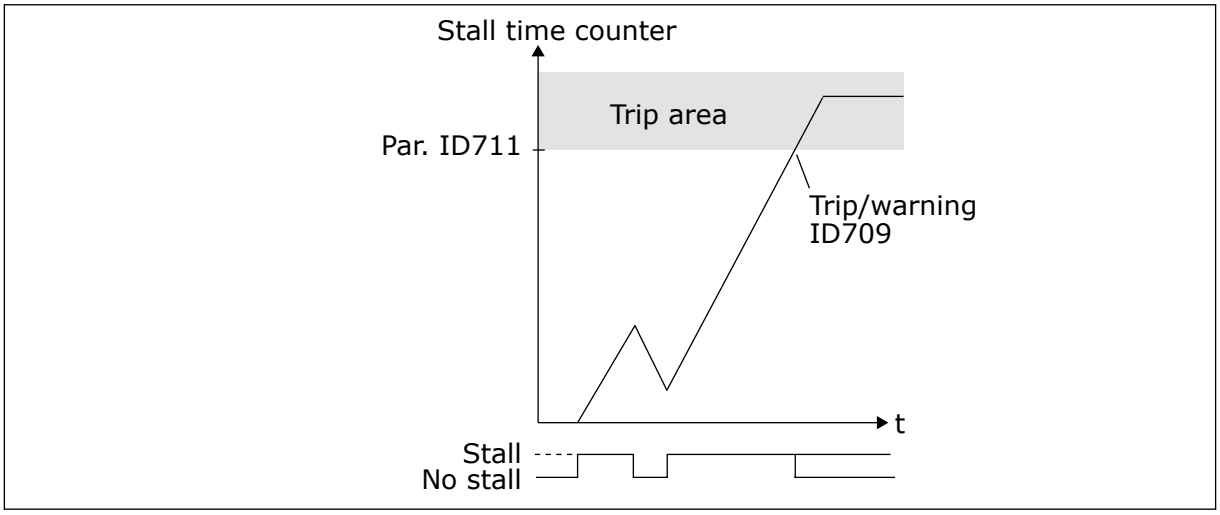

Fig. 75: Stall time count

712 STALL FREQUENCY LIMIT 234567 (2.7.16)

The frequency can be set between 1-f_{max}(ID102).

For a stall state to occur, the output frequency must be below this limit for a certain time. See Chapter *8.5 Parameters of stall protection (IDs 709 to 712)*.

713 UNDERLOAD PROTECTION 234567 (2.7.17)

Table 172: Selections for parameter ID713

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to ID506	
3	Fault, stop mode after fault always by coasting	

See Chapter *8.6 Parameters of underload protection (IDs 713 to 716)*.

714 UNDERLOAD PROTECTION, FIELD WEAKENING AREA LOAD 234567 (2.7.18)

You can set the value of this parameter between 10.0—150.0 % x T_{nMotor}. This value is the limit for the minimum torque when the output frequency is above the field weakening point.

If you change parameter ID113 (Motor nominal current), this parameter goes automatically back to its default value. See Chapter *8.6 Parameters of underload protection (IDs 713 to 716)*.

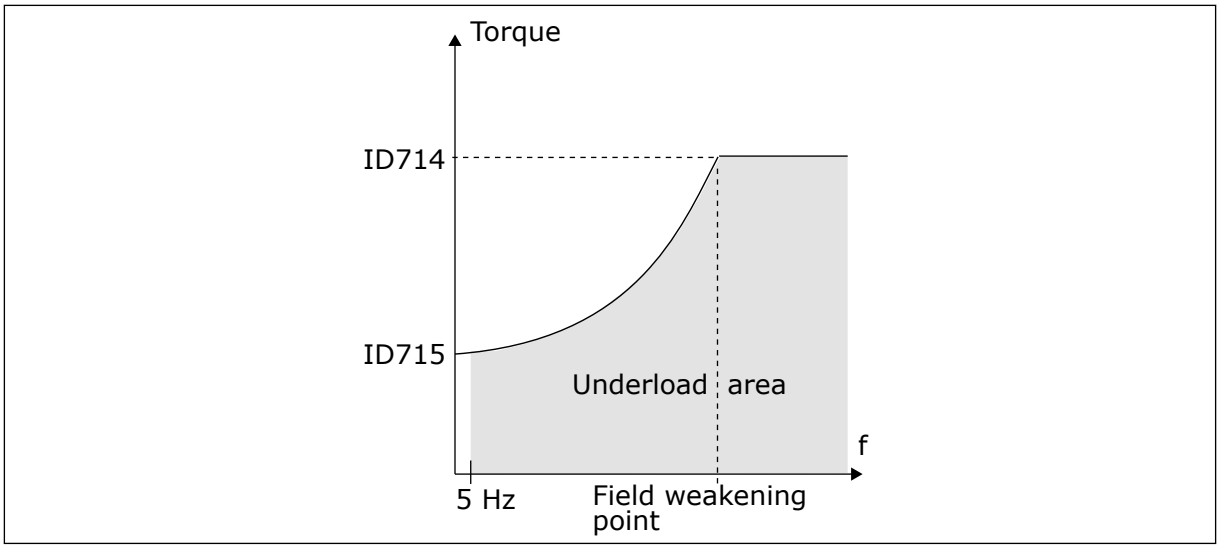

Fig. 76: Setting of the minimum load

715 UNDERLOAD PROTECTION, ZERO FREQUENCY LOAD 234567 (2.7.19)

The torque limit can be set between 5.0—150.0 % x T_{nMotor}.

Gives the value for the minimum torque that is possible with zero frequency. See *Fig. 76 Setting of the minimum load*. If you change the value of parameter ID113 (Motor nominal current), this parameter is automatically restored to the default value. See chapter *8.6 Parameters of underload protection (IDs 713 to 716)*.

716 UNDERLOAD TIME 234567 (2.7.20)

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

This is the maximum time for an underload status to be active. An internal counter counts the underload time. If the value of the counter goes above this limit, the protection causes the drive to trip. The drive trips as is set in parameter ID713. If the drive stops, the underload counter goes back to 0. See *Fig. 77 The Underload time counter function* and chapter *8.6 Parameters of underload protection (IDs 713 to 716)*.

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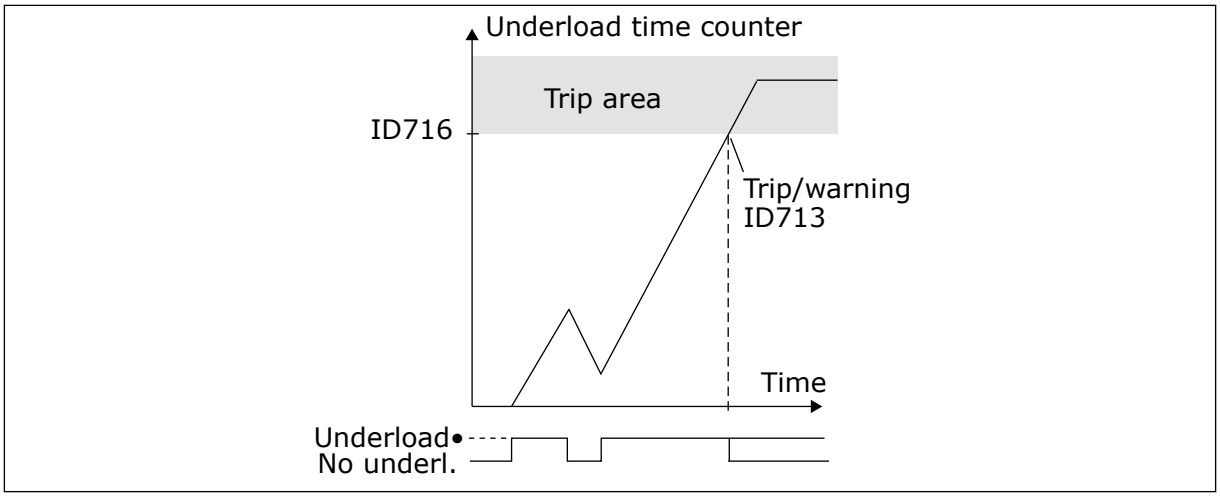

Fig. 77: The Underload time counter function

717 AUTOMATIC RESTART: WAIT TIME 234567 (2.8.1)

The wait time before the first reset is done.

718 AUTOMATIC RESTART: TRIAL TIME 234567 (2.8.2)

Use this parameter to set the trial time for the automatic reset function. During the trial time, the automatic reset function tries to reset the faults that occur. If the number of faults during the trial time exceed the value of the respective parameter set with ID720 to ID725 a permanent fault is generated.

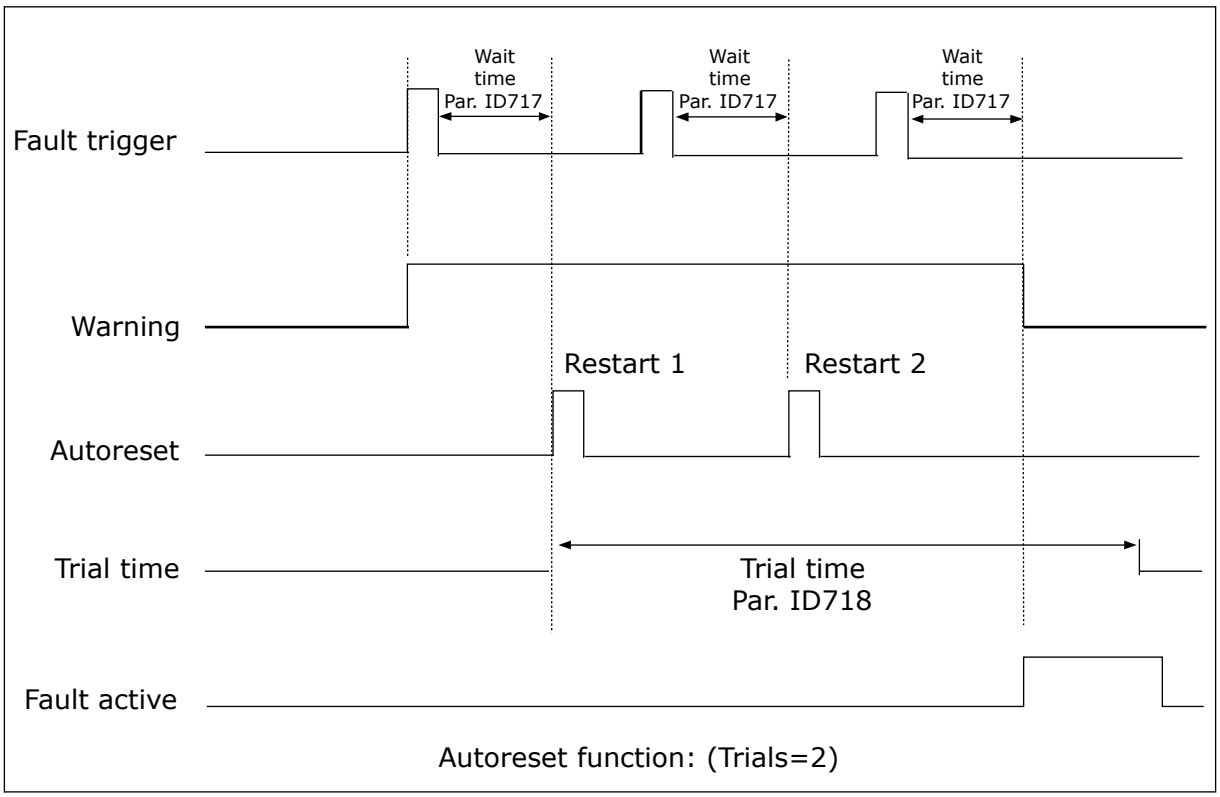

Fig. 78: Example of Automatic restarts with two restarts

Parameters ID720 to ID725 determine the maximum number of automatic restarts during the trial time set by parameter ID718. The time count starts from the first autoreset. If the number of faults occurring during the trial time exceeds the values of parameters ID720 to ID725 the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault start the trial time count again.

If a single fault remains during the trial time, a fault state is true.

719 AUTOMATIC RESTART: START FUNCTION 234567 (2.8.3)

The selection of the start mode for Automatic reset.

Table 173: Selections for parameter ID719

Selection number	Selection name	Description
0	Start with ramp	
1	Flying start	
2	Start according to ID505	

720 AUTOMATIC RESTART: NUMBER OF TRIES AFTER UNDERVOLTAGE FAULT TRIP 234567 (2.8.4)

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after and undervoltage trip.

Table 174: Selections for parameter ID720

Selection number	Selection name	Description
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 has returned to the normal level.

721 AUTOMATIC RESTART: NUMBER OF TRIES AFTER OVERVOLTAGE TRIP 234567 (2.8.5)

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after an overvoltage trip.

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Table 175: Selections for parameter ID721

Selection number	Selection name	Description
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.

722 AUTOMATIC RESTART: NUMBER OF TRIES AFTER OVERCURRENT TRIP 234567 (2.8.6)

NOTE!

IGBT temp fault also included.

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

Table 176: Selections for parameter ID722

Selection number	Selection name	Description
0	No automatic restart after overcurrent fault trip	
>0	Number of automatic restarts after overcurrent trip and IGBT temperature faults.	

723 AUTOMATIC RESTART: NUMBER OF TRIES AFTER 4MA REFERENCE TRIP 234567 (2.8.7)

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

Table 177: Selections for parameter ID 723

Selection number	Selection name	Description
0	No automatic restart after reference fault trip	
>0	Number of automatic restarts after the analogue current signal (4-20mA) has returned to the normal level (>4mA)	

725 AUTOMATIC RESTART: NUMBER OF TRIES AFTER EXTERNAL FAULT TRIP 234567 (2.8.9)

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

Table 178: Selections for parameter ID725

Selection number	Selection name	Description
0	No automatic restart after External fault trip	
>0	Number of automatic restarts after External fault trip	

726 AUTOMATIC RESTART: NUMBER OF TRIES AFTER MOTOR TEMPERATURE FAULT TRIP 234567 (2.8.8)

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

Table 179: Selections for parameter ID726

Selection number	Selection name	Description
0	No automatic restart after Motor temperature fault trip	
>0	Number of automatic restarts after the motor temperature has returned to its normal level	

727 RESPONSE TO UNDERVOLTAGE FAULT 234567 (2.7.5)

Table 180: Selections for parameter ID727

Selection number	Selection name	Description
0	Fault stored in fault history	
1	Fault not stored in fault history	

For the undervoltage limits, see the product's User Manual.

728 4MA FAULT FREQUENCY REFERENCE 234567 (2.7.2)

If the value of parameter ID700 is set to 3 and the 4mA fault occurs then the frequency reference to the motor is the value of this parameter.

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730 INPUT PHASE SUPERVISION 234567 (2.7.4)

Table 181: Selections for parameter ID730

Selection number	Selection name	Description
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 AC drive have an approximately equal current.

731 AUTOMATIC RESTART 1 (2.20)

Use this parameter to enable the Automatic reset function.

Table 182: Selections for parameter ID731

Selection number	Selection name	Description
0	Disabled	
1	Enabled	

The function resets the following faults (max. three times) (see the product's User Manual:

- Overcurrent (F1)
- Overvoltage (F2)
- Undervoltage (F9)
- Frequency converter overtemperature (F14)
- Motor overtemperature (F16)
- Reference fault (F50)

732 RESPONSE TO THERMISTOR FAULT 234567 (2.7.21)

Table 183: Selections for parameter ID732

Selection number	Selection name	Description
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.

733 RESPONSE TO FIELDBUS FAULT 234567 (2.7.22)

Set here the response mode for the fieldbus fault if fieldbus is the active control place. For more information, see the respective Fieldbus Board Manual.

See parameter ID732.

734 RESPONSE TO SLOT FAULT 234567 (2.7.23)

Set here the response mode for a board slot fault due to missing or broken board.

See parameter ID732.

738 AUTOMATIC RESTART: NUMBER OF TRIES AFTER UNDERLOAD FAULT TRIP (2.8.10)

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718.

Table 184: Selections for parameter ID738

Selection number	Selection name	Description
0	No automatic restart after Underload fault trip	
>0	Number of automatic restarts after Underload fault trip	

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739 TBOARD1 NUMBERS (NUMBER OF PT100 INPUTS IN USE) 567 (2.7.24)

NOTE!

The parameter name TBoard1 Numbers is used in Multi-Purpose Control Application. The old name (Number of PT100 inputs in use) is still used in PID Control Application and Pump and Fan Control Application.

If you have a temperature board installed in your AC drive you can choose here the number of sensors in use. See also the Vacon I/O boards manual.

