VACON NX

"ALL IN ONE"
APPLICATION MANUAL
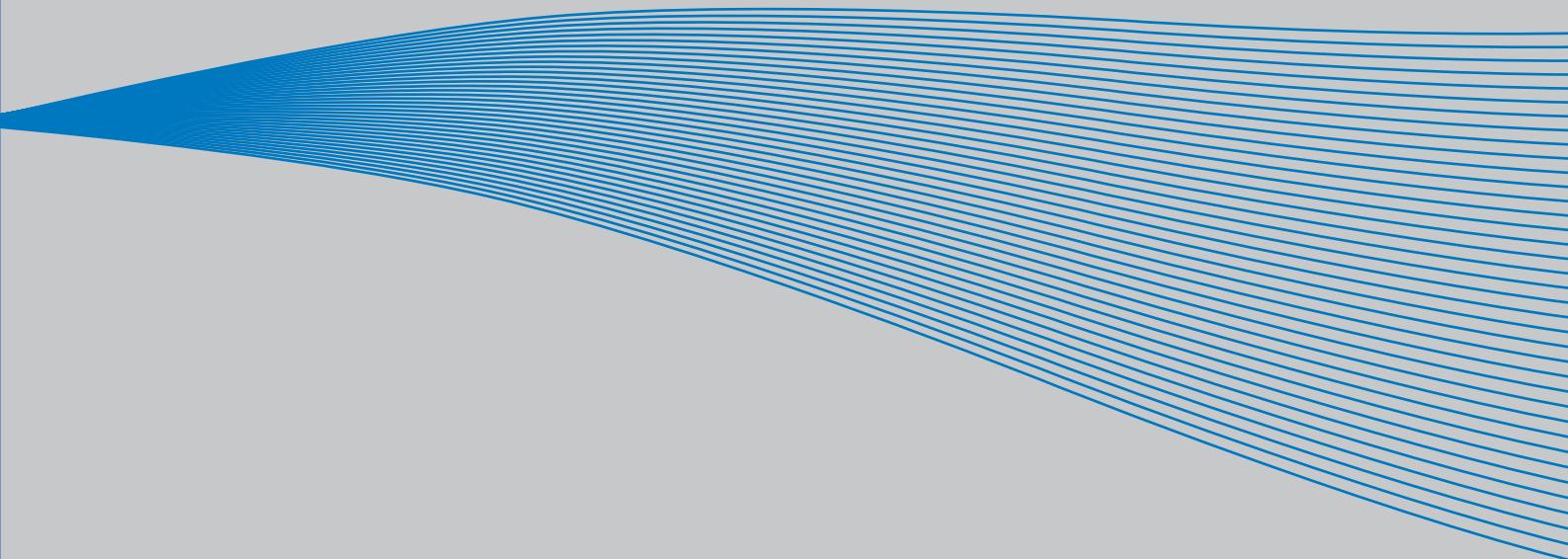
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INDEX

1. Basic Application

Software code: ASFIFF01

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's Manual.

Digital input DIN3 is programmable.

The parameters of the Basic Application are explained in Chapter 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. The motor thermal protection is explained in more detail on pages 200.

1.2   CONTROL I/O

Table 1. Basic application default I/O configuration

Reference potentiometer, 1...10 kΩ

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1 Voltage range 0—10V DC Programmable (P2.14)	Analogue input 1 frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2	Analogue input 2 frequency reference
5	AI2-	Current range 0—20mA	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward	Contact closed = start forward
9	DIN2	Start reverse	Contact closed = start reverse
10	DIN3	External fault input Programmable (P2.17)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls

			DIN4	DIN5	Frequency ref.
14	DIN4	Preset speed select 1	Open	Open	I/O ref (P2.14)
15	DIN5	Preset speed select 2	Closed	Open	Preset speed1
			Open	Closed	Preset speed 2
			Closed	Closed	Max frequency

16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Analogue output 1	Range 0—20 mA/R$_L$, max. 500Ω
19	AO1-	Output frequency Programmable (P2.16)	
20	DO1	Digital output 1 READY	Open collector, I≤50mA, U≤48 VDC

OPTA2			
21	RO1	Relay output 1 RUN	
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	
25	RO2		
26	RO2		

READY

RUN

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

Jumper block X3: CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

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Figure 1.

1.3   Control signal logic in Basic Application
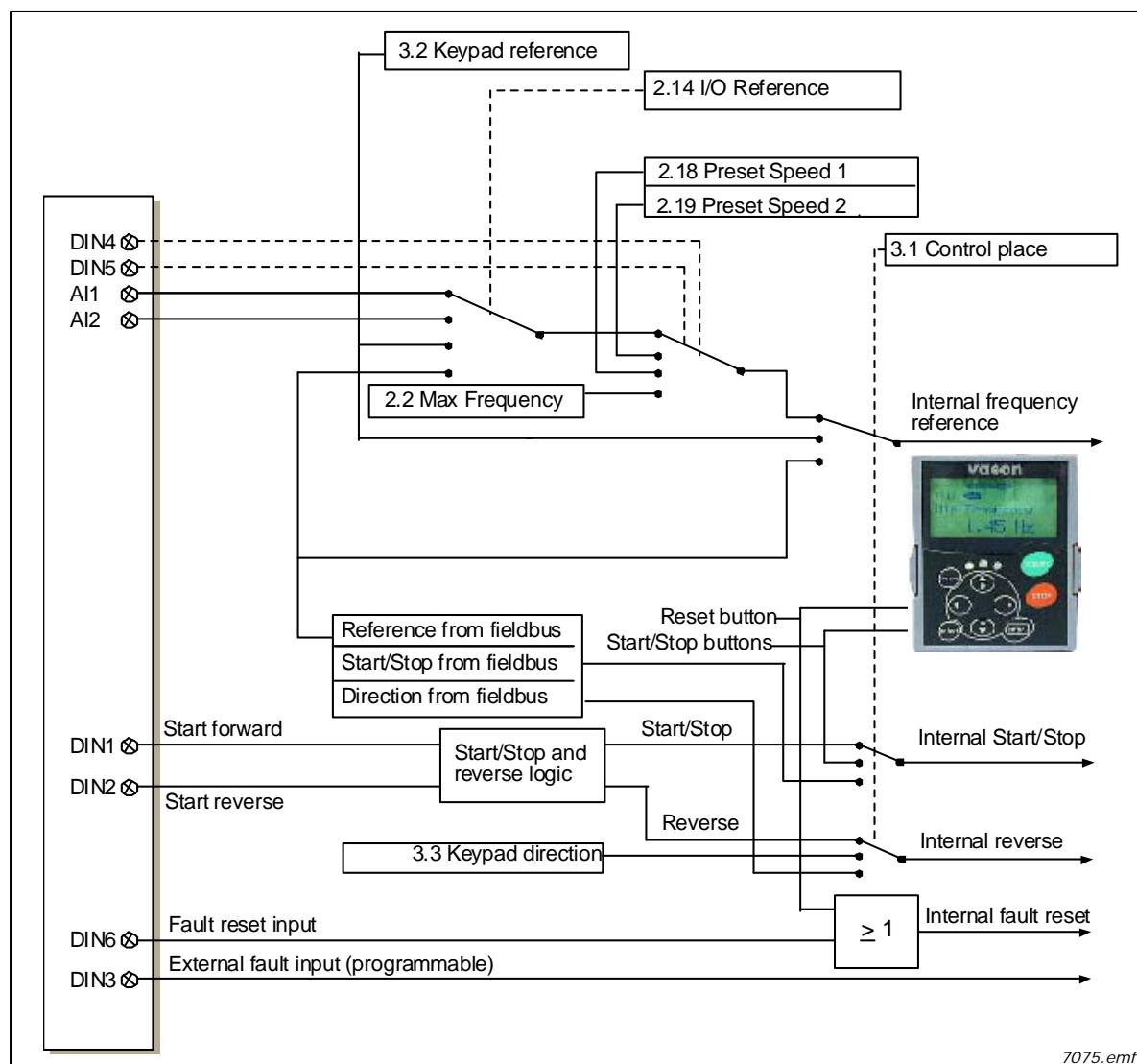
Figure 2. Control signal logic of the Basic Application

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1.4   Basic Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 131 to pages 230.

Column explanations:

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

Parameter = Name of parameter

Min   = Minimum value of parameter

Max   = Maximum value of parameter

Unit   = Unit of parameter value; Given if available

Default   = Value preset by factory

Cust   = Customer's own setting

ID   = ID number of the parameter

            = Parameter value can only be changed after the frequency converter has been stopped.