Table 185: Selections for parameter ID739

Selection number	Selection name	Description
0	Not used	
1	Channel 1	
2	Channel 1 and 2	
3	Channel 1, 2 and 3	
4	Channel 2 and 3	
5	Channel 3	

NOTE!

If the selected value is greater than the actual number of used sensors, the display will read 200°C. If the input is short-circuited the displayed value is –30°C.

740 TBOARD FLT.RESP (RESPONSE TO PT100 FAULT) 567 (2.7.25)

NOTE!

The parameter name TBoard Flt.Resp is used in Multi-Purpose Control Application. The old name (Response to PT100 fault) is still used in PID Control Application and Pump and Fan Control Application.

Table 186: Selections for parameter ID740

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to ID506	
3	Fault, stop mode after fault always by coasting	

741 TBOARD1 WARN.LIM (PT100 WARNING LIMIT) 567 (2.7.26)

NOTE!

The parameter name TBoard1 Warn.Lim is used in Multi-Purpose Control Application. The old name (PT100 warning limit) is still used in PID Control Application and Pump and Fan Control Application.

Set here the limit at which the temperature warning will be activated.

742 TBOARD1 FLT.LIM (PT100 FAULT LIMIT) 567 (2.7.27)

NOTE!

The parameter name TBoard1 Flt.Lim is used in Multi-Purpose Control Application. The old name (PT100 fault limit) is still used in PID Control Application and Pump and Fan Control Application.

Set here the limit at which the temperature fault (F56) will be activated.

743 TBOARD2 NUMBERS 6 (2.7.37)

If you have a temperature board installed in your AC drive you can choose here the number of sensors in use. See also the Vacon I/O boards manual.

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Table 187: Selections for parameter ID743

Selection number	Selection name	Description
0	Not used	
1	Channel 1	
2	Channel 1 & 2	
3	Channel 1 & 2 & 3	
4	Channel 2 & 3	
5	Channel 3	

NOTE!

If the selected value is greater than the actual number of used sensors, the display will read 200°C. If the input is short-circuited the displayed value is –30°C.

745 TBOARD2 WARN. LIM 6 (2.7.38)

Set here the limit at which the temperature warning will be activated.

746 TBOARD2 FLT.LIM 6 (2.7.39)

Set here the limit at which the temperature fault (F65) will be activated.

750 COOLING MONITOR 6 (2.2.7.23)

When using a liquid-cooled drive, connect this input to the Cooling OK signal from the heat exchange unit or any input that shows the state of the used cooling unit. A fault is generated if the input is low when the drive is in RUN state. If the drive is in STOP state only warning is generated. See the User Manual for Vacon liquid-cooled drives.

751 COOLING FAULT DELAY 6 (2.7.32)

This parameter defines the delay after which the drive goes to FAULT state when the 'Cooling OK' signal is missing.

752 SPEED ERROR FAULT FUNCTION 6 (2.7.33)

Defines the fault response when the speed reference and the encoder speed exceed set limits.

Table 188: Selections for parameter ID752

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault always by coasting	

753 SPEED ERROR MAXIMUM DIFFERENCE 6 (2.7.34)

The speed error refers to the difference between the speed reference and the encoder speed. This parameter defines the limit when a fault is generated.

754 SPEED ERROR DELAY 6 (2.7.35)

Defines time before the speed error is considered as fault.

755 SAFE DISABLE MODE 6 (2.7.36)

NOTE!

See separate Vacon NX OPTAF (STO) Board Manual for detailed information on the Safe Disable function. This function is available only if the drive is equipped with Vacon option board OPTAF.

With this parameter it is possible to select whether the activated safe disable function is responded as fault or warning. The safe disable input will stop the drive modulation regardless of this parameter value.

756 SAFE DISABLE ACTIVE 6 (2.3.3.30)

Select the digital output to show the status of the Safe Disable.

850 FIELDBUS REFERENCE MINIMUM SCALING 6 (2.9.1)

851 FIELDBUS REFERENCE MAXIMUM SCALING 6 (2.9.2)

Use these two parameters to scale the fieldbus reference signal.

If ID850 = ID851 custom scaling is not used and the minimum and maximum fre quencies are used for scaling.

The scaling takes place as presented in . See also Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.

NOTE!

Using this custom scaling function also affects the scaling of the actual value.

852 TO 859 FIELDBUS DATA OUT SELECTIONS 1 TO 8 6 (2.9.3 TO 2.9.10)

Using these parameters, you can monitor any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to monitor for the value of these parameters. See Chapter *8.7 Fieldbus control parameters (IDs 850 to 859)*.

1	Output frequency	15	Digital inputs 1,2,3 statuses
2	Motor speed	16	Digital inputs 4,5,6 statuses
3	Motor current	17	Digital and relay output statuses
4	Motor torque	25	Frequency reference
5	Motor power	26	Analogue output current
6	Motor voltage	27	AI3
7	DC link voltage	28	AI4
8	Unit temperature	31	AO1 (expander board)
9	Motor temperature	32	AO2 (expander board)
13	AI1	37	Active fault 1
14	AI2	45	Motor current (drive independent) given with one decimal point

See also Chapter *6.4.1 Monitoring values (Control keypad: Menu M1)* for more monitoring values.

876 TO 883 FIELDBUS DATA IN SELECTIONS 1 TO 8

Using these parameters, you can control any parameter or some monitoring values from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters. See *Table 45 Monitoring values, NXP drives*.

1001 NUMBER OF AUXILIARY DRIVES 7 (2.9.1)

With this parameter the number of auxiliary drives in use will be defined. The functions controlling the auxiliary drives (parameters 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.

1002 START FREQUENCY, AUXILIARY DRIVE 17 (2.9.2)

The frequency of the drive controlled by the AC drive 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 *Fig. 79 Example of parameter setting; Variable speed drive and one auxiliary drive*, ID101 and ID102.

1003 STOP FREQUENCY, AUXILIARY DRIVE 17 (2.9.3)

The frequency of the drive controlled by the AC drive must fall with 1 Hz below the limit defined with these parameters before the auxiliary drive is stopped. The stop frequency limit also defines the frequency to which the frequency of the drive controlled by the AC drive is dropped after starting the auxiliary drive. See *Fig. 79 Example of parameter setting; Variable speed drive and one auxiliary drive*.

1004 START FREQUENCY, AUXILIARY DRIVE 27 (2.9.4)

1005 STOP FREQUENCY, AUXILIARY DRIVE 27 (2.9.5)

1006 START FREQUENCY, AUXILIARY DRIVE 37 (2.9.6)

1007 STOP FREQUENCY, AUXILIARY DRIVE 37 (2.9.7)

1008 START FREQUENCY, AUXILIARY DRIVE 47 (2.9.8)

1009 STOP FREQUENCY, AUXILIARY DRIVE 47 (2.9.9)

See parameters ID1002 and ID1003.

1010 START DELAY OF AUXILIARY DRIVES 7 (2.9.10)

The frequency of the drive controlled by the AC drive 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 momentary start limit exceedings. See *Fig. 79 Example of parameter setting; Variable speed drive and one auxiliary drive*.

1011 STOP DELAY OF AUXILIARY DRIVES 7 (2.9.11)

The frequency of the drive controlled by the AC drive must remain below the stop limit of the auxiliary drive for the time defined with this parameter before the drive is stopped. The delay defined applies to all auxiliary drives. This prevents unnecessary stops caused by momentary falls below the stop limit.

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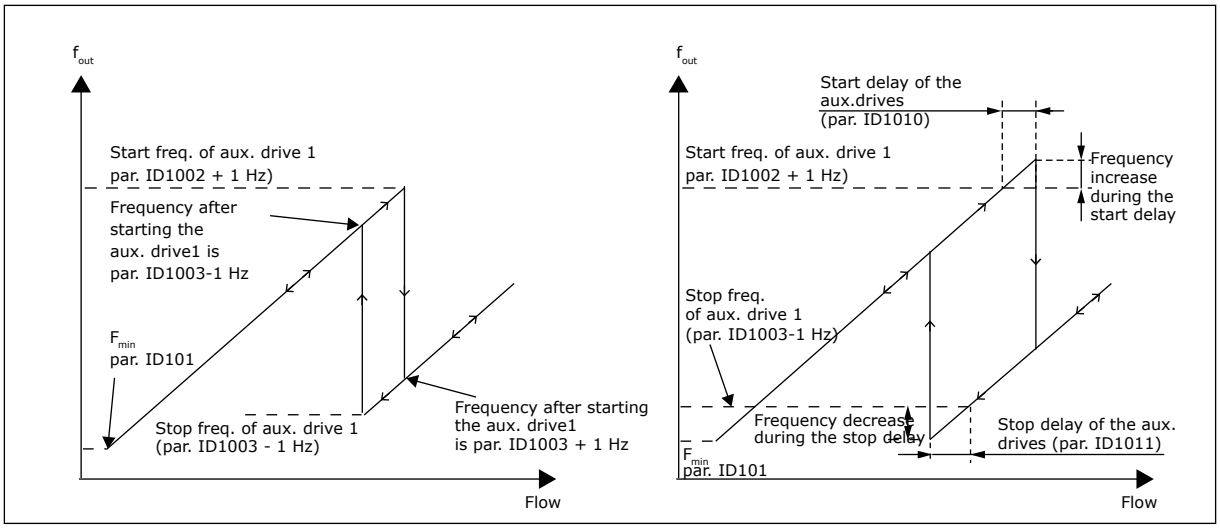

Fig. 79: Example of parameter setting; Variable speed drive and one auxiliary drive

1012 REFERENCE STEP AFTER START OF AUXILIARY DRIVE 17 (2.9.12)

1013 REFERENCE STEP AFTER START OF AUXILIARY DRIVE 27 (2.9.13)

1014 REFERENCE STEP AFTER START OF AUXILIARY DRIVE 37 (2.9.14)

1015 REFERENCE STEP AFTER START OF AUXILIARY DRIVE 47 (2.9.15)

The reference step will be automatically added to the reference value always 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.

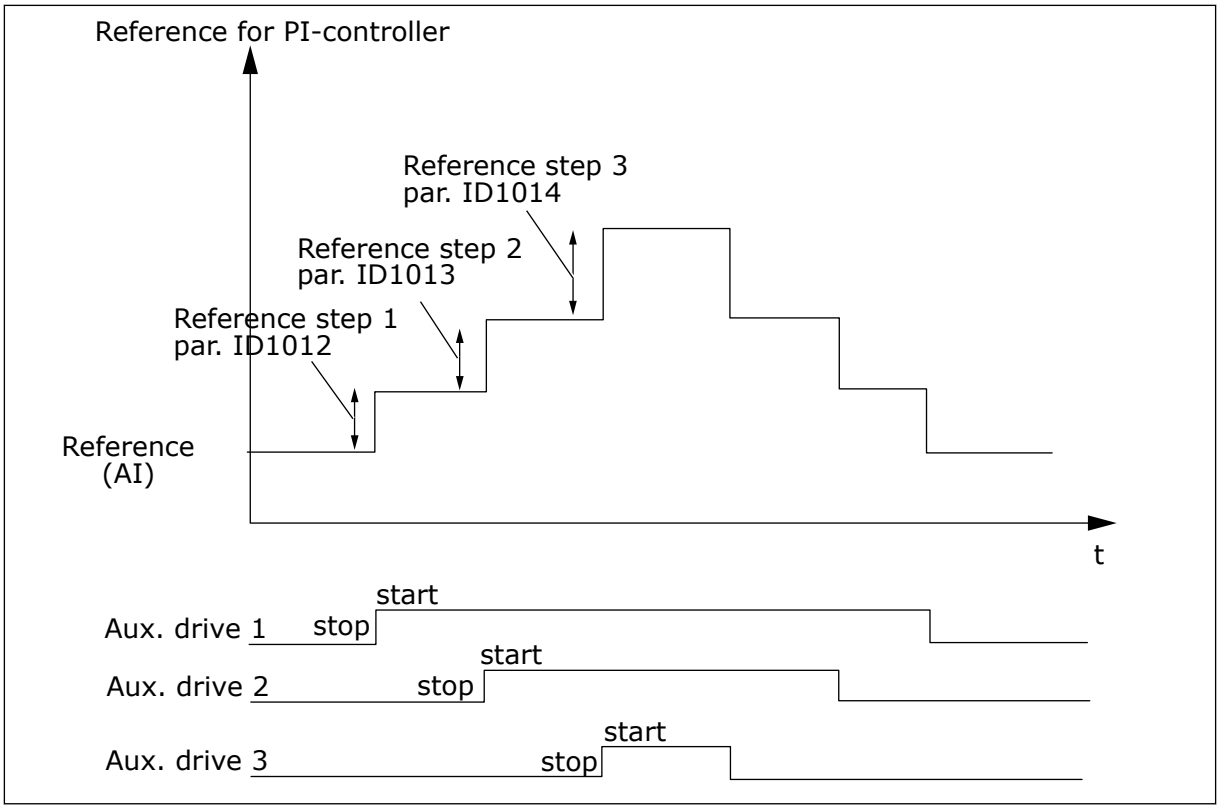

Fig. 80: Reference steps after starting auxiliary drives

1016 SLEEP FREQUENCY 57 (2.1.15)

The drive goes to sleep mode (that is, the drive stops) when the output frequency of the drive is less than the frequency limit that is set in this parameter for a time greater than that determined by parameter ID1017. During the Stop state, the PID controller is operating switching the AC drive to Run state when the actual value signal either falls below or exceeds (see parameter ID1019) the Wake-up level determined by parameter ID1018. See *Fig. 81 AC drive sleep function*.

1017 SLEEP DELAY 57 (2.1.16)

The minimum quantity of time during which the frequency has to stay below the sleep level before the drive stops. See *Fig. 81 AC drive sleep function*.

1018 WAKE-UP LEVEL 57 (2.1.17)

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 AC drive is restored.

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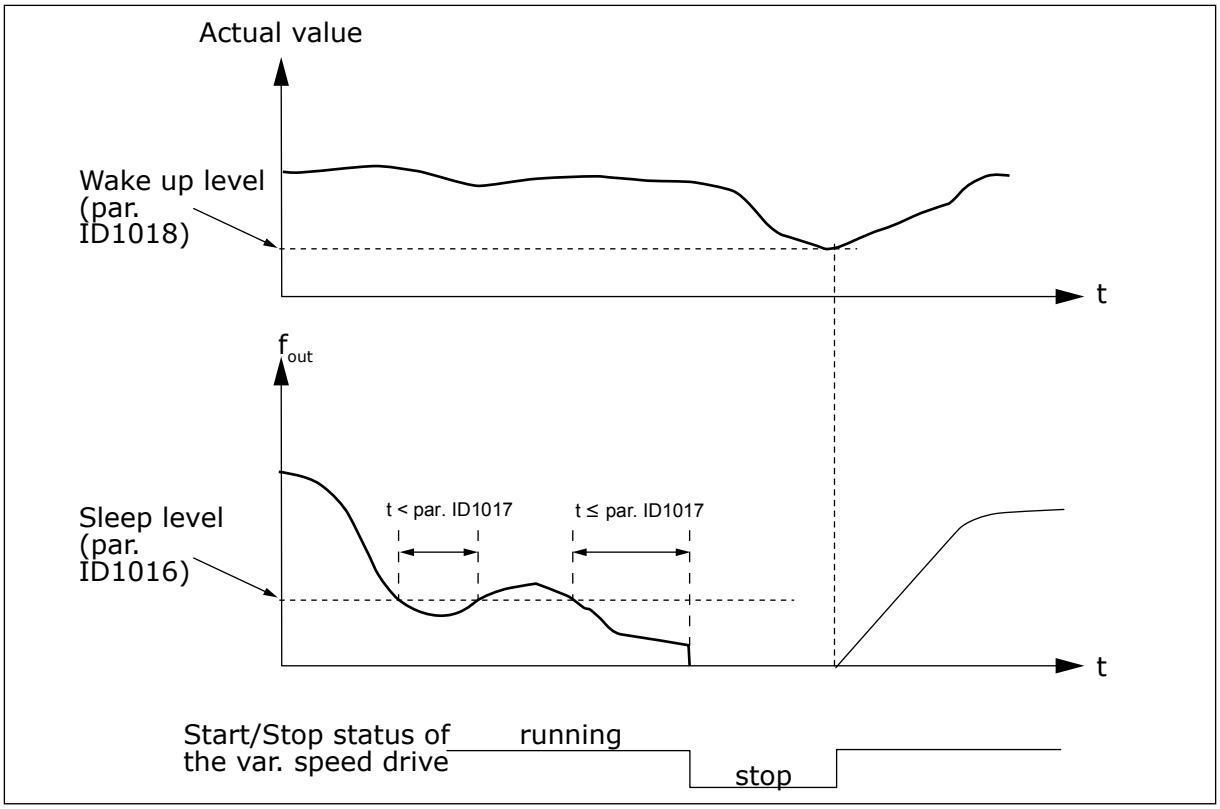


Fig. 81: AC drive sleep function

1019 WAKE-UP FUNCTION 57 (2.1.18)

This parameter defines whether the restoration of the Run state occurs when the actual value signal falls below or exceeds the Wake-up level (parameter ID1018). See Chapter *1018 Wake-up level 57 (2.1.17)* and *Table 190*.