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.

See the product's User's Manual for more information.

Table 2. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I$_{out}$	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

1.4.2   Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 3. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1	Min frequency	0,00	P2.2	Hz	0,00		101	
P2.2	Max frequency	P2.1	320,00	Hz	50,00		102	NOTE: If f_{max} > 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	
P2.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.6	Nominal voltage of the motor	180	690	V	NX2:230V NX5:400V NX6:690V		110	Check the rating plate of the motor.
P2.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor.
P2.8	Nominal speed of the motor	24	20 000	rpm	1440		112	Check the rating plate of the motor. The default applies for a 4-pole motor and a nominal size frequency converter.
P2.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.10	Motor cosφ	0,30	1,00		0,85		120	Check 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** = Coasting **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—20mA **1** = 4mA—20 mA
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)
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

Table 3. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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 **1** = 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's Manual.

Table 4. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1** = I/O terminal **2** = Keypad **3** = Fieldbus
P3.2	Keypad reference	P2.1	P2.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	Reverse request activated from the panel
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 frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User's 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's Manual.

2.   STANDARD APPLICATION

Software code: ASFIFF02

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 of this manual. The explanations are arranged according to the individual ID number of the parameter.

2.2   Control I/O

Reference potentiometer, 1...10 kΩ
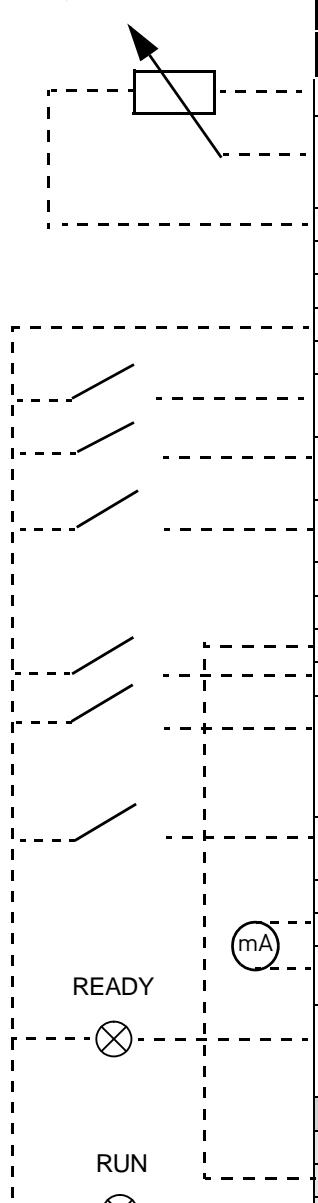
Table 5. Standard application default I/O configuration

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1 Voltage range 0—10V DC Programmable (P2.1.11)	Analogue input 1 frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2 Current range 0—20mA	Analogue input 2 frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward Programmable logic (P2.2.1)	Contact closed = start forward
9	DIN2	Start reverse Ri min = 5 kohm	Contact closed = start reverse
10	DIN3	External fault input Programmable (P2.2.2)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls

14	DIN4	Preset speed select 1	DIN4	DIN5	Frequency ref.
15	DIN5	Preset speed select 2	Open	Open	I/O Reference
			Closed	Open	Preset Speed 1
			Open	Closed	Preset Speed 2
			Closed	Closed	Analogue input 2

16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset	
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V	
18	AO1+	Analogue output 1 Output frequency Programmable (P2.3.2)	Range 0—20 mA/R$_L$, max. 500Ω	
19	AO1-			
20	DO1	Digital output 1 READY Programmable (P2.3.7)	Open collector, I≤50mA, U≤48 VDC	

OPTA2			
21	RO1	Relay output 1 RUN Programmable (P2.3.8	
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT Programmable (P2.3.9)	
25	RO2		
26	RO2		

mA

READY

RUN

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

Jumper block X3: CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

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Figure 3.

2.3   Control signal logic in Standard Application
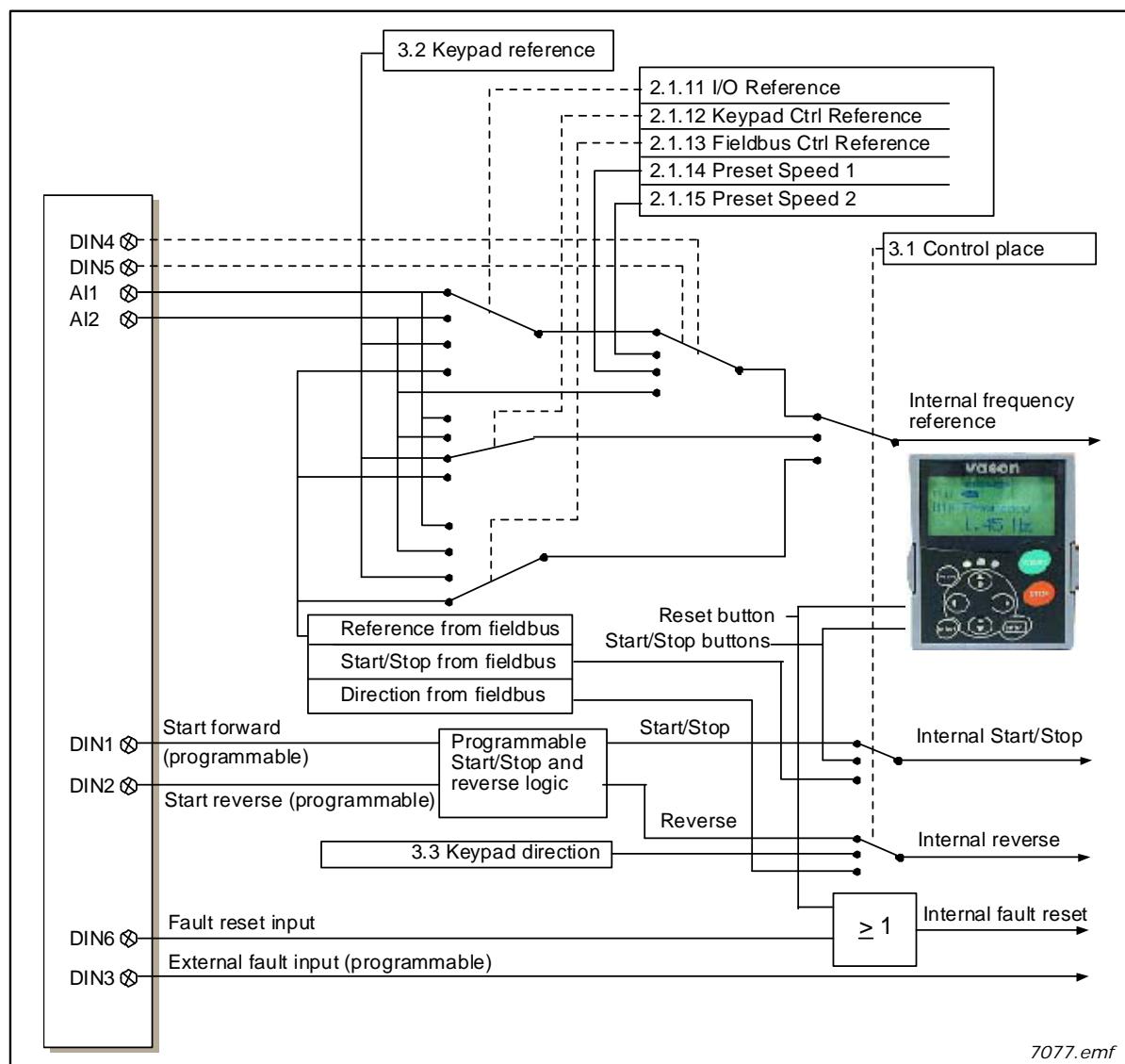
Figure 4. Control signal logic of the Standard Application

2.4   Standard Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on Pages 131 to230. The descriptions are arranged according to the ID number of the parameter.

Column explanations:

Code   = Location indication on the keypad; Shows the operator the present parameter
                 number
Parameter = Name of parameter
Min   = Minimum value of parameter
Max   = Maximum value of parameter
Unit   = Unit of parameter value; Given if available
Default   = Value preset by factory
Cust   = Customer's own setting
ID   = ID number of the parameter
            = In parameter row: Use TTF method to program these parameters.
            = On parameter code: Parameter value can only be changed after the frequency
                 converter has been stopped.

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.

See the product's User's Manual for more information.

Table 6. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Monitoring items			Displays three selectable monitoring values

2.4.2   Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 7. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	NOTE: If f_{max} > 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	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check 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	

2.4.3   Input signals (Control keypad: Menu M2 -> G2.2)

Table 8. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
									DIN 1	DIN2
P2.2.1	Start/Stop logic	0	6		0		300	0 1 2 3 4 5 6	Start fwd Start/Stop Start/Stop Start pulse Start fwd* Start*/Stop Start*/Stop	Start rvs Rvs/Fwd Run enable Stop pulse Start rvs* Rvs/Fwd Run enable
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—20mA (0—10V)** **1** = 4—20mA (2—10V)**		
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 page 72.		
P2.2.9	AI2 signal selection				A2		388	TTF programming method used. See page 72.		

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

2.4.4   Output signals (Control keypad: Menu M2 -> G2.3)

Table 9. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	Analogue output 1 signal selection	0			A.1		464	TTF programming method used. See page 72 .
P2.3.2	Analogue output function	0	8		1		307	**0** = Not used (20 mA/10 V) **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	
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** = Thermistor fault/warng **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 page 72.
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
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)
P2.3.17	Analogue output 2 scaling	10	1000	%	1,00		476	

2

2.4.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 10. Drive control parameters, G2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		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	$0,7 \times I_H$		507	
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 **1** = 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 11. Prohibit frequency parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	
P2.5.2	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 12. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0** = Frequency control **1** = Speed control Additionally for NXP: **2** = Not used **3** = Closed loop speed 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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See 8-14 for exact values
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	
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	
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	

Table 12. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	
P2.6.14.11	Start-up torque	0	32000		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	3	%	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

2.4.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 13. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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 **1** = 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 13. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	25,0		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	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		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 14. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**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's Manual.

Table 15. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1** = I/O terminal **2** = Keypad **3** = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0** = Forward **1** = Reverse
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: M6)

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

3.   Local/Remote Control Application

Software code: ASFIFF03

3.1   Introduction

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

Utilising 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 of this manual. The explanations are arranged according to the individual ID number of the parameter.

3.2   Control I/O

Table 16. Local/Remote control application default I/O configuration.

Reference potentiometer,
1...10 kΩ

Remote Reference
0(4) - 20 mA

Remote Control ground

READY

RUN

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1 Voltage range 0—10V DC Programmable (P2.1.12)	Analogue input 1 reference for place B
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2	Analogue input 2 reference for place A
5	AI2-	Current range 0—20mA Programmable (P2.1.11)	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Place A: Start forward Programmable logic (P2.2.1)	Contact closed = start forward
9	DIN2	Place A: Start reverse Ri min = 5 kohm	Contact closed = start reverse
10	DIN3	External fault input Programmable (P2.2.2)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Place B: Start forward Programmable logic (P2.2.15)	Contact closed = start for-ward
15	DIN5	Place B: Start reverse Ri min = 5 kohm	
16	DIN6	Place A/B selection	Contact closed = start reverse
16	DIN6	Place A/B selection	Contact open = place A is active Contact closed = Place B is active
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Analogue output 1	Range 0—20 mA/R$_L$, max. 500Ω
19	AO1-	Output frequency Programmable (P2.3.2)	
20	DO1	Digital output READY Programmable (P2.3.7)	Open collector, I≤50mA, U≤48 VDC
OPTA2			
21	RO1	Relay output 1	
22	RO1	RUN	
23	RO1	Programmable (P2.3.8)	
24	RO2	Relay output 2	
25	RO2	FAULT	
26	RO2	Programmable (P2.3.9)	

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

Jumper block X3: CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

7078.emf

Figure 5.

3.3   Control signal logic in Local/Remote Application
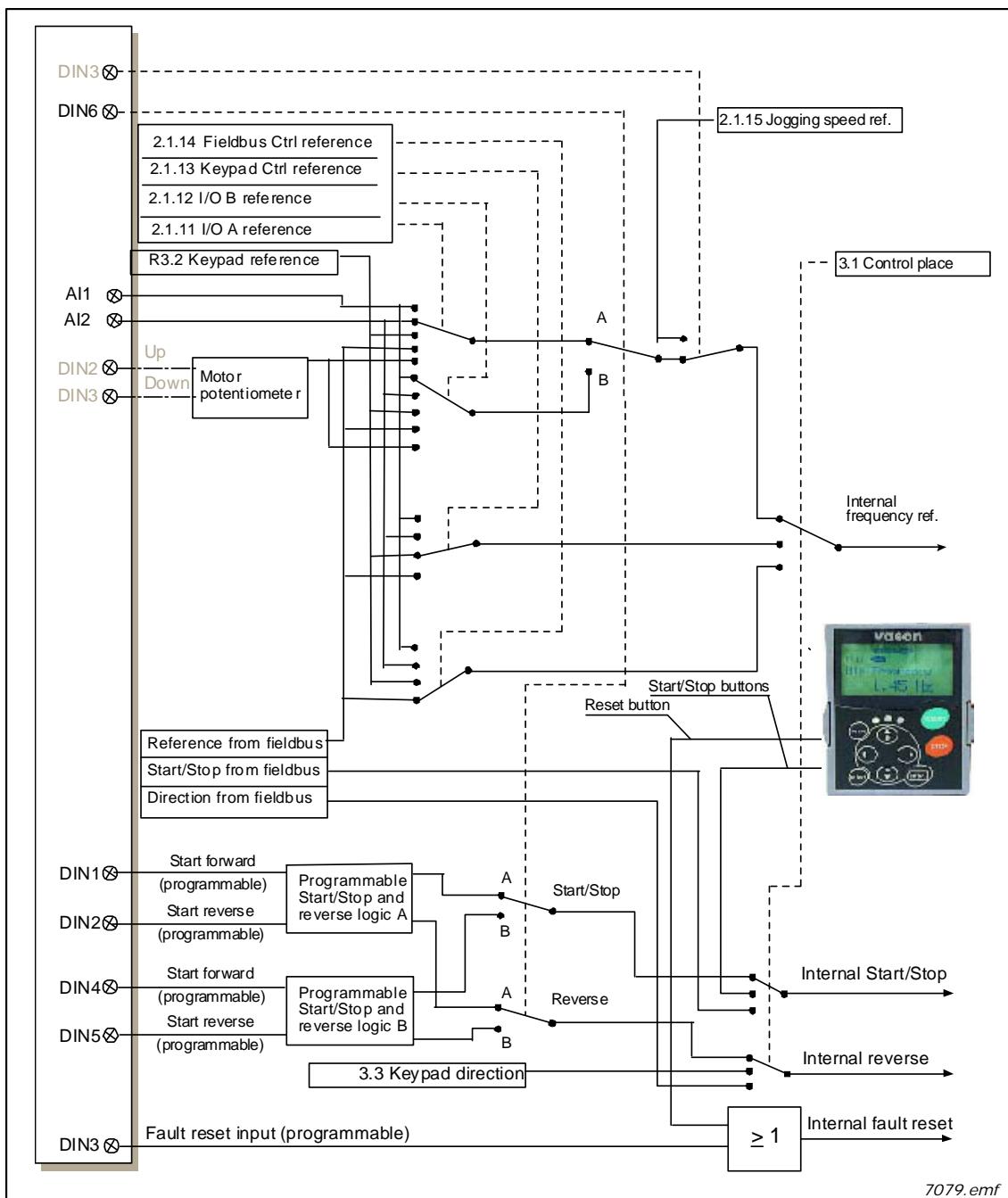
Figure 6. Control signal logic of the Local/Remote Control Application

3.4   Local/Remote control application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 131 to 229.

Column explanations:

Code   = Location indication on the keypad; Shows the operator the present parameter number
Parameter   = Name of parameter
Min   = Minimum value of parameter
Max   = Maximum value of parameter
Unit   = Unit of parameter value; Given if available
Default   = Value preset by factory
Cust   = Customer's own settings
ID   = ID number of the parameter
▮   = In parameter row: Use TTF method to program these parameters.
▮   = On parameter number: Parameter value can only be changed after the frequency converter has been stopped.

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. See the product's User's Manual for more information.