The application 5 has selections 0-1 and application 7 selections 0-3 available.

Table 190: Selectable wake-up functions

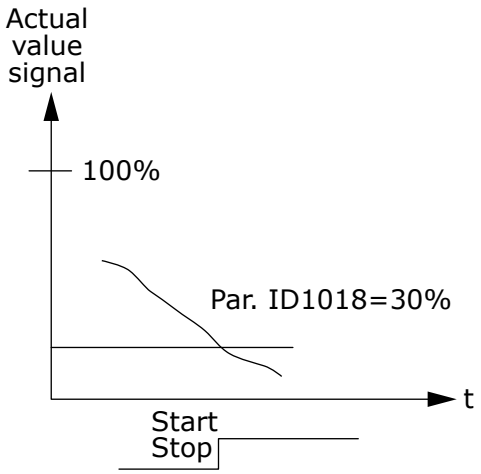
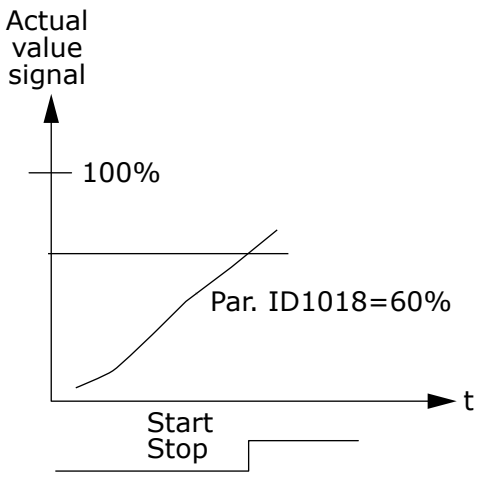
Selection number	Function	Limit	Description
0	Wake-up happens when actual value goes below the limit	The limit defined with parameter ID1018 is in percent of the maximum actual value	
1	Wake-up happens when actual value exceeds the limit	The limit defined with parameter ID1018 is in percent of the maximum actual value	

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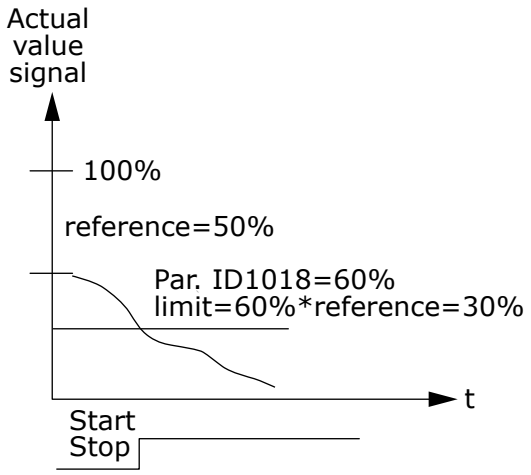
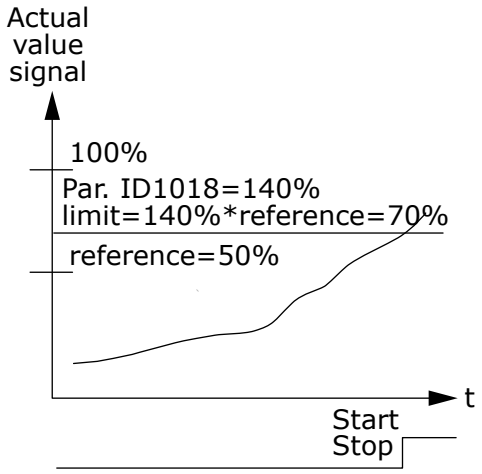
Table 190: Selectable wake-up functions

Selection number	Function	Limit	Description
2	Wake up happens when actual value goes below the limit	The limit defined with parameter 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 parameter ID1018 is in percent of the current value of the reference signal	

1020 PID CONTROLLER BYPASS 7 (2.9.16)

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.

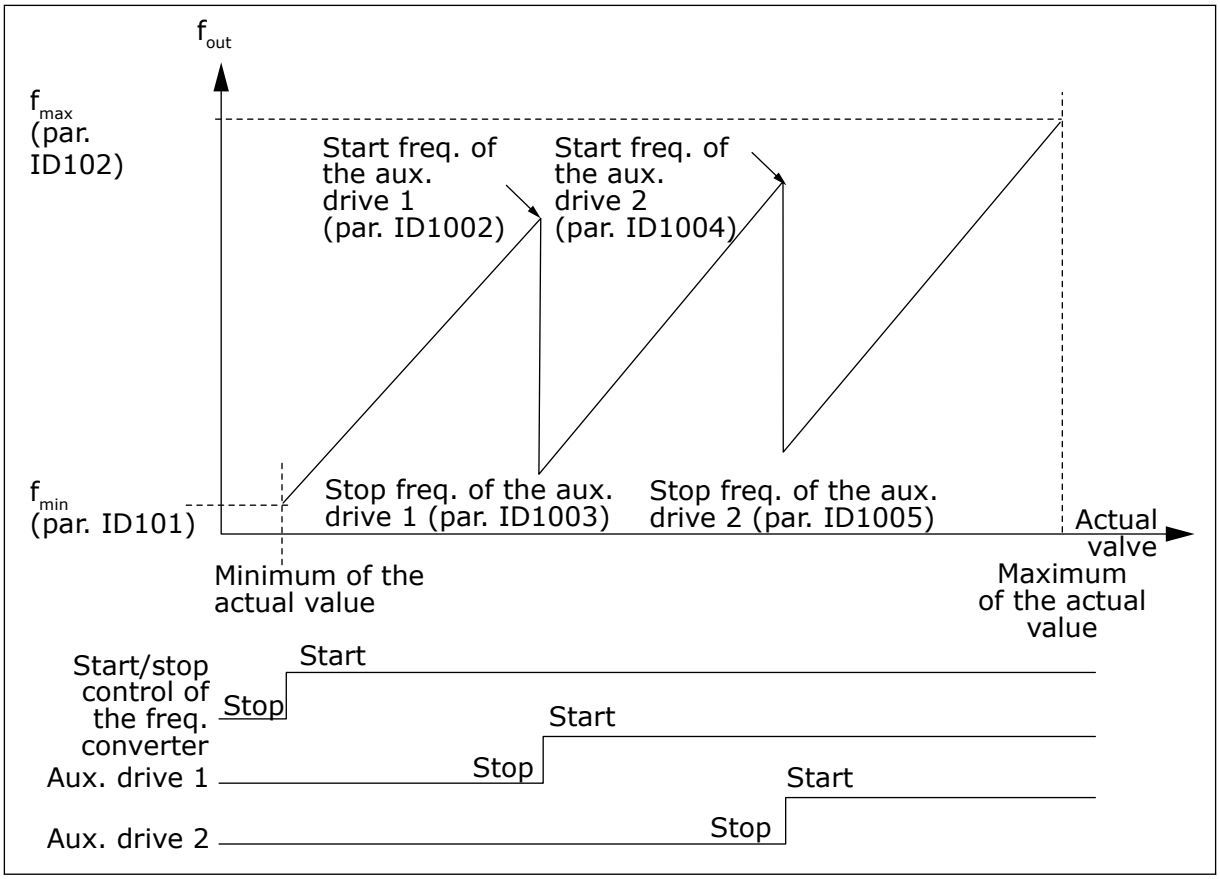


Fig. 82: Example of variable speed drive and two auxiliary drives with bypassed PID controller

1021 ANALOGUE INPUT SELECTION FOR INPUT PRESSURE MEASUREMENT 7 (2.9.17)

1022 INPUT PRESSURE HIGH LIMIT 7 (2.9.18)

1023 INPUT PRESSURE LOW LIMIT 7 (2.9.19)

1024 OUTPUT PRESSURE DROP VALUE 7 (2.9.20)

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 analogue input selected with parameter ID1021.

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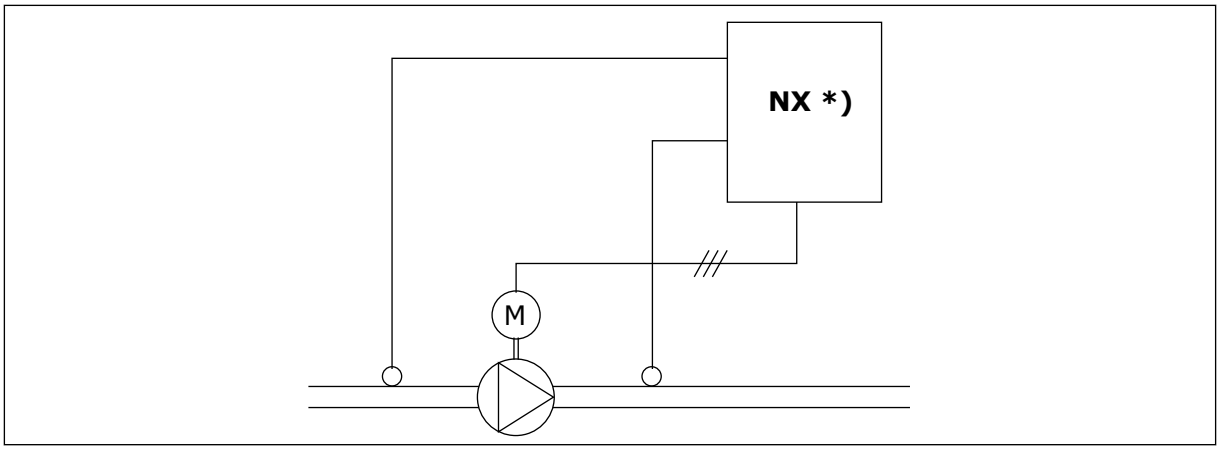

Fig. 83: Input and output pressure measuring

***)**

- Input pressure measurement selected with par. ID1021
- PI-controller actual value input par. ID333

With parameters ID1022 and ID1023 the limits for the area of the input pressure, where the output pressure is decreased, can be selected. The values are in percent of the input pressure measurement maximum value. With parameter ID1024 the value for the output pressure decrease within this area can be set. The value is in percent of the reference value maximum.

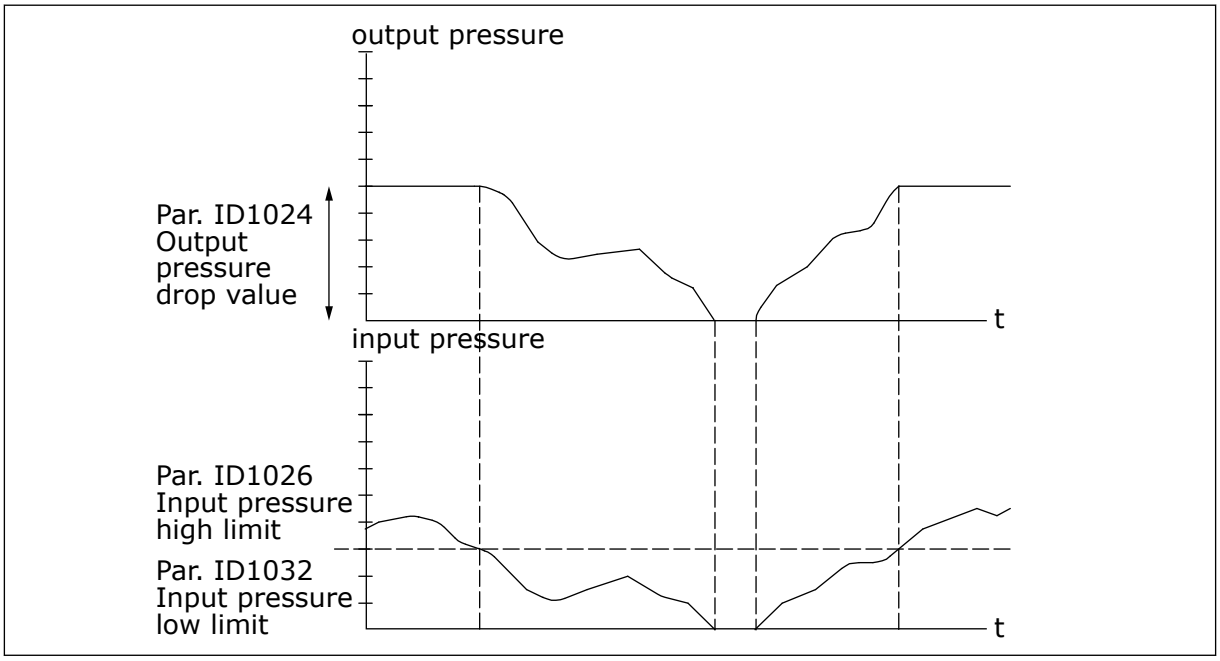

Fig. 84: Output pressure behaviour depending on input pressure and parameter settings

1025 FREQUENCY DROP DELAY AFTER STARTING AUXILIARY DRIVE 7 (2.9.21)

1026 FREQUENCY INCREASE DELAY AFTER STOPPING AUXILIARY DRIVE 7 (2.9.22)

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 variable speed drive will make the control smoother. This delay can be adjusted with parameter 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 variable speed drive can be programmed with parameter ID1026.

If either of the values of parameters ID1025 and ID1026 is set to maximum (300.0 s) no frequency drop nor increase takes place.

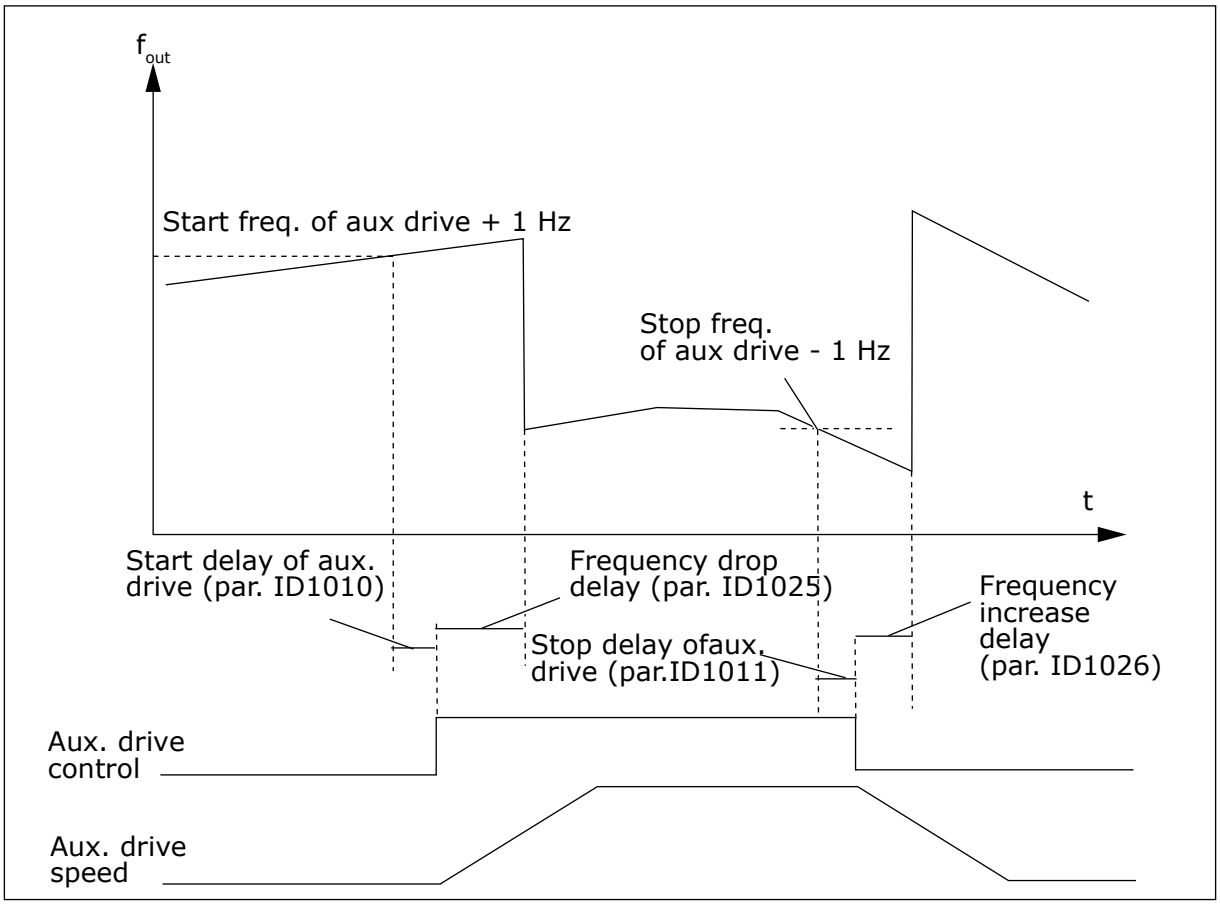

Fig. 85: Frequency drop and increase delays

1027 AUTOCHANGE 7 (2.9.24)

Table 191: Selections for parameter ID1027

Selection number	Selection name	Description
0	Autochange not used	
1	Autochange used	

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1028 AUTOCHANGE/INTERLOCKS AUTOMATICS SELECTION 7 (2.9.25)

Table 192: Selections for parameter ID1028

Selection number	Selection name	Description
0	Automatics (autochange/interlockings) applied to auxiliary drives only	The drive controlled by the AC drive remains the same. Only the mains contactor is needed for each drive. See *Fig. 86 Autochange applied to auxiliary drives only*.
1	All drives included in the autochange/interlockings sequence	The drive controlled by the AC drive is included in the automatics and two contactors are needed for each drive to connect it to the mains or the AC drive. See *Fig. 87 Autochange with all drives*.