Table 17. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I$_{out}$	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

3.4.2   Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 18. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	NOTE: If f_{max} > 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	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor $\cos\varphi$	0,30	1,00		0,85		120	Check 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	

3.4.3 Input signals (Control keypad: Menu M2 -> G2.2)

Table 19. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
P2.2.1	Place A Start/Stop logic selection	0	8		0		300		DIN1	DIN2
								0 Start fwd **1** Start/Stop **2** Start/Stop **3** Start pulse **4** Start fwd **5** Start fwd* **6** Start*/Stop **7** Start*/Stop **8** Start fwd*		Start rvs Reverse Run enable Stop pulse Mot.pot.UP Start rvs* Reverse Run enable Mot.pot.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		A.1		377	TTF programming method used. See page 72.		
P2.2.4	AI1 signal range	0	2		0		320	**0** = 0—10 V (0 – 20 mA**) **1** = 2 – 10 V (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	%	100,0		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 page 72.		
P2.2.10	AI2 signal range	0	2		1		325	**0** = 0 – 20 mA (0—10 V **) **1** = 4 – 20 mA (2 – 10 V **) **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 19. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
									DIN4	DIN5
P2.2.15	Place B Start/Stop logic selection	0	6		0		363	**0** **1** **2** **3** **4** **5** **6**	Start fwd Start/Stop Start/Stop Start pulse Start fwd* Start*/Stop Start*/Stop	Start rvs Reverse Run enable Stop pulse Start rvs* Reverse Run enable
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		
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 function **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 pow ered 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		

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

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

Table 20. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	AO1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See page 72.
P2.3.2	Analogue output function	0	8		1		307	**0** = Not used (20 mA / 10 V) **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 **1** = 4 mA
P2.3.6	Analogue output scale	10	1000	%	100		311	
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. **20** = Unrequested rotation direction **21** = Ext. brake control inverted **22** = Thermistor fault/warn.
P2.3.8	Relay output 1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 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
P2.3.11	Output frequency limit 1; Supervision 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	

3

Table 20. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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 page 72.
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 **1** = 4 mA
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

3.4.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 21. Drive control parameters, G2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		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	$0,7 \times I_H$		507	
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 **1** = 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 22. Prohibit frequency parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	0,0		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	0,0		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	0,0		514	**0** = Prohibit range 3 is off
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

3

3.4.7   Motor control parameters (Control keypad: Menu M2 -> G2.6)

Table 23. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0** = Frequency control **1** = Speed control <u>Additionally for NXP:</u> **2** = Not used **3** = Closed loop speed 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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	$n\% \times U_{nmot}$
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	$n\% \times U_{nmot}$ Maximum value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	$n\% \times U_{nmot}$
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 121 for exact values
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	
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	
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	

Table 23. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	
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

3.4.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 24. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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 **1** = 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	
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	

Table 24. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		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

3.4.9   Autorestart parameters (Control keypad: Menu M2 -> G2.8)

Table 25. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**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 temp 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's Manual.

Table 26. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1** = I/O terminal **2** = Keypad **3** = Fieldbus
P3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0** = Forward **1** = Reverse
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 frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User's 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's Manual.

4.   MULTI-STEP SPEED CONTROL APPLICATION

Software code: ASFIFF04

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. Totally 15 + 2 different speeds can be programmed: one basic speed, 15 multi-step speeds and one jogging speed. The speed steps are selected with digital signals DIN3, DIN4, DIN5 and DIN6. If jogging speed is used, DIN3 can be programmed from fault reset to jogging speed select.

The basic speed reference can be either voltage or current signal via 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 of this manual. The explanations are arranged according to the individual ID number of the parameter.

4.2   CONTROL I/0

Table 27. Multi-step speed control application default I/O configuration.

Reference potentiometer, 1...10 kΩ

Basic reference (optional)

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1. Voltage range 0—10V DC	Analogue input 1 frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2. Current Range 0 – 20 mA Programmable (P2.1.11)	Analogue input 2 frequency reference Default reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward Programmable logic (P2.2.1)	Contact closed = start forward
9	DIN2	Start reverse R$_i$ min. = 5kΩ	Contact closed = start reverse
10	DIN3	External fault input Programmable (P2.2.2)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Preset speed select 1	sel 1 sel 2 sel 3 sel 4 (with DIN3) 0 0 0 0 I/O reference
15	DIN5	Preset speed select 2	1 0 0 0 Speed 1 0 1 0 0 Speed 2
16	DIN6	Preset speed select 3	- - - - - - 1 1 1 1 Speed 15
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Analogue Output 1: Output frequency Programmable (P2.3.2)	Range 0—20 mA/R$_L$, max. 500Ω
19	AO1-		
20	DO1	Digital output READY Programmable (P2.3.7)	Open collector, I≤50mA, U≤48 VDC
OPTA2			
21	RO1	Relay output 1 RUN Programmable (P2.3.8)	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT Programmable (P2.3.9)	Programmable
25	RO2		
26	RO2		

READY

RUN

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

Jumper block X3: CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

7080.emf

Figure 7.

4.3   CONTROL SIGNAL LOGIC IN MULTI-STEP SPEED CONTROL APPLICATION
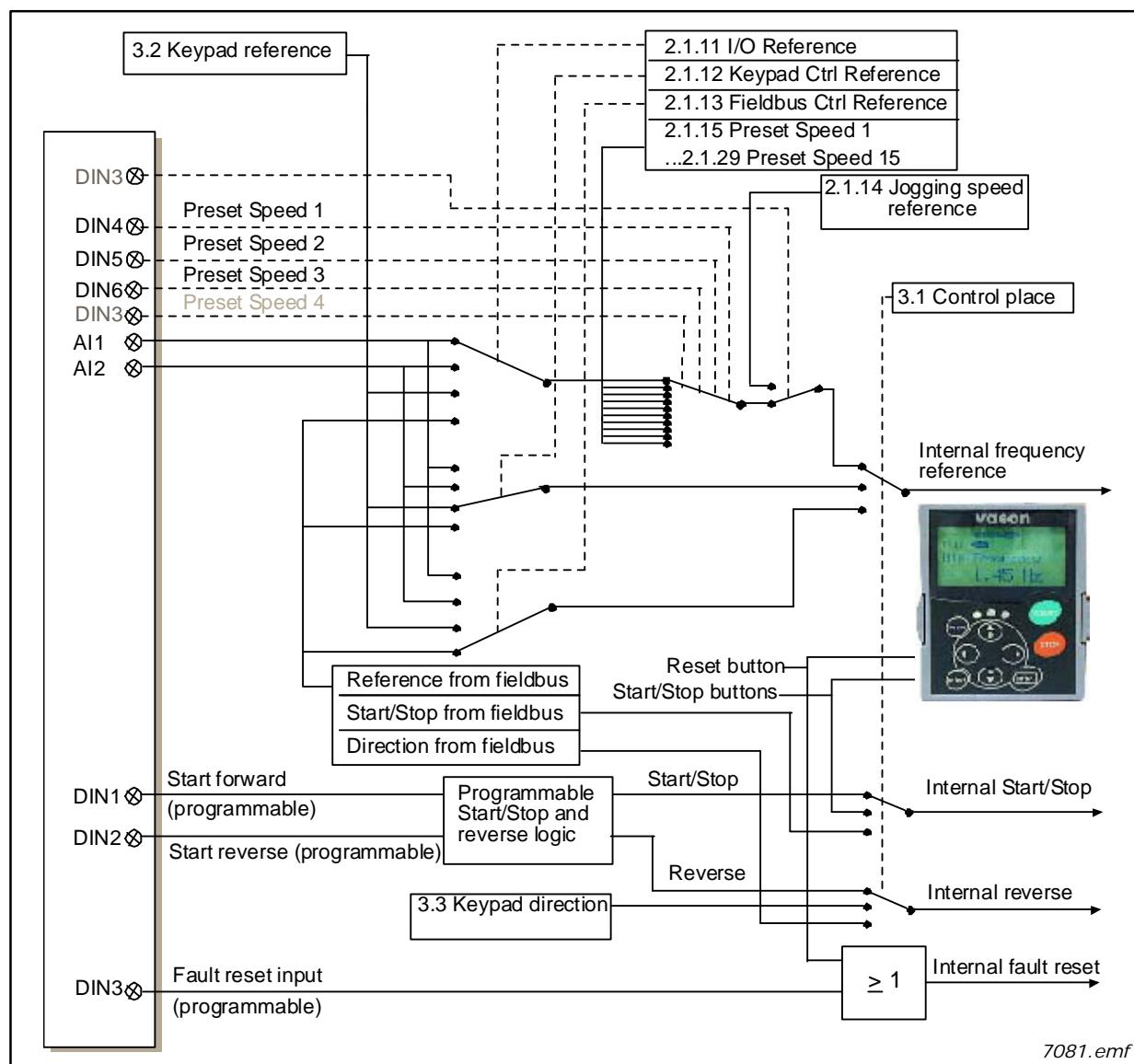
Figure 8. Control signal logic of the Multi-step Speed Application

4.4 Multi-step speed control application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 131 to 229.

Column explanations:

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

Parameter   = Name of parameter

Min   = Minimum value of parameter

Max   = Maximum value of parameter

Unit   = Unit of parameter value; Given if available

Default   = Value preset by factory

Cust   = Customer's own setting

ID   = ID number of the parameter

                    = In parameter row: Use TTF method to program these parameters.

                    = On parameter code: Parameter value can only be changed after the frequency converter has been stopped.

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.

See the product's User's Manual for more information.

Table 28. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

4.4.2   Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 29. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	NOTE: If f_{max} > 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	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check 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 pref.	0,00	P2.1.2	Hz	0,00		124	
P2.1.15	Preset speed 1	0,00	P2.1.2	Hz	5,00		105	Multi-step speed 1
P2.1.16	Preset speed 2	0,00	P2.1.2	Hz	10,00		106	Multi-step speed 2
P2.1.17	Preset speed 3	0,00	P2.1.2	Hz	12,50		126	Multi-step speed 3
P2.1.18	Preset speed 4	0,00	P2.1.2	Hz	15,00		127	Multi-step speed 4
P2.1.19	Preset speed 5	0,00	P2.1.2	Hz	17,50		128	Multi-step speed 5
P2.1.20	Preset speed 6	0,00	P2.1.2	Hz	20,00		129	Multi-step speed 6
P2.1.21	Preset speed 7	0,00	P2.1.2	Hz	22,50		130	Multi-step speed 7
P2.1.22	Preset speed 8	0,00	P2.1.2	Hz	25,00		133	Multi-step speed 8
P2.1.23	Preset speed 9	0,00	P2.1.2	Hz	27,50		134	Multi-step speed 9
P2.1.24	Preset speed 10	0,00	P2.1.2	Hz	30,00		135	Multi-step speed 10
P2.1.25	Preset speed 11	0,00	P2.1.2	Hz	32,50		136	Multi-step speed 11
P2.1.26	Preset speed 12	0,00	P2.1.2	Hz	35,00		137	Multi-step speed 12
P2.1.27	Preset speed 13	0,00	P2.1.2	Hz	40,00		138	Multi-step speed 13
P2.1.28	Preset speed 14	0,00	P2.1.2	Hz	45,00		139	Multi-step speed 14
P2.1.29	Preset speed 15	0,00	P2.1.2	Hz	50,00		140	Multi-step speed 15

4.4.3 Input signals (Control keypad: Menu M2 -> G2.2)

Table 30. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
P2.2.1	Start/Stop logic	0	6		0		300		DIN1	DIN2
								0 **1** **2** **3** **4** **5** **6**	Start fwd Start/Stop Start/Stop Start pulse Start fwd* Start*/Stop Start*/Stop	Start rvs Rvs/Fwd Run enable Stop pulse Start rvs* Reverse Run enable
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		A.1		377	TTF programming method used. See page 72.		
P2.2.4	AI1 signal range	0	2		0		320	**0** = 0–10 V (0-20 mA**) **1** = 2-10 V (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	%	100,0		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 page 72.		
P2.2.10	AI2 signal range	0	2		1		325	**0** = 0-20 mA (0–10 V**) **1** = 4-20 mA (2-10 V**) **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		

Table 30. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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
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. times **4** = Reduces torque supervision limit P2.3.15)

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

* = Rising edge required to start

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

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

Table 31. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	AO1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See page 72.
P2.3.2	Analogue output function	0	8		1		307	**0** = Not used (20 mA / 10 V) **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	
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. **20** = Unrequested rotation direction **21** = Ext. brake control inverted **22** = Thermistor fault/warn.
P2.3.8	Relay output 1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 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
P2.3.11	Output frequency limit 1; Supervision 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	

Table 31. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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 limit value	-10	100	°C	40		355	
P2.3.22	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming method used. See page 72 .
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)
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

4.4.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 32. Drive control parameters, G2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		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	$0,7 \times I_H$		507	
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 **1** = 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 33. Prohibit frequency parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	

4.4.7   Motor control parameters (Control keypad: Menu M2 → G2.6)

Table 34. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0** = Frequency control **1** = Speed control Additionally for NXP: **2** = Not used **3** = Closed loop speed 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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 121 for exact values
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	
P2.6.13	Identification	0	1/2		0		631	**0** = No action **1** = Identification w/o run **2** = Identification with run

Table 34. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0,00	2 x I_H	A	0,00		612	
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	
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	%			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

4.4.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 35. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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 under-voltage fault	0	1		0		727	**0** = Fault stored in history **1** = 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	
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	25,0		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	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		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 field-bus 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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4.4.9   Autorestart parameters (Control keypad: Menu M2 -> G2.8)

Table 36. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**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 temp 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's manual.

Table 37. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	1 = I/O terminal 2 = Keypad 3 = Fieldbus
P3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	0 = Forward 1 = Reverse
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: M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's 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's manual.

5.   PID Control Application

Software code: ASFIFF05

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 of this manual. The explanations are arranged according to the individual ID number of the parameter.

5.2   Control I/O

Table 38. PID application default I/O configuration (with 2-wire transmitter).

Reference potentiometer,
1...10 kΩ

2 wire Transmitter

Actual
value (0) 4...20
mA

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Description
2	AI1+	Analogue input 1 Voltage range 0—10V DC Programmable (P2.1.11)	Voltage for potentiometer, etc.
3	AI1-	I/O Ground	Analogue input 1 PID reference
4	AI2+	Analogue input 2	Ground for reference and controls
5	AI2-	Current range 0—20mA Programmable (P2.2.9)	Analogue input 2 PID actual value 1
6	+24V	Control voltage output	
7	GND	I/O ground	Voltage for switches, etc. max 0.1 A
8	DIN1	Place A: Start forward R$_i$ min. = 5kΩ	Ground for reference and controls
9	DIN2	External fault input Programmable (P2.2.1)	Start signal for control place A PID Controller.
10	DIN3	Fault reset Programmable (P2.2.2)	Contact closed = fault Contact open = no fault
11	CMA	Common for DIN 1—DIN 3	Contact closed = fault reset
12	+24V	Control voltage output	Connect to GND or +24V
13	GND	I/O ground	Voltage for switches (see #6)
14	DIN4	Place B: Start forward R$_i$ min. = 5kΩ	Ground for reference and controls
15	DIN5	Jogging speed selection Programmable (P2.2.3)	Start signal for control place B Frequency reference (P2.2.5.)
16	DIN6	Control place A/B selection	Contact closed = Jogging speed active
17	CMB	Common for DIN4—DIN6	Contact open = Control place A is active Contact closed = Control place B is active
18	A01+	Analogue output 1	Connect to GND or +24V
19	A01-	Output frequency Programmable (P2.3.2)	Range 0—20 mA/R$_L$, max. 500Ω
20	D01	Digital output READY Programmable (P2.3.7)	Open collector, I≤50mA, U≤48 VDC
OPTA2			
21	R01	Relay output 1 RUN Programmable (P2.3.8)	
22	R01		
23	R01		
24	R02	Relay output 2 FAULT Programmable (P2.3.9)	
25	R02		
26	R02		

READY

RUN

Note: See jumper selections below.
More information in the product's
user's manual.

**Jumper block X3:
CMA and CMB grounding**

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA
internally connected together,
isolated from GND

= Factory default

7082.emf

Figure 9.