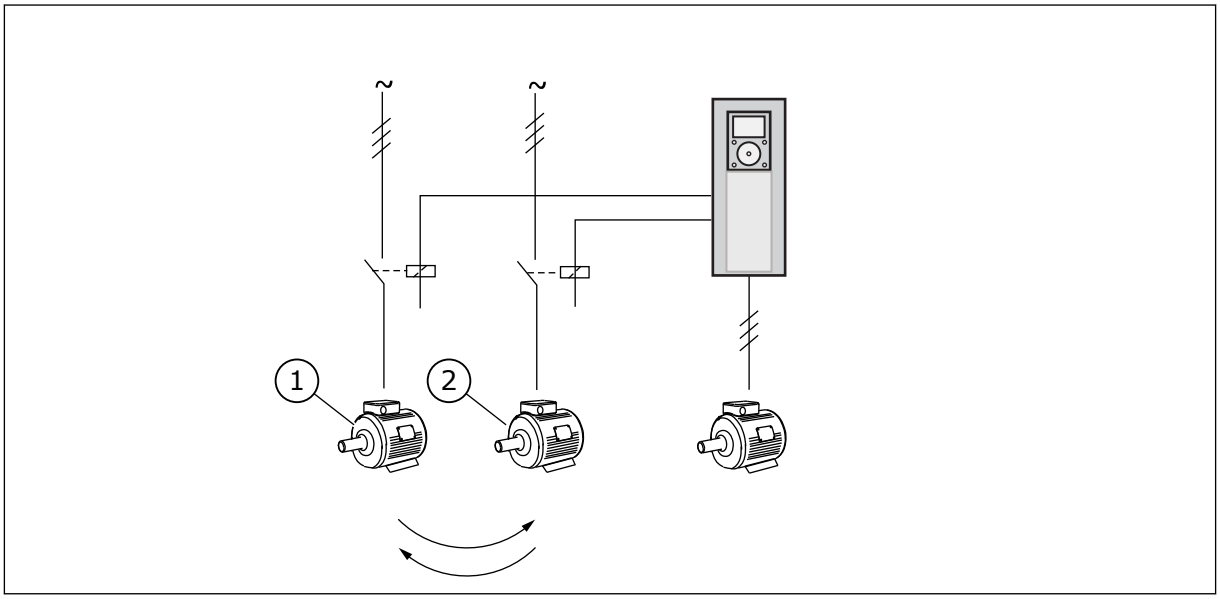

Fig. 86: Autochange applied to auxiliary drives only

1. Motor aux.1
2. Motor aux.2

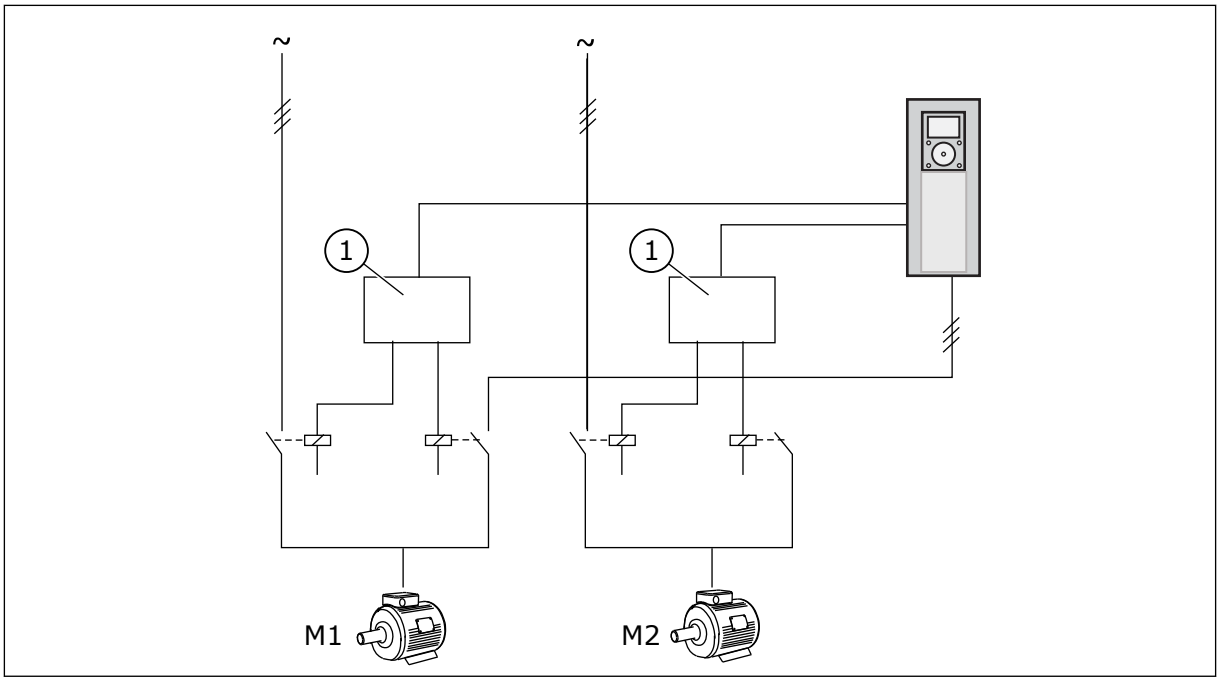

Fig. 87: Autochange with all drives

1. Auxiliary connection

1029 AUTOCHANGE INTERVAL 7 (2.9.26)

When this time is over, the autochange occurs if the capacity is below the level set with parameters 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 Chapter *1031 Autochange frequency limit 7 (2.9.28)*.

1030 MAXIMUM NUMBER OF AUXILIARY DRIVES 7 (2.9.27)

1031 AUTOCHANGE FREQUENCY LIMIT 7 (2.9.28)

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:

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- If the number of running auxiliary drives is smaller than the value of parameter ID1030 the autochange function can take place.
- If the number of running auxiliary drives is equal to the value of parameter ID1030 and the frequency of the controlled drive is below the value of parameter ID1031 the autochange can take place.
- If the value of parameter ID1031 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of parameter ID1030.

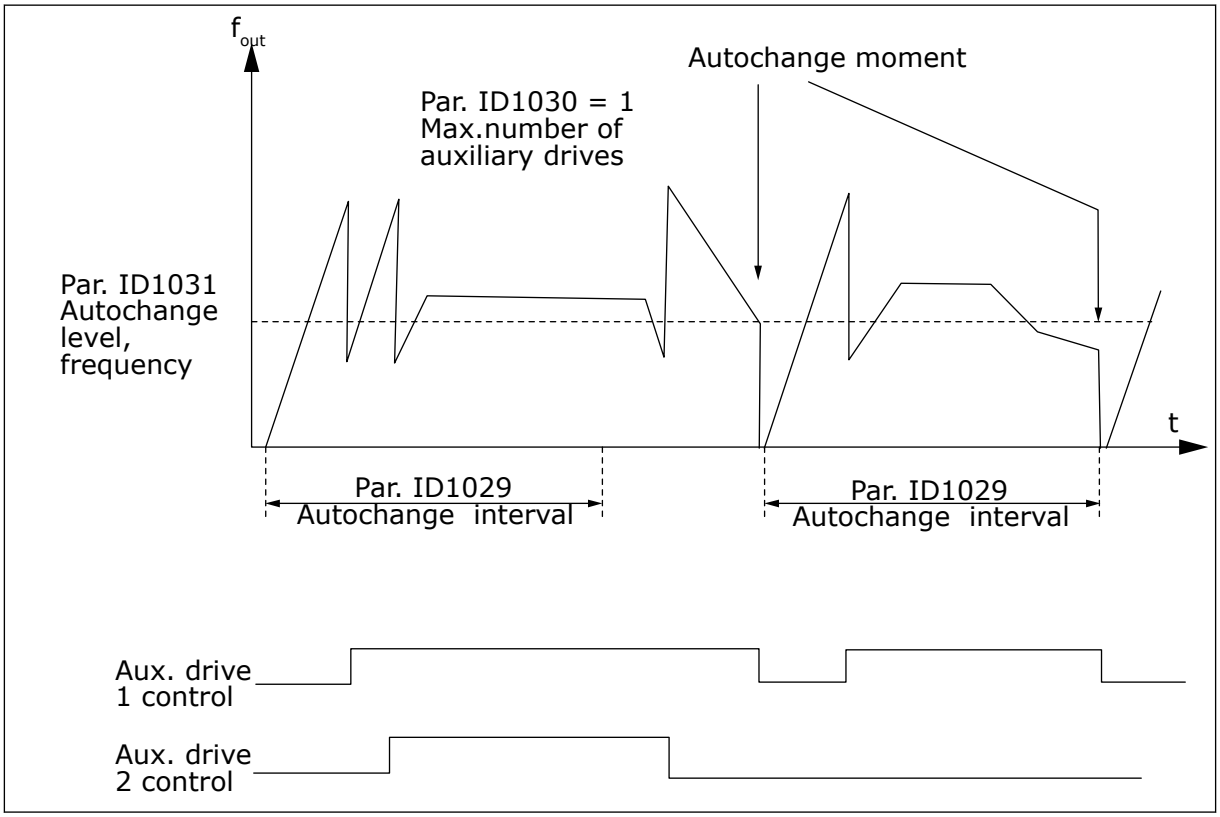

Fig. 88: Autochange interval and limits

1032 INTERLOCK SELECTION 7 (2.9.23)

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 (AC drive), directly to the mains or place them to off-state. The interlock feedback functions are connected to the digital inputs of the AC drive. Program parameters ID426 to ID430 to connect the feedback functions to the digital inputs. Each drive must be connected to its own interlock input. The Pump and fan control controls only those motors whose interlock input is active.

Table 193: Selections for parameter ID1032

Selection number	Selection name	Description
0	Interlock feedback not used	The AC drive receives no interlock feedback from the drives
1	Update of autochange order in Stop	The AC drive receives interlock feedback from the drives. In case one of the drives is, for some reason, disconnected from the system and eventually reconnected, 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 AC drive receives interlock feedback from the drives. At reconnection of a drive to the autochange line, the automatics will stop all motors immediately and re-start with a new set-up. EXAMPLE: [P1 -> P2 -> P4] -> [P3 LOCKED] -> [STOP] -> [P1 -> P2 -> P3 -> P4]

1033 ACTUAL VALUE SPECIAL DISPLAY MINIMUM 57 (2.2.46, 2.9.29)

1034 ACTUAL VALUE SPECIAL DISPLAY MAXIMUM 57 (2.2.47, 2.9.30)

1035 ACTUAL VALUE SPECIAL DISPLAY DECIMALS 57 (2.2.48, 2.9.31)

1036 ACTUAL VALUE SPECIAL DISPLAY UNIT 57 (2.2.49, 2.9.32)

The Actual value special display parameters are used to convert and display the actual value signal in a form more informative to the user.

The Actual value special display parameters are available in PID Control Application and Pump and Fan Control Application.

EXAMPLE:

The actual value signal sent from a sensor (in mA) tells you the amount of waste water pumped from a tank per second. The signal range is 0(4)-20 mA. Instead of receiving the level of the actual value signal (in mA) on the display, you wish to receive the amount of water pumped in m3/s. You then set a value for parameter ID1033 to correspond to the minimum signal level (0/4 mA) and another value for parameter ID1034 to correspond to the maximum signal level (20 mA). The number of decimals needed can be set with parameter ID1035 and

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the unit (m3/s) with parameter ID1036. The level of the actual value signal is then scaled between the set min and max values and displayed in the selected unit.

The following units can be selected (parameter ID1036):

Table 194: Selectable values for Actual Value Special Display

Value	Unit	On keypad
0	Not used	
1	%	%
2	°C	°C
3	m	m
4	bar	bar
5	mbar	mbar
6	Pa	Pa
7	kPa	kPa
8	PSI	PSI
9	m/s	m/s
10	l/s	l/s
11	l/min	l/m
12	l/h	l/h
13	m3/s	m3/s
14	m3/min	m3/m
15	m3/h	m3/h
16	°F	°F
17	ft	ft
18	gal/s	GPS
19	gal/min	GPM
20	gal/h	GPH
21	ft3/s	CFS
22	ft3/min	CFM
23	ft3/h	CFH
24	A	A
25	V	V
26	W	W

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Table 194: Selectable values for Actual Value Special Display

Value	Unit	On keypad
27	kW	kW
28	Hp	Hp
29 *	Inch	Inch

* = Valid only for Application 5 (PID Control Application).

NOTE!

The maximum number of characters that can be shown on keypad is 4. This means that in some cases the display of the unit on the keypad does not comply with the standards.

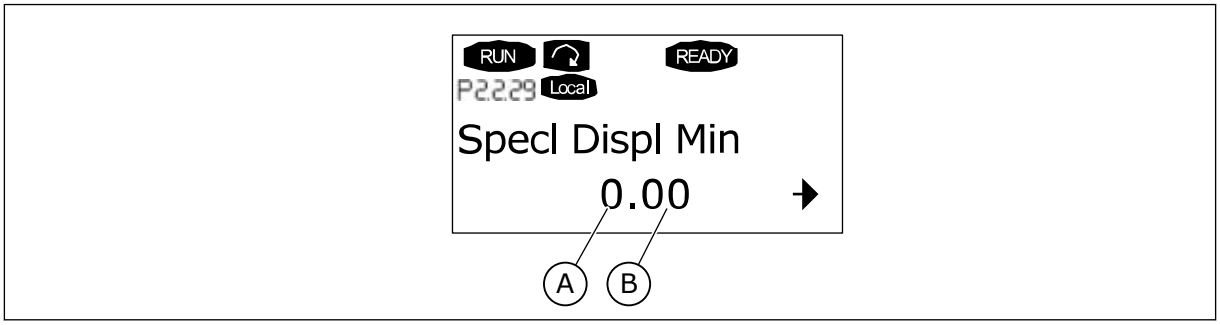

Fig. 89: Display example

A. Actual value min (max)

B. Number of decimals

1080 DC-BRAKE CURRENT AT STOP 6 (2.4.14)

In the Multi-Purpose Control application, this parameter defines the current injected to the motor in stop state when parameter ID416 is active. In all other applications this value is fixed to a tenth of the DC brake current.

The parameter is available for NXP drives only.

1081 FOLLOWER REFERENCE SELECTION 6 (2.11.3)

Select the speed reference for the follower drive.

Table 195: Selections for parameter ID1081

Selection number	Function	Description
0	Analogue input 1 (AI1)	See ID377
1	Anlogue input 2 (AI2)	See ID388
2	AI1+AI2	
3	AI1–AI2	
4	AI2–AI1	
5	AI1*AI2	
6	AI1 joystick	
7	AI2 joystick	
8	Keypad reference (R3.2)	
9	Fieldbus reference	
10	Potentiometer reference; controlled with ID418 (TRUE=increase) and ID417 (TRUE=decrease)	
11	AI1 or AI2, whichever is lower	
12	AI1 or AI2, whichever is greater	
13	Max. frequency ID102 (recommended in torque control only)	
14	AI1/AI2 selection	See ID422
15	Encoder 1 (AI input C.1)	
16	Encoder 2 (With OPTA7 Speed Synchronization, NXP only AI input C.3)	
17	Master Reference	
18	Master Ramp Out (default)	

1082 SYSTEMBUS COMMUNICATION FAULT RESPONSE 6 (2.7.30)

Defines the action when SystemBus heartbeat is missing.