5.3   Control signal logic in PID Control Application
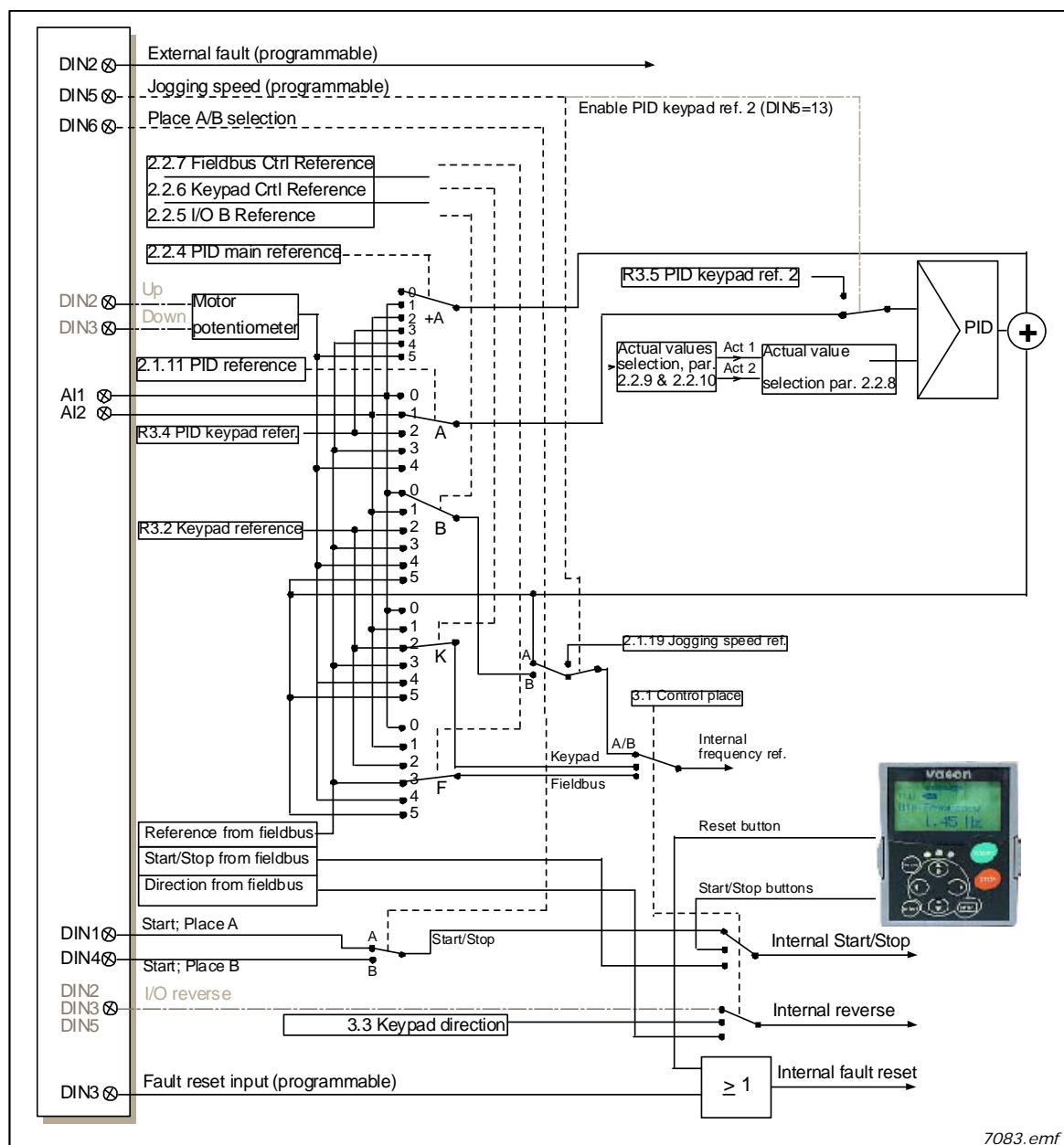
Figure 10.Control signal logic of the PID Control Application

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5.4   PID Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 131 to 229.

Column explanations:

Code   = Location indication on the keypad; Shows the operator the present param. number
Parameter   = Name of parameter
Min   = Minimum value of parameter
Max   = Maximum value of parameter
Unit   = Unit of parameter value; Given if available
Default   = Value preset by factory
Cust   = Customer's own setting
ID   = ID number of the parameter
                   = In parameter row: Use TTF method to program these parameters.
                   = On code: Parameter value can only be changed after the FC has been stopped.

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.

See the product's user's manual for more information. Note that the monitoring values V1.19 to V1.22 are available with the PID control application only.

Table 39. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor 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	DIN1, DIN2, DIN3		15	Digital input statuses
V1.16	DIN4, DIN5, DIN6		16	Digital input statuses
V1.17	DO1, RO1, RO2		17	Digital and relay output statuses
V1.18	Analogue I_{out}	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	In % of the max. error value
V1.22	PID Output	%	23	In % of the max. output value
V1.23	Special display for actual value		29	See parameters 2.2.46 to 2.2.49
V1.24	PT-100 Temperature	C°	42	Highest temperature of used inputs
G1.25	Monitoring items			Displays three selectable monitoring values

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

Table 40. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	NOTE: If f_{max} > 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	NOTE: If PID-controller is used, Acceleration time 2 (P2.4.3) is automati-cally applied
P2.1.4	Deceleration time 1	0,1	3000,0	s	1,0		104	NOTE: If PID-controller is used, Deceleration time 2 (P2.4.4) is automati-cally applied
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	PID controller reference signal (Place A)	0	4		0		332	**0** = AI1 **1** = AI2 2 = PID ref from Keypad control page, P3.4 **3** = PID ref from fieldbus (Pro cessDataIN 1) **4** = Motor potentiometer
P2.1.12	PID controller gain	0,0	1000,0	%	100,0		118	
P2.1.13	PID controller I-time	0,00	320,00	s	1,00		119	
P2.1.14	PID controller D-time	0,00	100,00	s	0,00		132	
P2.1.15	Sleep frequency	0,00	P 2.1.2	Hz	10,00		1016	
P2.1.16	Sleep delay	0	3600	s	30		1017	
P2.1.17	Wake up level	0,00	100,00	%	25,00		1018	
P2.1.18	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)
P2.1.19	Jogging speed reference	0,00	P2.1.2	Hz	10,00		124	

5.4.3   Input signals (Control keypad: Menu M2 -> G2.2)

Table 41. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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
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 41. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	9		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
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		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 page 72
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	0		0		328	**0** = Not inverted **1** = Inverted
P2.2.26	AI2 filter time	0,00	10,00	s	0,10		329	**0** = No filtering

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Table 41. Input signals, G2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.27	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331	
P2.2.28	Motor potentiometer frequency reference memory reset	0	2		1		367	**0** = No reset **1** = Reset if stopped or pow-ered 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 pow ered down **2** = Reset if powered down
P2.2.30	PID minimum limit	–1600,0	P2.2.31	%	0,00		359	
P2.2.31	PID maximum limit	P2.2.30	1600,0	%	100,00		360	
P2.2.32	Error value inversion	0	1		0		340	**0** = No inversion **1** = Inversion
P2.2.33	PID reference rising time	0,0	100,0	s	5,0		341	
P2.2.34	PID reference falling time	0,0	100,0	s	5,0		342	
P2.2.35	Reference scaling minimum value, place B	0,00	320,00	Hz	0,00		344	
P2.2.36	Reference scaling maximum value, place B	0,00	320,00		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 page 72
P2.2.39	AI3 signal range	0	1		1		143	**0** = Signal range 0—10V **1** = Signal range 2—10V
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 page 72
P2.2.43	AI4 signal range	0	1		1		154	**0** = Signal range 0—10V **1** = Signal range 2—10V
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	28		4		1036	See page 220 .

CP=control place, cc= contact oc=opening contact
*Remember to place jumpers of block X2 accordingly. See the product's User's Manual.

5.4.4   Output signals (Control keypad: Menu M2 -> G2.3)

Table 42. Output signals, G2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	Analogue output 1 signal selection	0.1	E.10		A.1		464	TTF programming method used. See page 72
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)
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 supervision **17** = External brake control **18** = Control place: IO **19** = FC temp. limit superv. **20** = Unrequested direction **21** = Ext. brake control inv. **22** = Thermistor fault/warn. **23** = Fieldbus DIN1

Table 42. Output signals, G2.3

Code	Parameter	Min	Max	Unit	**Default**	Cust	ID	**Note**
P2.3.8	Relay output 1 function	0	23		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 function	0	23		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	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; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.14	Torque limit supervision	0	2		0		348	**0** = Not used **1** = Low limit supervision **2** = High limit supervision
P2.3.15	Torque limit supervision value	-300,0	300,0	%	100,0		349	
P2.3.16	Reference limit supervision	0	2		0		350	**0** = Not used **1** = Low limit **2** = High limit
P2.3.17	Reference limit supervision	0,00	100,00	%	0,00		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	FC temperature supervision	0	2		0		354	**0** = Not used **1** = Low limit **2** = High limit
P2.3.21	FC temperature supervised value	−10	100	°C	40		355	
P2.3.22	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming method used. See page .
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 **1** = 4 mA
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

5.4.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 43. Drive control parameters, G2.4

Code	Para meter	Min	Max	Unit	Default	Cust	ID	Note
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	0,1		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	0,1		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	$0,7 \times I_H$		507	
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 **1** = 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 44. Prohibit frequency parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	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	

5.4.7 Motor control parameters (Control keypad: Menu M2 -> G2.6)

Table 45. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0** = Frequency control **1** = Speed control <u>Additionally for NXP:</u> **2** = Not used **3** = Closed loop speed 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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	$n\% \times U_{nmot}$
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	$n\% \times U_{nmot}$ Parameter max. value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	$n\% \times U_{nmot}$
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See 8-14 for exact value
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	
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	$2 \times I_H$	A	0,00		612	
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	0,0		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	
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

Table 45. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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

5.4.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 46. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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 **1** = 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	
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	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	25,0		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	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	

Table 46. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	
P2.7.25	Response to PT100 fault	0	3		2		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	C°	120,0		741	
P2.7.27	PT100 fault limit	−30,0	200,0	C°	130,0		742	

5.4.9 Autorestart parameters (Control keypad: Menu M2 -> G2.8)

Table 47. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	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 temp 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's manual.