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Table 196: Selections for parameter ID1082

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to ID506	
3	Fault, stop mode after fault always by coasting	

1083 FOLLOWER TORQUE REFERENCE SELECTION 6 (2.11.4)

Select the torque reference for the follower drive.

1084 CONTROL OPTIONS 6 (2.4.19)

The parameter is available for NXP drives only.

Table 197: Selections for parameter ID1084

Selection number	Selection name	Description
b0	Disables encoder fault	
b1	Update Ramp Generator when MotorControlMode changes from TC (4) to SC (3)	
b2	RampUp; use acceleration ramp (for Closed Loop torque control)	
b3	RampDown; use deceleration ramp (for Closed Loop torque control)	
b4	FollowActual; follow actual speed value within WindowPos/ NegWidth (for closed loop torque control)	
b5	TC ForceRampStop; Under stop request the speed limit forces the motor to stop	
b6	Reserved	
b7	Disables switching frequency decrease	
b8	Disable the parameter "Run state parameter lock"	
b9	Reserved	
b10	Invert delayed digital output 1	
b11	Invert delayed digital output 2	

1085 BRAKE ON/OFF CURRENT LIMIT 6 (2.3.4.16)

The mechanical brake closes immediately if the motor current is below this value.

This parameter is available for NXP drives only.

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1087 SCALING OF GENERATING TORQUE LIMIT 6 (2.2.6.6)

Table 198: Selections for parameter ID1087

Selection number	Selection name	Description
0	Parameter	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	FB limit scaling	

This signal will adjust the maximum motor generating torque between 0 and max. limit set with parameter ID1288. Analogue input level zero means zero generator torque limit. This parameter is available for NXP drives only.

1088 SCALING OF GENERATING POWER LIMIT 6 (2.2.6.8)

Table 199: Selections for parameter ID1088

Selection number	Selection name	Description
0	Parameter	
1	AI1	
2	AI2	
3	AI3	
4	AI4	
5	FB limit scaling	

This signal will adjust the maximum motor generating power between 0 and max. limit set with parameter ID1290 This parameter is available for Closed Loop control mode only. Analogue input level zero means zero generator power limit.

1089 FOLLOWER STOP FUNCTION 6 (2.11.2)

Defines how the follower drive stops (when selected follower reference is not Master's ramp, parameter ID1081, selection 18).

Table 200: Selections for parameter ID1089

Selection number	Selection name	Description
0	Coasting, follower remains in control even if master has stopped at fault	
1	Ramping, follower remains in control even if master has stopped at fault	
2	As master; follower behaves as master	

1090 RESET ENCODER COUNTER 6 (2.2.7.29)

Resets the monitoring values Shaft Angle and Shaft Rounds to zero. See *Table 44 Monitoring values, NXS drives*.

The parameter is available for NXP drives only.

1092 MASTER FOLLOWER MODE 26 (2.2.7.31)

Select the digital input to activate the second Master Follower mode selected by parameter ID1093. The parameter is available for NXP drives only.

1093 MASTER FOLLOWER MODE 2 SELECTION 6 (2.11.7)

Select Master Follower mode 2 that is used when the DI is activated. When Follower is selected the Run Request command is monitored from Master and all other references are selectable by parameters.

Table 201: Selections for parameter ID1093

Selection number	Selection name	Description
0	Single Drive	
1	Master	
2	Follower	

1209 INPUT SWITCH ACKNOWLEDGEMENT 6 (2.2.7.32)

Select the digital input to acknowledge the status of the input switch. The input switch is normally a switch fuse unit or main contactor with which the power is fed to the drive. If the input switch acknowledgement is missing, the drive trips at Input switch open fault (F64). The parameter is available for NXP drives only.

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1210 EXTERNAL BRAKE ACKNOWLEDGEMENT 6 (2.2.7.24)

Connect this digital input signal to an auxiliary contact of the mechanical brake. If the brake opening command is given, but the contact of the brake feedback signal does not close in given time, a mechanical brake fault shows (fault code 58). The parameter is available for NXP drives only.

1213 EMERGENCY STOP 6 (2.2.7.30)

Indication to the drive that the machine has been stopped by the external emergency stop circuit. Select the digital input to activate the emergency stop input to the drive. When the digital input is low the drive stops as per the parameter definition of ID1276 Emergency stop mode and indicates the warning code A63.

The parameter is available for NXP drives only.

1217 ID BIT FREE DO1 6 (P2.3.1.6)

Select the signal for controlling the DO. The parameter has to be set in format xxxx.yy where xxxx is the ID number of a signal and yy is the bit number. For example, the value for DO control is 43.06. 43 is the ID number of Status Word. So the digital output is ON when bit number 06 of Status Word (ID no. 43) i.e. Run Enable is on.

1218 DC READY PULSE 6 (2.3.3.29)

Charge DC. Used to charge the inverter drive through an input switch. When the DC link voltage is above the charging level a 2-second pulse train is generated to close the input switch. The pulse train is OFF when the input switch acknowledgement goes high. The parameter is available for NXP drives only.

1239 INCHING REFERENCE 1 6 (2.4.15)

1240 INCHING REFERENCE 2 6 (2.4.16)

These parameters define the frequency reference when inching is activated.

The parameter is available for NXP drives only.

1241 SPEED SHARE 6 (2.11.5)

Defines the percentage for final speed reference from received speed reference.

TORQUE REFERENCE FILTERING TIME 6 (2.10.10)

Gives the filtering time for the torque reference.

1248 LOAD SHARE 6 (2.11.6)

Defines the percentage for final torque reference from received torque reference.

1250 FLUX REFERENCE 6 (2.6.23.32)

Defines how much magnetization current will be used.

1252 SPEED STEP 6 (2.6.15.1, 2.6.25.25)

NCDrive parameter to help adjusting the speed controller. See closer NCDrive Tools: Step response. With this tool you can give a step value to speed reference after ramp control.

1253 TORQUE STEP 6 (2.6.25.26)

NCDrive parameter to help adjusting the torque controller. See closer NCDrive Tools: Step response. With this tool you can give step to torque reference.

1257 INCHING RAMP 6 (2.4.17)

Gives the acceleration and deceleration times when the Inching function is active.

The parameter is available for NXP drives only.

1276 EMERGENCY STOP MODE 6 (2.4.18)

Defines the action after the IO emergency input goes low. The parameter is available for NXP drives only.

Table 202: Selections for parameter ID1276

Selection number	Selection name	Description
0	Coasting stop	
1	Ramping stop	

1278 TORQUE SPEED LIMIT, CLOSED LOOP 6 (2.10.6)

With this parameter the maximum frequency for the torque control can be selected.

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Table 203: Selections for parameter ID1278

Selection number	Selection name	Description
0	Closed Loop speed control	
1	Positive and negative frequency limit	
2	Ramp generator output (-/+)	
3	Negative frequency limit – Ramp generator output	
4	Ramp generator output – Positive frequency limit	
5	Ramp generator output with window	
6	0 – Ramp generator output	
7	Ramp generator output with window and On/Off limits	

For the selection of this parameter in NXS drives, see ID644.

1285 POSITIVE FREQUENCY LIMIT 6 (2.6.20)

Maximum frequency limit for the drive. The parameter is available for NXP drives only.

1286 NEGATIVE FREQUENCY LIMIT 6 (2.6.19)

Minimum frequency limit for the drive. The parameter is available for NXP drives only.

1287 MOTORING TORQUE LIMIT 6 (2.6.22)

The maximum torque limit of the motoring side. The parameter is available for NXP drives only.

1288 GENERATOR TORQUE LIMIT 6 (2.6.21)

The maximum torque limit of the generating side. The parameter is available for NXP drives only.

1289 MOTORING POWER LIMIT 6 (2.6.23.20)

The maximum power limit of the generating side. For Closed Loop control mode only.

1290 GENERATOR POWER LIMIT 6 (2.6.23.19)

The maximum power limit of the motoring side. For Closed Loop control mode only.

1316 BRAKE FAULT RESPONSE 6 (2.7.28)

Defines the action when a brake fault is detected.

Table 204: Selections for parameter ID1316

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to ID506	
3	Fault, stop mode after fault always by coasting	

1317 BRAKE FAULT DELAYS 6 (2.7.29)

The delay before the brake fault (F58) is activated. Used when there is a mechanical delay in the brake. See parameter ID1210.

1324 MASTER/FOLLOWER SELECTION 6 (2.11.1)

Select Master/Follower mode. When the value Follower is selected the Run Request command is monitored from Master. All other references are selectable by parameters.

Table 205: Selections for parameter ID1324

Selection number	Selection name	Description
0	Single Drive	
1	Master	
2	Follower	

1352 SYSTEMBUS FAULT DELAY 6 (2.7.31)

Defines the delays for the fault generation when heartbeat is missing.

1355 TO 1369 FLUX 10-150% 6 (2.6.25.1 - 2.6.25.15)

Motor voltage corresponding to 10%-150% of flux as a percentage of nominal flux voltage.

1385 ID BIT FREE DO2 6 (P2.3.2.6)

Select the signal for controlling the DO. The parameter has to be set in format xxxx.yy where xxxx is the ID number of a signal and yy is the bit number. For example, the value for DO control is 43.06. 43 is the ID number of Status Word. So the digital output is ON when bit number 06 of Status Word (ID no. 43) i.e. Run Enable is on.

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1401 STOP STATE FLUX 6 (2.6.23.24)

The amount of flux as a percentage of the motor nominal flux maintained in the motor after the drive is stopped. The flux is maintained for the time set by parameter ID1402. This parameter can be used in closed loop motor control mode only.

1402 FLUX OFF DELAY 6 (2.6.23.23)

The flux defined by parameter ID1401 is maintained in the motor for the set time after the drive is stopped. This function is used to shorten the time before the full motor torque is available.

Table 206: Selections for parameter ID1402

Selection number	Selection name	Description
0	No flux after the motor is stopped.	
>0	The flux off delay in seconds.	
<0	The flux is maintained in the motor after stop until the next Run request is given to the drive.	

1412 TORQUE STABILIZER GAIN 6 (2.6.26.1)

Additional gain for the torque stabilizer at zero frequency.

1413 TORQUE STABILATOR DAMPING 6 (2.6.26.2)

This parameter defines the time constant for the torque stabilator. The greater the parameter value, the shorter the time constant.

If a PMS motor is used in Open Loop control mode it is recommended to use value 980 in this parameter instead of 1000.

1414 TORQUE STABILATOR GAIN IN FIELDWEAKENING POINT 6 (2.6.26.3)

The general gain for the torque stabilator.

1420 PREVENTION OF STARTUP 6 (2.2.7.25)

This parameter is enabled when the "Prevention of start" circuit is used to inhibit the gate pulses. The parameter is available for NXP drives only.

1424 RESTART DELAY 6 (2.6.17)

The delay time within which the drive can not be restarted after a coast stop. The time can be set up to 60.000 seconds. The Closed Loop control mode uses a different delay.

NOTE!

This function is not available when flying start is selected for start function (ID505).

The parameter is available for NXP drives only.

1536 FOLLOWER FAULT 6 (2.11.8)

Defines the response in Master drive when a fault occurs in any of the follower drives. For diagnostic purposes, when one of the drives trips to fault the master drive will send a command to trigger Data Logger in all the drives.

Table 207: Selections for parameter ID1536

Selection number	Selection name	Description
0	No response	
1	Warning	
2	Fault, stop mode after fault according to Stop function	

1550 FLUX CIRCLE STABILATOR GAIN 6 (2.6.26.5)

Gain for flux circle stabilizer (0-32766)

1551 FLUX STABILATOR TC 6 (2.6.26.6)

Filter coefficient of id-current stabilizer.

1552 VOLTAGE STABILATOR TC 6 (2.6.26.11)

Damping rate of voltage stabilizer, (0-1000).

1553 VOLTAGE STABILATOR LIMIT 6 (2.6.26.11)

This parameter sets the limits for the voltage stabilizer output i.e. the max. and the min. value for the correction term df in FreqScale.

1587 INV DELAYED DO1 6 (P2.3.1.5)

Inverts delayed digital output signal 1.

1588 INV DELAYED DO2 6 (P2.3.2.5)

Inverts delayed digital output signal 2.

1720 TORQUE STABILATOR LIMIT RATIO 6 (2.6.26.4)

Limit of torque stabilator output.

ID111 * ID1720 = Torque Stabilator Limit

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1738 VOLTAGE STABILATOR GAIN 6 (2.6.26.9)

1796 FLUX STABILATOR COEFFICIENT 6 (2.6.26.8)

1797 FLUX STABILATOR GAIN 6 (2.6.26.7)

1900 RAMP; SKIP S2 6 (P2.4.21)

This function is used to bypass the second corner S ramp (i.e. to avoid the unnecessary speed increase, shown with the solid line in *Fig. 90 Ramp; Skip S2*) when the reference is changed before the final speed is reached. Also S4 is bypassed when reference is increased while speed is ramping down.

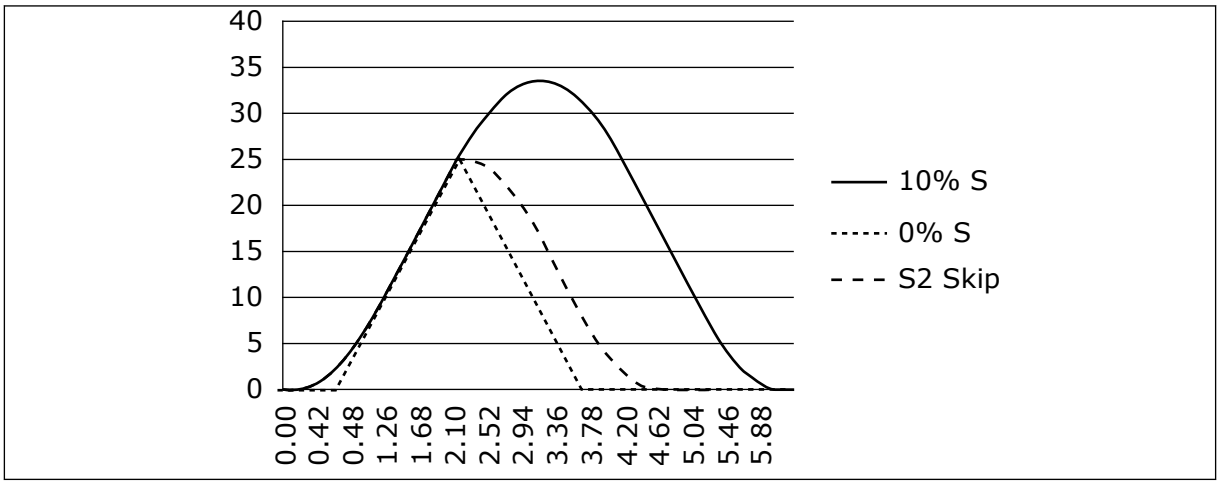

Fig. 90: Ramp; Skip S2

Second S curve is bypassed when reference changes at 25 Hz.

8.1 KEYPAD CONTROL PARAMETERS

Unlike the parameters listed above, these parameters are located in the M3 menu of the control keypad. The frequency and torque reference parameters do not have an ID number.

114 STOP BUTTON ACTIVATED (3.4, 3.6)

If you wish to make the Stop button a "hotspot" which always stops the drive regardless of the selected control place, give this parameter the value 1.
See also parameter ID125.

125 CONTROL PLACE (3.1)

The active control place can be changed with this parameter. For more information, see the product's User Manual.

Pushing the Start button for 3 seconds selects the control keypad as the active control place and copies the Run status information (Run/Stop, direction and reference).

Table 208: Selections for parameter ID125

Selection number	Selection name	Description
0	PC Control, Activated by NCDrive	
1	I/O terminal	
2	Keypad	
3	Fieldbus	

123 KEYPAD DIRECTION (3.3)

Table 209: Selections for parameter ID123

Selection number	Selection name	Description
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 product's User Manual.

R3.2 KEYPAD REFERENCE (3.2)

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 M3. For more information, see the product's User Manual.

167 PID REFERENCE 1 57 (3.4)

The PID controller keypad reference can be set between 0% and 100%. This reference value is the active PID reference if parameter ID332 = 2.

168 PID REFERENCE 2 57 (3.5)

The PID controller keypad reference 2 can be set between 0% and 100%. This reference is active if the DIN5 function = 13 and the DIN5 contact is closed.

R3.5 TORQUE REFERENCE 6 (3.5)

Define here the torque reference within -300.0...300.0%.

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8.2 MASTER/FOLLOWER FUNCTION (NXP ONLY)

The Master/Follower function is designed for applications in which the system is run by several NXP drives and the motor shafts are coupled to each other via gearing, chain, belt etc. It is recommended that the Closed Loop control mode be used.

The external Start/Stop control signals are connected to the Master drive only. Speed and torque references and control modes are selected for each drive separately. The Master controls the Follower(s) via a SystemBus. The Master station is typically speed-controlled and the other drives follow its torque or speed reference.

Torque control of the Follower should be used when the motor shafts of the Master and Follower drives are solidly coupled to each other by gearing, a chain etc., so that no speed difference between the drives is possible. Window control is recommended to keep the speed of the follower close to that of the master.

Speed control of the Follower should be used when the demand of speed accuracy is lower. In such cases, use of load drooping is recommended in all drives to balance the load.

8.2.1 MASTER/FOLLOWER LINK PHYSICAL CONNECTIONS

In figures below, the master drive is located on the left side and all others are followers. The master/follower physical link can be built with OPTD2 option board. See Vacon NX I/O Board Manual for further information.

8.2.2 OPTICAL FIBRE CONNECTION BETWEEN AC DRIVES WITH OPTD2

The OPTD2 board in the Master has the default jumper selections, i.e. X6:1-2, X5:1-2. For the followers, the jumper positions have to be changed: X6:1-2, X5:2-3. This board also has a CAN communication option that is useful for multiple drive monitoring with NCDrive PC software, when commissioning Master Follower functions or line systems.

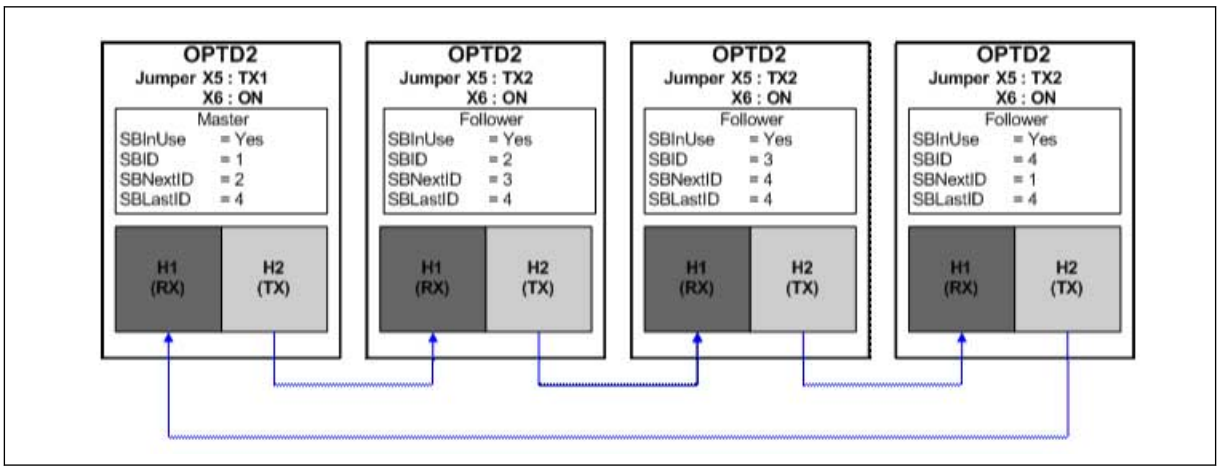

Fig. 91: System bus physical connections with the OPTD2 board

For information on the OPTD2 expander board parameters, see Vacon NX I/O Board Manual.

8.3 EXTERNAL BRAKE CONTROL WITH ADDITIONAL LIMITS (IDS 315, 316, 346 TO 349, 352, 353)

The external brake used for additional braking can be controlled through parameters 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.

NOTE!

During Identification Run (see parameter ID631), brake control is disabled.

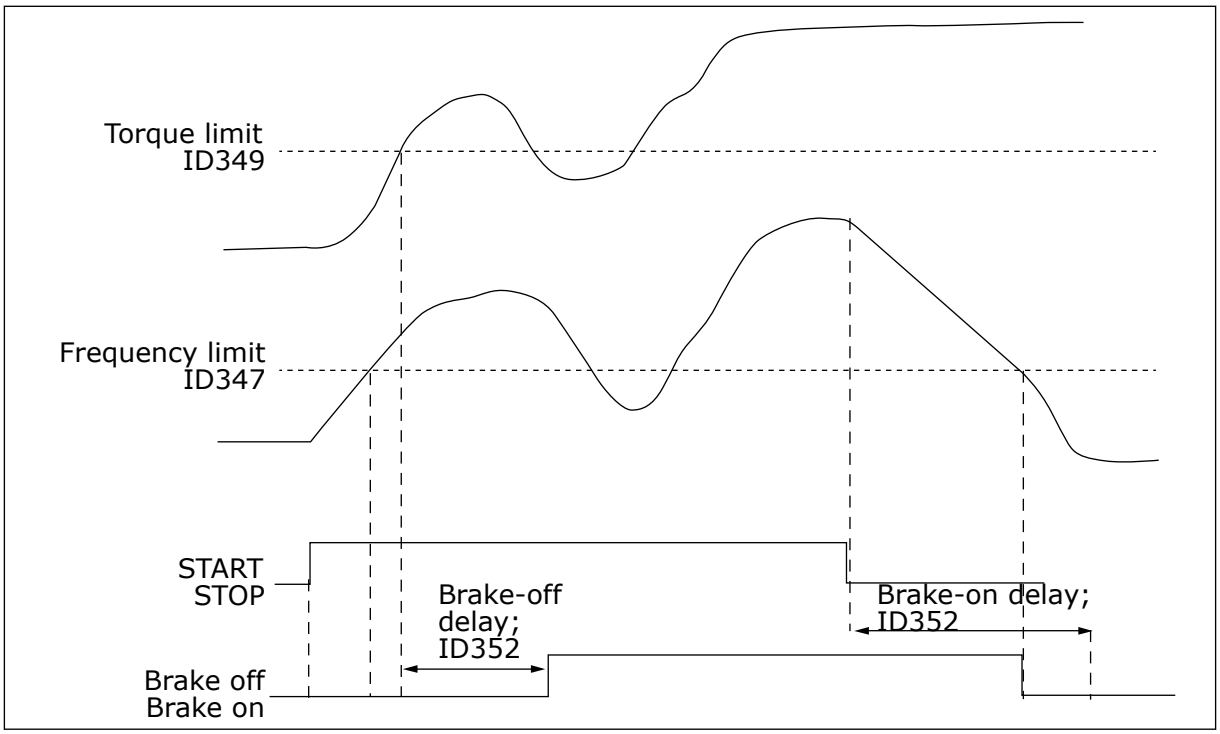

Fig. 92: Brake control with additional limits

In 21 above, the brake control is set to react to both the torque supervision limit (parameter ID349) and frequency supervision limit (ID347). Additionally, the same frequency limit is used for both brake-off and brake-on control by giving parameter ID346 the value 4. Use of two different frequency limits is also possible. Then parameters 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.

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

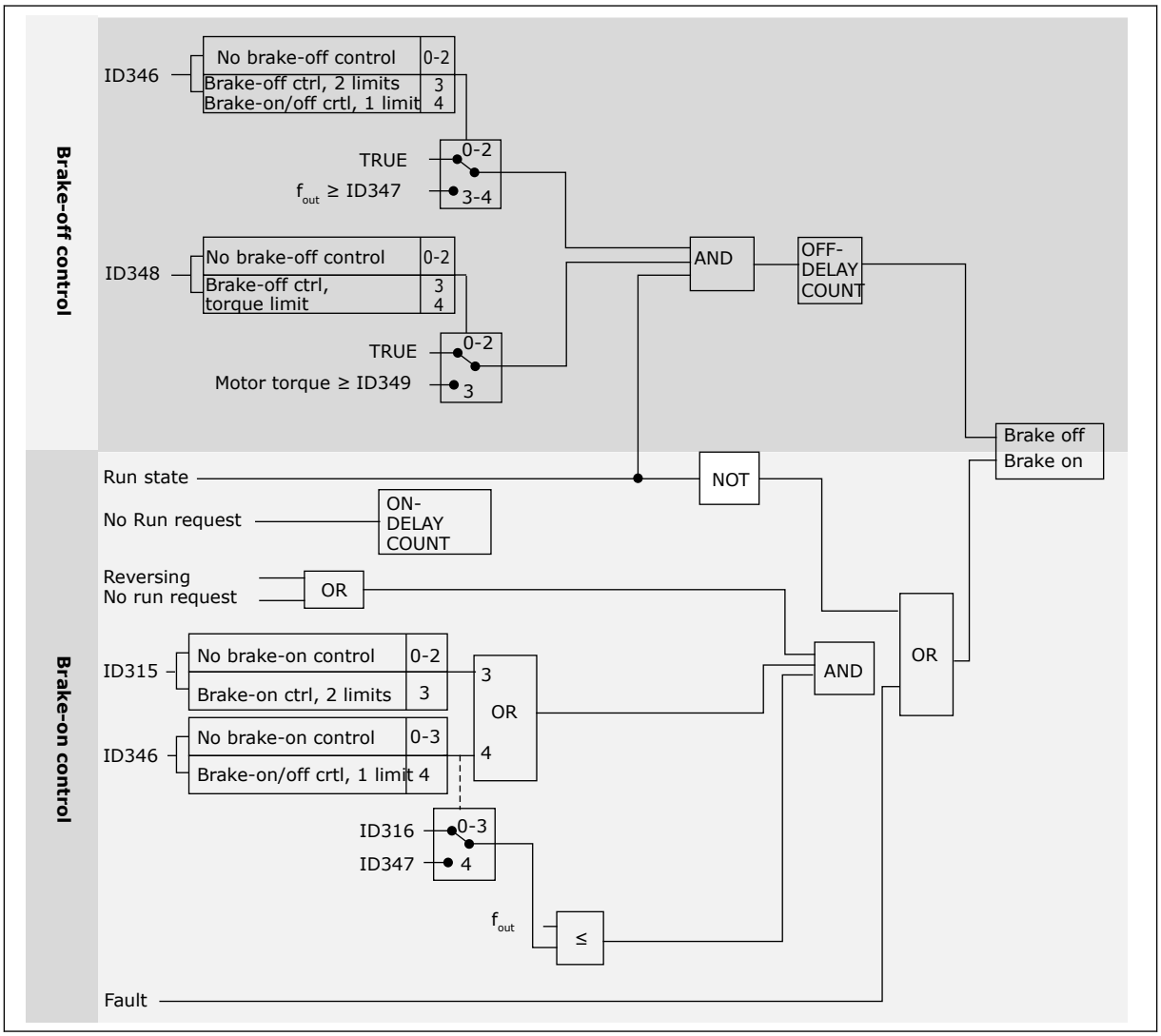

Fig. 93: Brake control logic

When using the Master Follower function, the follower drive will open the brake at the same time with the Master even if the Follower's conditions for brake opening have not been met.

8.4 PARAMETERS OF MOTOR THERMAL PROTECTION (IDS 704 TO 708)

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

The AC drive can supply a current that is higher than the nominal current. The high current can be necessary to the load, and it must be used. In these conditions, there is a risk of a thermal overload. Low frequencies have a higher risk. At low frequencies, the cooling effect and the capacity of the motor decrease. If the motor has an external fan, the load reduction at low frequencies is small.

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

The motor thermal protection can be adjusted with parameters. The thermal current IT 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 the product's User Manual.

NOTE!

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

CAUTION!

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

8.5 PARAMETERS OF STALL PROTECTION (IDS 709 TO 712)

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

The stall status of the motor is specified with parameters ID710 (Stall current) and ID712 (Stall frequency limit). If the current is higher than the limit, and the output frequency is lower than the limit, the motor is in a stall status.

The stall protection is a type of overcurrent protection.

NOTE!

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

8.6 PARAMETERS OF UNDERLOAD PROTECTION (IDS 713 TO 716)

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

You can adjust the motor underload protection with parameters ID714 (Field Weakening Area Load) and ID715 (Zero Frequency Load). The underload curve is a squared curve between the zero frequency and the field weakening point. The protection is not active below 5 Hz. The underload time counter does not operate below 5 Hz.

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

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NOTE!

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

8.7 FIELDBUS CONTROL PARAMETERS (IDS 850 TO 859)

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.

8.7.1 PROCESS DATA OUT (SLAVE -> MASTER)

The fieldbus master can read the AC drive's actual values using process data variables. Basic, Standard, Local/Remote, Multi-Step, PID control and Pump and fan control applications use process data as follows:

Table 210: The default values for Process Data Out in fieldbus

Data	Default value	Unit	Scale	ID
Process Data Out 1	Output frequency	Hz	0.01 Hz	1
Process Data Out 2	Motor speed	rpm	1 rpm	2
Process Data Out 3	Motor current	A	0.1 A	45
Process Data Out 4	Motor torque	%	0.1%	4
Process Data Out 5	Motor power	%	0.1%	5
Process Data Out 6	Motor voltage	V	0.1 V	6
Process Data Out 7	DC link voltage	V	1 V	7
Process Data Out 8	Active fault code	-	-	37

The Multipurpose application has a selector parameter for every Process Data. The monitoring values and drive parameters can be selected using the ID number. Default selections are as in the table above.

8.7.2 CURRENT SCALING IN DIFFERENT SIZE OF UNITS

NOTE!

Monitoring value ID45 (usually in Process data OUT3) is given with one decimal only.

Table 211: Current scaling in different size of units

Voltage	Size	Scale
208 - 240 Vac	NX_2 0001 – 0011	100 – 0.01A
208 - 240 Vac	NX_2 0012 – 0420	10 – 0.1A
380 - 500 Vac	NX_5 0003 – 0007	100 – 0.01A
380 - 500 Vac	NX_5 0009 – 0300	10 – 0.1A
380 - 500 Vac	NX_5 0385 –	1 – 1A
525 - 690 Vac	NX_6 0004 – 0013	100 – 0.01A
252 - 690 Vac	NX_6 0018 –	10 – 0.1A

8.7.3 PROCESS DATA IN (MASTER -> SLAVE)

ControlWord, Reference and Process Data are used in All in One applications as follows:

Table 212: Basic, Standard, Local/Remote, Multi-Step applications

Data	Value	Unit	Scale
Reference	Speed reference	%	0.01%
ControlWord	Start/Stop command Fault reset command	-	-
PD1 – PD8	Not used	-	-

NOTE!

Settings in the table below are factory defaults. See also parameter group G2.9.

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Table 213: Multipurpose control application

Data	Value	Unit	Scale
Reference	Speed reference	%	0.01%
ControlWord	Start/Stop command Fault reset command	-	-
Process Data IN1	Torque reference	%	0.1%
Process Data IN2	Free analogue input	%	0.01%
Process Data IN3	Adjust input	%	0.01%
PD3 – PD8	Not used	-	-

Table 214: PID control and Pump and fan control applications

Data	Value	Unit	Scale
Reference	Speed reference	%	0.01%
ControlWord	Start/Stop command Fault reset command	-	-
Process Data IN1	Reference for PID controller	%	0.01%
Process Data IN2	Actual value 1 to PID controller	%	0.01%
Process Data IN3	Actual value 2 to PID controller	%	0.01%
PD4 – PD8	Not used	-	-

8.8 CLOSED LOOP PARAMETERS (IDS 612 TO 621)

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

Closed loop control mode (see Chapter *600 Motor control mode 234567 (2.6.1)*) 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 Vacon NXP 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). Switch the encoder wiring or the phases of motor cables if necessary. Do not run if encoder speed is wrong. Program the no-load current to parameter ID612 or perform the ID run without load on motor shaft and set parameter ID619 (Slip Adjust) to get the voltage slightly above the linear U/f-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.

8.9 "TERMINAL TO FUNCTION" (TTF) PROGRAMMING PRINCIPLE

The programming principle of the input and output signals in the Multipurpose 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 Vacon NX 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 for. See Warning in Chapter *8.9.2 Defining a terminal for a certain function with NCDrive programming tool*.

8.9.1 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 Vacon NX control board (see the product's User Manual) and the respective signal number, see below.