Table 48. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	1 = I/O terminal 2 = Keypad 3 = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	0 = Forward 1 = Reverse
P3.4	PID reference	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

5.4.11   System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's 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's manual.

6.   Multi-purpose Control Application

Software codes: ASFIFF06 (NXS); APFIFF06 (NXP)

6.1   Introduction

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

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

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

6.2   Control I/0

Table 49. Multi-purpose control application default I/O configuration and connection example.

Reference potentiometer,
1...10 kΩ

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1 Voltage range 0—10V DC Programmable (P2.1.11)	Analogue input 1 frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2	Analogue input 2 frequency reference
5	AI2-	Current range 0—20mA	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward Programmable logic (P2.2.1.1)	Contact closed = start forward
9	DIN2	Start reverse R$_i$ min. = 5kΩ	Contact closed = start reverse
10	DIN3	Fault reset Programmable (G2.2.7)	Contact closed (rising edge) = fault reset
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Jogging speed selection Programmable (G2.2.7)	Contact open = IO reference active Contact closed = Jogging speed active
15	DIN5	External fault Programmable (G2.2.7)	Contact open = no fault Contact closed = external fault
16	DIN6	Accel. /decel. time select Programmable (G2.2.7)	Contact open = P2.1.3, and P2.1.4 in use Contact closed = P2.4.3., and P2.4.4 in use
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AOA1+	Analogue output 1	Range 0—20 mA/R$_L$, max. 500Ω
19	AOA1-	Output frequency Programmable (P2.3.5.2)	
20	DOA1	Digital output READY Programmable (G2.3.3)	Open collector, I≤50mA, U≤48 VDC
OPTA2			
21	RO1	Relay output 1	
22	RO1	RUN	
23	RO1	Programmable (G2.3.3)	
24	RO2	Relay output 2	
25	RO2	FAULT	
26	RO2	Programmable (G2.3.3)	

READY

RUN

Note: See jumper selections below. More information in the product's user's manual.

Jumper block X3: CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

7084.emf

Figure 11.

Phone: 800.894.0412 - Fax: 888.723.4773 - Web: www.clrwtr.com - Email: info@clrwtr.com

6.3 Control signal logic in Multi-Purpose Control Application
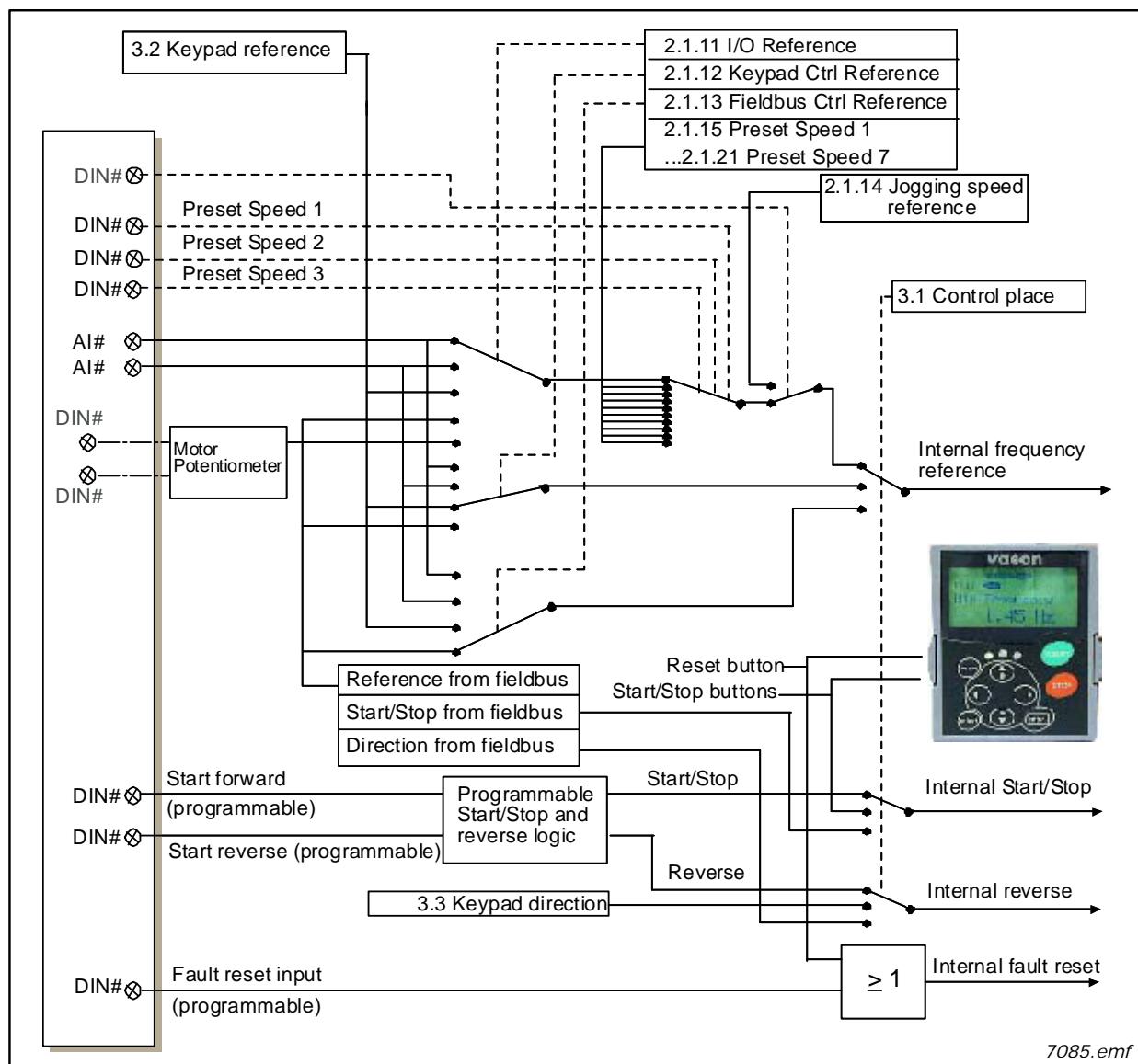
Figure 12.Control signal logic of the Multi-purpose Control Application

6.4 "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* on page 73.

6.4.1 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's manual) and the *respective signal number*, see below.

7086.emf
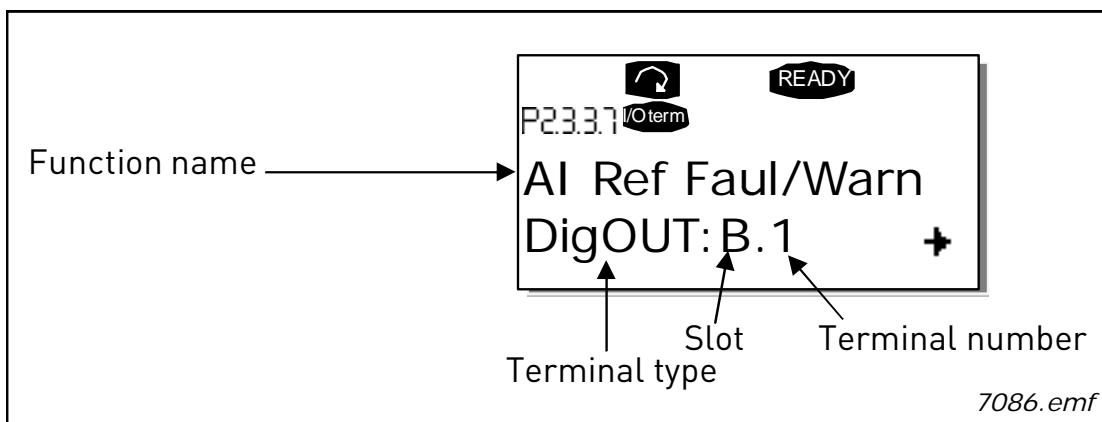
Example: You want to connect the digital output function *Reference fault/warning* (parameter 2.3.3.7) to the digital output DO1 on the basic board OPTA1 (see the product's user's manual).