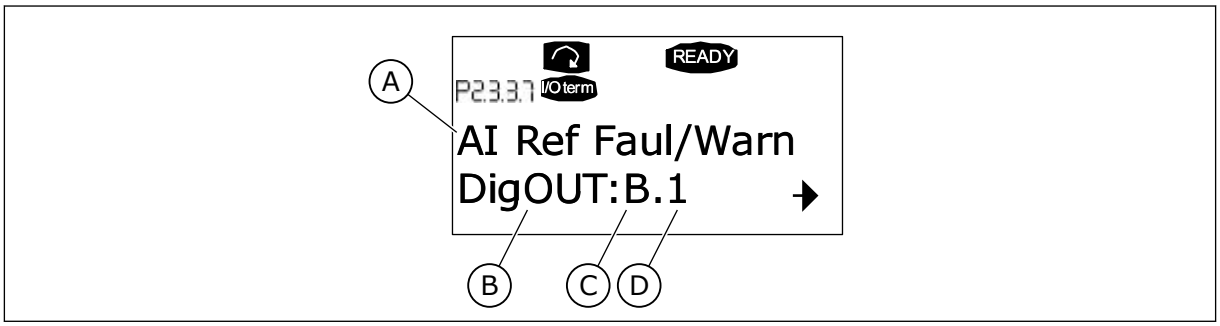

Fig. 94: Defining an input/output for a certain function on keypad

A. Function name
B. Terminal type
C. Slot
D. Terminal number

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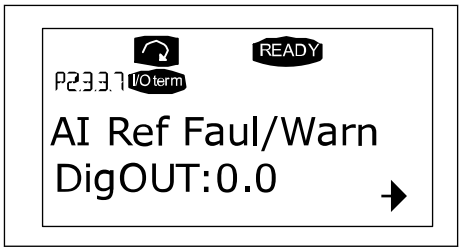
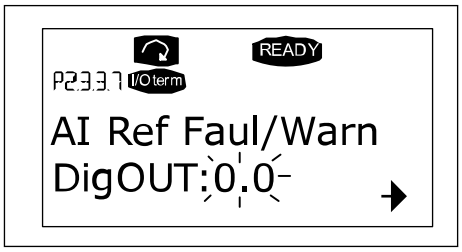
EXAMPLE

You want to connect the digital output function Reference fault/warning (parameter 2.3.3.7) to the digital output DO1 on the basic board OPTA1 (see the product's User Manual).

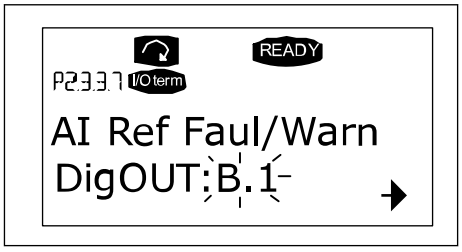
1 Find the parameter 2.3.3.7 on the keypad. Press the Menu button right once to enter the edit mode. On the value line, you will see the terminal type on the left (DigIN, DigOUT, An.IN, An.OUT) and on the right, the present input/output the function is connected to (B.3, A.2 etc.), or if not connected, a value (0.#).



2 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.



3 Once you have set the desired value, press the Enter button once to confirm the change.



8.9.2 DEFINING A TERMINAL FOR A CERTAIN FUNCTION WITH NCDRIVE PROGRAMMING TOOL

If you use the NCDrive 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.

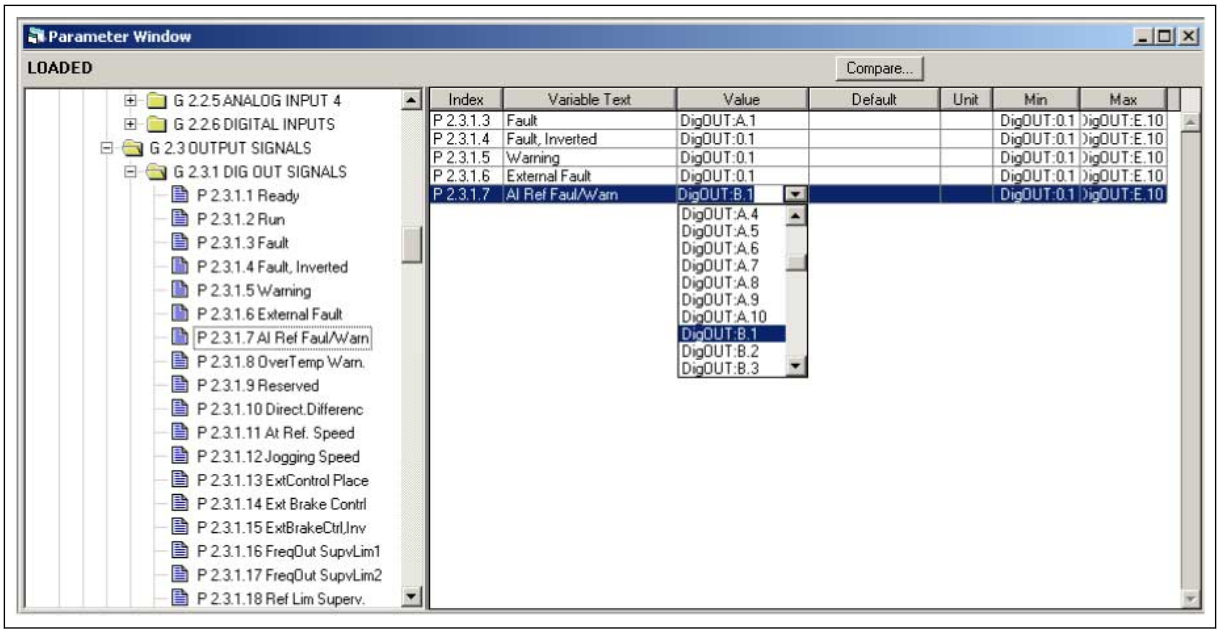


Fig. 95: Screenshot of NCDrive programming tool; Entering the address code

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.

NOTE!

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

8.9.3 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 0.1 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 analogue inputs, giving the value 1 for the terminal number corresponds to 0% signal level, value 2 corresponds to 20%, value 3 to 30% and so on. Giving value 10 for the terminal number corresponds to 100% signal level.

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8.10 SPEED CONTROL PARAMETERS (APPLICATION 6 ONLY)

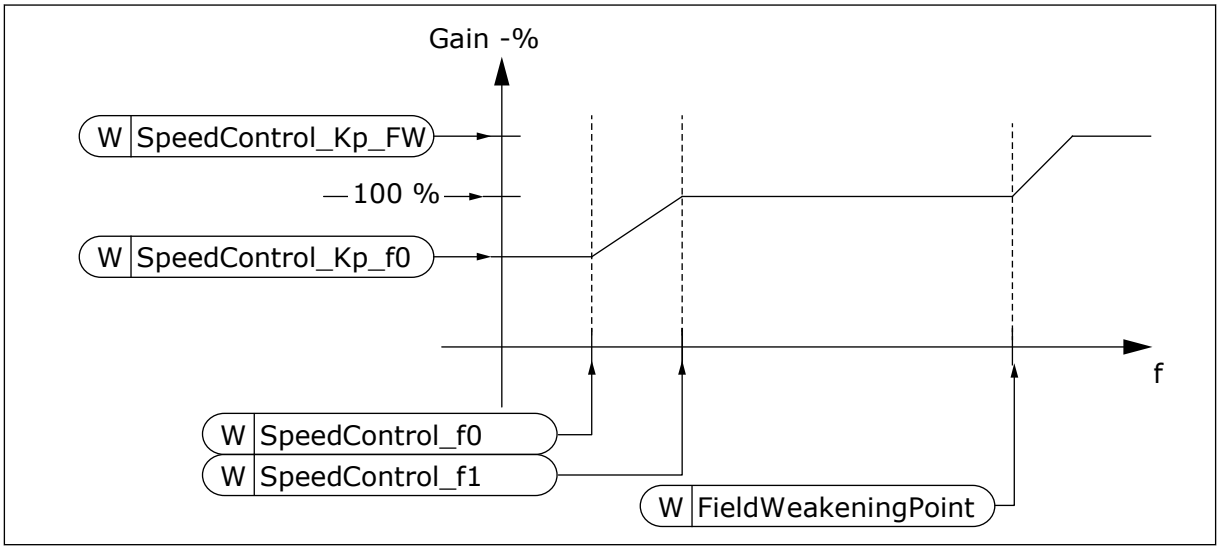

Fig. 96: Speed Controller adaptive gain

1295 SPEED CONTROLLER TORQUE MINIMUM GAIN 6 (2.6.23.30)

The relative gain as a percentage of ID613 of the speed controller when the torque reference or the speed control output is less than the value of parameter ID1296. This parameter is normally used to stabilise the speed controller for a drive system with gear backlash.

1296 SPEED CONTROLLER TORQUE MINIMUM 6 (2.6.23.29)

The level of torque reference below which the speed controller gain is changed from ID613 to ID1295 . This is in percentage of motor nominal torque. The change is filtered according to parameter ID1297.

1297 SPEED CONTROLLER TORQUE MINIMUM FILTERING TIME 6 (2.6.23.31)

Filtering time for torque when the speed controller gain is changed between ID613 and ID1295 depending on ID1296.

1298 SPEED CONTROLLER GAIN IN FIELD WEAKENING AREA 6 (2.6.23.28)

The relative gain of the speed controller in the field weakening area as a percentage of parameter ID613.

1299 SPEED CONTROLLER GAIN F0 6 (2.6.23.27)

The relative gain of the speed controller as a percentage of parameter ID613 when the speed is below the level defined by ID1300.

1300 SPEED CONTROLLER F0 POINT 6 (2.6.23.26)

The speed level in Hz below which the speed controller gain is equal to parameter ID1299.

1301 SPEED CONTROLLER F1 POINT 6 (2.6.23.25)

The speed level in Hz above which the speed controller gain is equal to parameter ID613. From the speed defined by parameter ID1300 to speed defined by parameter ID1301, the speed controller gain changes linearly from parameters ID1299 to ID613 and vice versa.

1304 WINDOW POSITIVE 6 (2.10.12)

Defines the size of window to positive direction from the final speed reference.

1305 WINDOW NEGATIVE 6 (2.10.11)

Defines the size of window to negative direction from the final speed reference.

1306 WINDOW POSITIVE OFF LIMIT 6 (2.10.14)

Defines speed controller positive off limit when the speed controller brings speed back to window.

1307 WINDOW NEGATIVE OFF LIMIT 6 (2.10.13)

Defines speed controller negative off limit when the speed controller brings speed back to window.

1311 SPEED ERROR FILTER TC 6 (2.6.23.33)

Filter time constant for speed reference and actual speed error. Can be used to remove small disturbances in the encoder signal.

1382 SPEED CONTROL OUTPUT LIMIT 6 (2.10.15)

The maximum torque limit for the speed controller output as a percentage of the motor nominal torque.

8.11 AUTOMATIC CHANGING BETWEEN DRIVES (APPLICATION 7 ONLY)

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 AC drive can also be included in the automatic changing and locking sequence (P2.9.25). 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 2.9.24, Autochange.
- The autochange takes place when the time set with parameter 2.9.26, Autochange interval, has expired and the capacity used is below the level defined with parameter 2.9.28, 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 AC drive connect the drives to the AC drive or to the mains. If the motor controlled by the AC drive 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 *Fig. 98 Example of 2-pump autochange, main diagram* and *Fig. 99 Example of 3-pump autochange, main diagram*).

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1027 AUTOCHANGE 7 (2.9.24)

Table 215: Selections for parameter ID1027

Selection number	Selection name	Description
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 AC drive. depending on the setting of parameter 2.9.25, Automatics selection. By default, the Autochange is activated for 2 drives. See *Fig. 19 Pump and fan control application default I/O configuration andconnection example (with 2-wire transmitter)* and *Fig. 98 Example of 2-pump autochange, main diagram*.

1028 AUTOCHANGE/INTERLOCKINGS AUTOMATICS SELECTION 7 (2.9.25)

Table 216: Selections for parameter ID1028

Selection number	Selection name	Description
0	Automatics (autochange/interlockings) applied to auxiliary drives only	The drive controlled by the AC drive 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 AC drive is included in the automatics and a contactor is needed for each drive to connect it to either the mains or the AC drive.

1029 AUTOCHANGE INTERVAL 7 (2.9.26)

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 2.9.28 (Autochange frequency limit) and 2.9.27 (Maximum number of auxiliary drives). Should the capacity exceed the value of P2.9.28, 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.

1030 AND 1031 MAXIMUM NUMBER OF AUXILIARY DRIVES AND AUTOCHANGE FREQUENCY LIMIT (2.9.27 AND 2.9.28)

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 2.9.27 the autochange function can take place.
- If the number of running auxiliary drives is equal to the value of parameter 2.9.27 and the frequency of the controlled drive is below the value of parameter 2.9.28 the autochange can take place.
- If the value of parameter 2.9.28 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of parameter 2.9.27.

8.12 INTERLOCK SELECTION (P2.9.23)

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 AC drive.
- If the interlock of the controlled drive is inactivated, all motors will be stopped and restarted with the new set-up.
- If the interlock is re-activated in Run status, the automatics functions according to parameter 2.9.23, Interlock selection:

Table 217: Selections for Interlock selection

Selection number	Selection name	Description
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 set-up. EXAMPLE: [P1 -> P2 -> P4] -> [P3 LOCKED] -> [STOP] -> [P1 -> P2 -> P3 -> P4]

See Chapter *8.13 Examples of Autochange and Interlock selection*.

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8.13 EXAMPLES OF AUTOCHANGE AND INTERLOCK SELECTION

8.13.1 PUMP AND FAN AUTOMATICS WITH INTERLOCKS AND NO AUTOCHANGE

Situation:

- One controlled drive and three auxiliary drives.
- Parameter settings: 2.9.1=3, 2.9.25=0
- Interlock feedback signals used, autochange not used.
- Parameter settings: 2.9.23=1, 2.9.24=0
- The interlock feedback signals come from the digital inputs selected with parameters 2.2.6.18 to 2.2.6.21.
- The Auxiliary drive 1 control (P2.3.1.27) is enabled through Interlock 1 (P2.2.6.18), the Auxiliary drive 2 control (P2.3.1.28) through Interlock 2 (P2.2.6.19) etc.

Phases:

1. The system and the motor controlled by the AC drive are started.
2. The Auxiliary drive 1 starts when the main drive reaches the starting frequency set (P2.9.2).
3. The main drive decreases speed down to Auxiliary drive 1 Stop frequency (P2.9.3) 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 (P2.9.4).
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 P2.9.23.
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).

8.13.2 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 2.9.23.

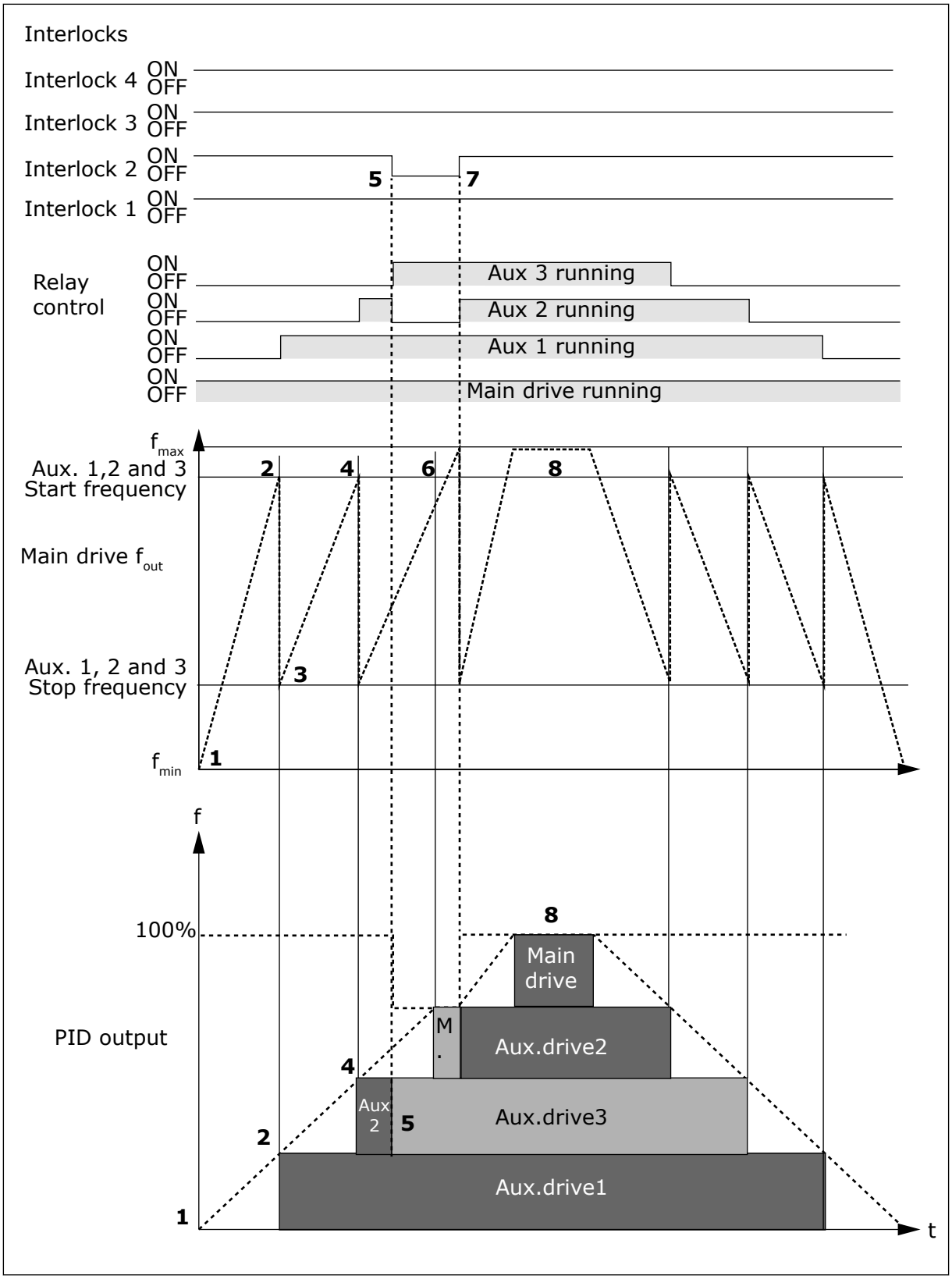

Fig. 97: Example of the function of the PFC application with three aux. drives

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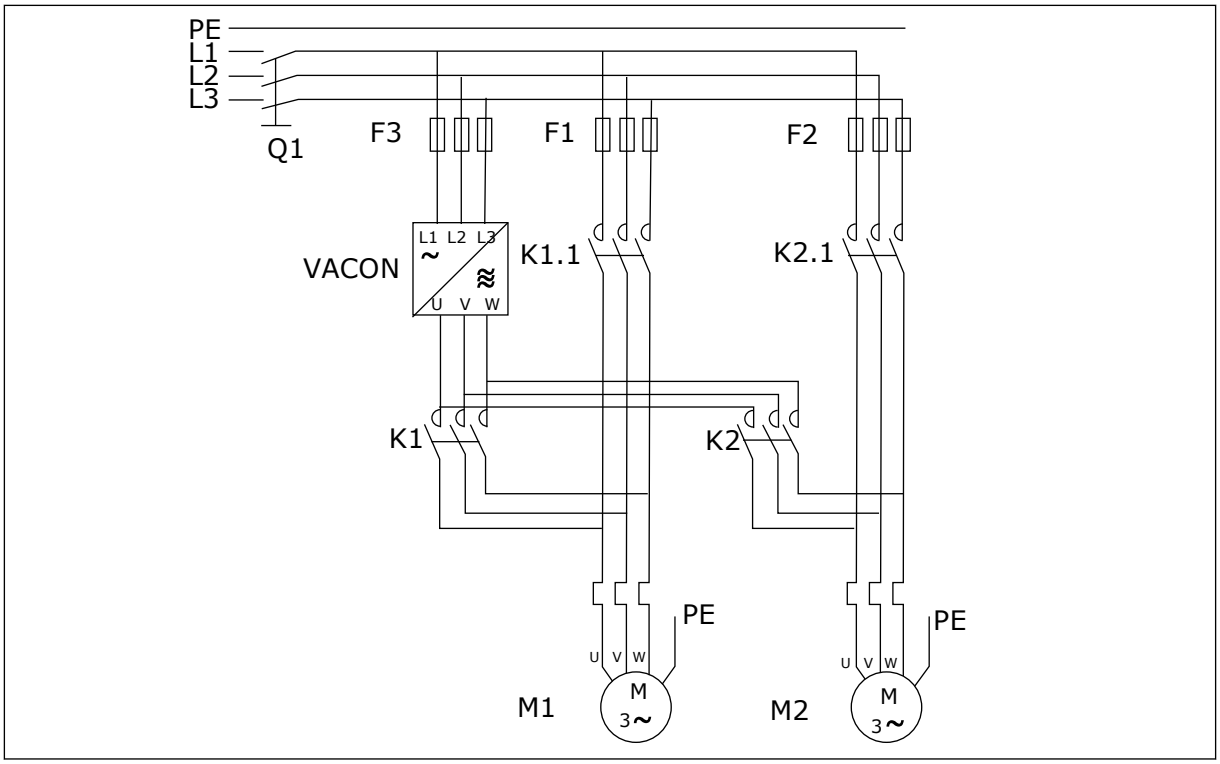

Fig. 98: Example of 2-pump autochange, main diagram

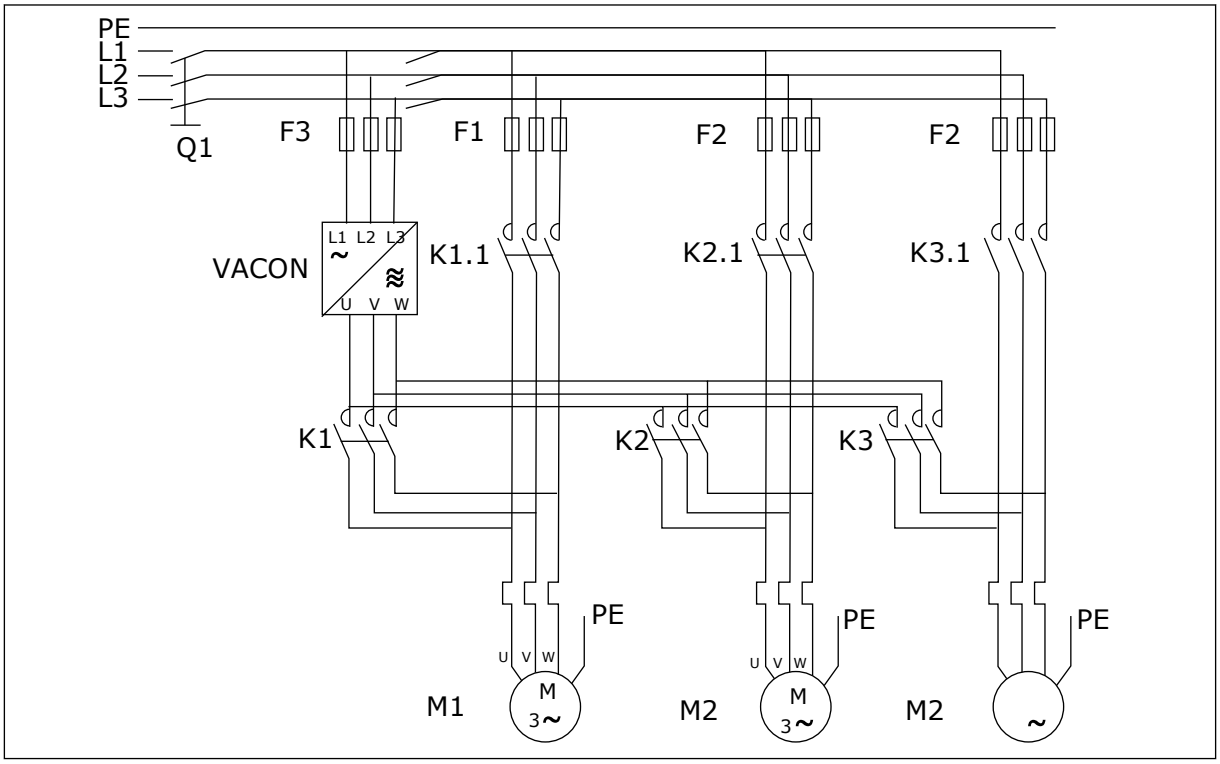

Fig. 99: Example of 3-pump autochange, main diagram

9 FAULT TRACING

9.1 FAULT CODES

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
1	Overcurrent	S1 = Hardware trip S2 = Reserved S3 = Current controller supervision	There is too high a current (>4*I H) in the motor cable. Its cause can be 1 of these. • a sudden heavy load increase • a short circuit in the motor cables • the motor is not the correct type	Do a check of the loading. Do a check of the motor. Do a check of the cables and connections. Make an identification run.
2	Overvoltage	S1 = Hardware trip S2 = Overvoltage control supervision	The DC-link voltage is higher than the limits. • too short a deceleration time • high overvoltage spikes in the supply • Start/Stop sequence too fast	Set the deceleration time longer. Use the brake chopper or the brake resistor. They are available as options. Activate the overvoltage controller. Do a check of the input voltage.
3 *	Earth fault		The measurement of current tells that the sum of the motor phase current is not zero. • an insulation malfunction in the cables or the motor	Do a check of the motor cables and the motor.
5	Charging switch		The charging switch is open, when the START command is given. • operation malfunction • defective component	Reset the fault and start the drive again. If the fault shows again, ask instructions from the distributor near to you.
6	Emergency stop		Stop signal has been given from the option board.	Do a check of the emergency stop circuit.

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Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
7	Saturation trip		• defective component • brake resistor short-circuit or overload	This fault cannot be reset from the control panel. Switch off the power. DO NOT RESTART THE DRIVE or CONNECT THE POWER! Ask instructions from the factory. If this fault shows at the same time with Fault 1, do a check of the motor cable and the motor.
8	System fault	S1 = Reserved	• operation malfunction • defective component	Reset the fault and start the drive again. If the fault shows again, ask instructions from the distributor near to you.
		S2 = Reserved		
		S3 = Reserved		
		S4 = Reserved		
		S5 = Reserved		
		S6 = Reserved		
		S7 = Charging switch		
		S8 = No power to driver card		
		S9 = Power unit communication (TX)		
		S10 = Power unit communication (Trip)		
		S11 = Power unit comm. (Measurement)		

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
9 *	Undervoltage	S1 = DC-link too low during run S2 = No data from power unit S3 = Undervoltage control supervision	The DC-link voltage is lower than the limits. • too low a supply voltage • AC drive internal fault • a defective input fuse • the external charge switch is not closed	If there is a temporary supply voltage break, reset the fault and start the drive again. Do a check of the supply voltage. If the supply voltage is sufficient, there is an internal fault. Ask instructions from the distributor near to you.
10 *	Input line supervision		The input line phase is missing.	Do a check of the supply voltage, the fuses and supply cable.
11 *	Output phase supervision		The measurement of current tells that there is no current in 1 motor phase.	Do a check of the motor cable and the motor.
12	Brake chopper supervision		There is no brake resistor. The brake resistor is broken. A defective brake chopper.	Do a check of the brake resistor and the cabling. If they are in good condition, there is a fault in the resistor or the chopper. Ask instructions from the distributor near to you.
13	Frequency converter undertemperature		Too low a temperature in the heatsink of the power unit or in the power board. The heatsink temperature is below -10 °C (14 °F).	
14	Frequency converter overtemperature		Heatsink temperature is over 90 °C (194 °F) (or 77 °C (170.6 °F), NX_6, FR6). Overtemperature alarm is issued when the heatsink temperature goes over 85 °C (185 °F) (72 °C (161.6 °F)).	Do a check of the actual amount and flow of cooling air. Examine the heatsink for dust. Do a check of the ambient temperature. Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.
15 *	Motor stalled		The motor stalled.	Do a check of the motor and the load.
16 *	Motor overtemperature		There is too heavy a load on the motor.	Decrease the motor load. If there is no motor overload, do a check of the temperature model parameters.
17 *	Motor underload		Motor underload protection has tripped.	Do a check of the load.

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Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
18 **	Unbalance	S1 = Current unbalance S2 = DC voltage unbalance	Unbalance between power modules in parallelled power units.	If the fault occurs again, ask instructions from the distributor near to you.
22	EEPROM checksum fault		Parameter save fault. • operation malfunction • defective component	If the fault occurs again, ask instructions from the distributor near to you.
24 **	Counter fault		Values displayed on counters are incorrect	
25	Microprocessor watchdog fault		• operation malfunction • defective component	Reset the fault and start the drive again. If the fault shows again, ask instructions from the distributor near to you.
26	Start-up prevented		Start-up of the drive has been prevented. Run request in ON when new application is downloaded to the drive.	Cancel prevention of start-up if this can be done safely. Remove Run request
29 *	Thermistor fault		The thermistor input of option board has detected increase of the motor temperature.	Do a check of the motor cooling and loading. Do a check of the thermistor connection. (If thermistor input of the option board is not in use it has to be short circuited).
30	Safe disable		The input on OPTAF board has opened,	Cancel Safe Disable if this can be done safely.
31	IGBT temperature (hardware)		IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Do a check of the loading. Do a check of the motor size. Make an identification run.
32	Fan cooling		Cooling fan of the AC drive does not start, when ON command is give.	Ask instructions from the distributor near to you.
34	CAN bus communication		Sent message not acknowledged.	Make sure that there is another device on the bus with the same configuration.

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
35	Application		Problem in application software.	Ask instructions from the distributor near to you. If you are an application programmer, do a check of the application program.
36	Control unit		NXS Control Unit can not control NXP Power Unit and vice versa	Change the control unit.
37 **	Device changed (same type)		The option board was replaced by a new one that you have used before in the same slot. The parameters are available in the drive.	Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.
38 **	Device added (same type)		The option board was added. You have used the same option board before in the same slot. The parameters are available in the drive.	Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.
39 **	Device removed		An option board was removed from the slot.	The device is not available. Reset the fault.
40	Device unknown	S1 = Unknown device	An unknown device was connected (the power unit/ option board)	Ask instructions from the distributor near to you.
		S2 = Power1not same type as Power2		
41	IGBT temperature		IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current.	Do a check of the loading. Do a check of the motor size. Make an identification run.
42	Brake resistor overtemperature		Brake resistor overtemperature protection has detected too heavy braking.	Set the deceleration time longer. Use external brake resistor.

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Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
43	Encoder fault	1 = Encoder 1 channel A is missing	Problem detected in encoder signals.	Do a check of the encoder connections. Do a check of the encoder board. Do a check of the encoder frequency in the open loop.
		2 = Encoder 1 channel B is missing		
		3 = Both encoder 1 channels are missing		
		4 = Encoder reversed		
		5 = Encoder board missing		
44 **	Device changed (different type)		Option board or power unit changed. New device of different type or different power rating.	Reset. Set the option board parameters again if option board was changed. Set converter parameters again if power unit was changed.
45 **	Device added (different type)		Option board of different type added.	Reset. Set the power unit parameters again.
49	Division by zero in application		Division by zero has occurred in application program.	If the fault shows again while the AC drive is in run state, ask instructions from the distributor near to you. If you are an application programmer, do a check of the application program.
50 *	Analogue input Iin < 4mA (sel. signal range 4 to 20 mA)		Current at the analogue input is < 4mA. control cable is broken or loose signal source has failed.	Do a check of the current loop circuitry.
51	External fault		Digital input fault.	Remove fault situation on external device.
52	Keypad communication fault		The connection between the control panel (or NCDrive) and the drive is defective.	Do a check of the control panel connection and the control panel cable.

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
53	Fieldbus fault		The data connection between the fieldbus master and the fieldbus board is defective.	Do a check of the installation and fieldbus master. If the installation is correct, ask instructions from the distributor near to you.
54	Slot fault		Defective option board or slot	Do a check of the board and slot. Ask instructions from the distributor near to you.
56	Over Temp.		Temperature exceeded set limit. Sensor disconnected. Short circuit.	Find the cause of temperature rise.
57 **	Identification		Identification run has failed.	Run command was removed before completion of identification run. The motor is not connected to the AC drive. There is load on motor shaft.
58 *	Brake		Actual status of the brake is different from the control signal.	Do a check of the mechanical brake state and connections.
59	Follower communication		SystemBus or CAN communication is broken between Master and Follower.	Do a check of the option board parameters. Do a check of the optical fibre cable or CAN cable.
60	Cooling		Coolant circulation on liquid-cooled drive has failed.	Do a check of the reason for the failure on the external system.
61	Speed error		Motor speed is unequal to reference.	Do a check of the encoder connection. PMS motor has exceeded the pull out torque.
62	Run disable		Run enable signal is low.	Do a check of the reason for the Run enable signal.
63 **	Emergency stop		Command for emergency stop received from digital input or fieldbus.	New run command is accepted after reset.
64 **	Input switch open		Drive input switch is open.	Do a check of the main power switch of the drive.
65	Over Temp.		Temperature exceeded set limit. Sensor disconnected. Short circuit.	Find the cause of temperature rise.

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Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
74	Follower fault		When using normal Master Follower function this fault code is given if one or more follower drives trip to fault.	

* = You can set different responses in the application for these faults. See parameter group Protections.

** = A faults (alarms) only.

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