First 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.#).

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

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

7087.emf

6.4.2 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 (see the Figure below).
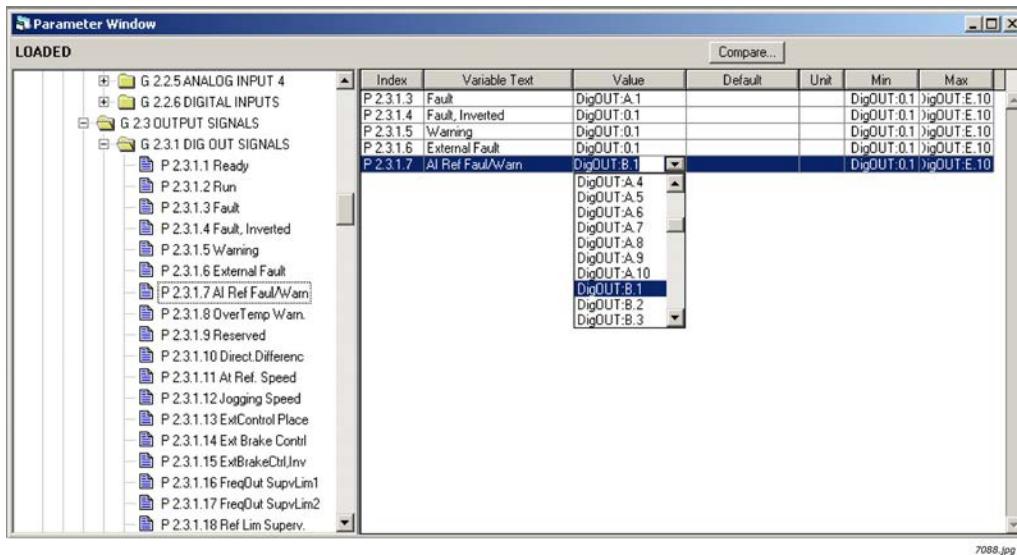
Figure 13. Screenshot of NCDrive programming tool; Entering the address code

⚠	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.

6.4.3 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.

6.5   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.

6.5.1   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 Option Board Manual (ud00741) for further information.

6.5.2   Optical fibre connection between frequency converters 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.
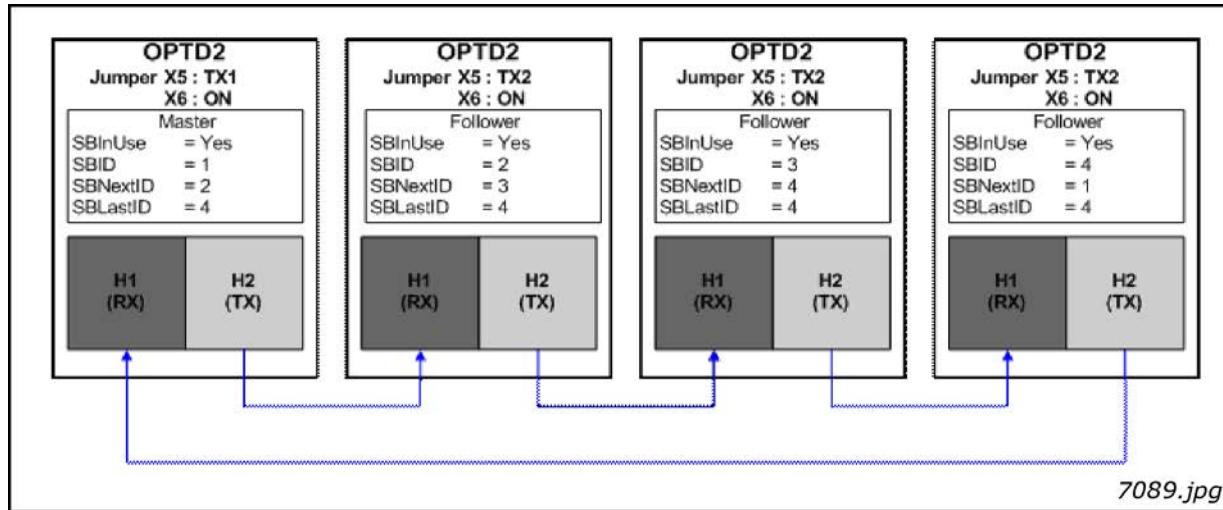
Figure 14.System bus physical connections with the OPTD2 board

For information on the OPTD2 expander board parameters, see Vacon Option Board User's Manual (document code ud00741).

6.6   Multi-purpose Control Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 131 to 230.

Column explanations:

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

Parameter = Name of parameter

Min   = Minimum value of parameter

Max   = Maximum value of parameter

Unit   = Unit of parameter value; Given if available

Default   = Value preset by factory

Cust   = Customer's own setting

ID   = ID number of the parameter

          = On param.code: Parameter value can only be changed after the FC has been stopped

          = Apply the Terminal to Function method (TTF) to these parameters (see chapter 6.4)

          = Monitoring values controllable from fieldbus using the ID number

6.6.1   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 on shadowed background can be controlled from the fieldbus. See the product's user's manual for more information.

Table 50. Monitoring values, NXS drives

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
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	PT-100 temperature	C°	42	Highest temperature of used PT100 inputs
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 chapter 6.6.1.8.

Table 50. Monitoring values, NXS drives

Code	Parameter	Unit	ID	Description
V1.21.5	Motor Current to FB	A	45	Motor current (drive independent) given with one decimal point

Table 51. Monitoring values, NXP drives

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses. See page .
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses. See page .
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	PT-100 temperature	C°	42	Highest temp of used PT100 inputs
G1.20	Multimonitoring items			Displays 3 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 chapter 6.6.1.8
V1.21.5	Encoder 1 Frequency	Hz	1124	Input C.1
V1.21.6	Shaft Rounds	r	1170	See ID1090
V1.21.7	Shaft Angle	Deg	1169	See ID1090
V1.21.8	Measured temperature 1	C°	50	
V1.21.9	Measured temperature 2	C°	51	
V1.21.10	Measured temperature 3	C°	52	
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	%	50	AO2

Table 51. Monitoring values, NXP drives

Code	Parameter	Unit	ID	Description
V1.21.21	Analogue output 3	%	51	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	PT100 4 temperature	C°	69	
V1.21.26	PT100 5 temperature	C°	70	
V1.21.27	PT100 6 temperature	C°	71	
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	
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 page 79
V1.22.8	DIN StatusWord 2		57	See page 79
V1.22.9	Warning		74	Last active warning code
V1.22.10	Fault Word1		1172	See page 79
V1.22.11	Fault Word2		1173	See page 79
V1.22.12	Warning Word1		1174	See page 80
V1.23.1	SystemBus System Status		1601	See page 80
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 page 81
V1.23.4.2	StatusWord D2		1602	See page 81.
V1.23.4.3	StatusWord D3		1603	See page 81.
V1.23.4.4	StatusWord D4		1604	See page 81.

6.6.1.1   *Digital input statuses: ID15 and ID16*

Table 52. Digital input statuses

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

6.6.1.2   Digital input statuses: ID56 and ID57

Table 53. Digital input statuses

	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	

6.6.1.3   Fault Word 1, ID1172

Table 54. Fault Word 1

	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

6.6.1.4   Fault Word 2, ID1173

Table 55. Fault Word 2

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

6.6.1.5   Warning Word 1, ID1174

Table 56. Warning Word 1

	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

6.6.1.6   SystemBus Status Word, ID1601

Table 57. SystemBus Status Word

	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

6.6.1.7   *Follower drive Status Word*

Table 58. 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

6.6.1.8   *Application Status Word*

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.

Table 59. Application Status Word content

Application Status Word						
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

6.6.2 Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 60. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	NOTE: If f_{max} > 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	0 Hz to Max frequency
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	Max frequency to 0 Hz
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	Check the rating plate of the motor. Note also used connection Delta/Star.
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check 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	**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 60. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.14	Jogging speed refer-ence	0,00	P2.1.2	Hz	5,00		124	See ID413.
P2.1.15	Preset speed 1	0,00	P2.1.2	Hz	10,00		105	Multi-step speed 1
P2.1.16	Preset speed 2	0,00	P2.1.2	Hz	15,00		106	Multi-step speed 2
P2.1.17	Preset speed 3	0,00	P2.1.2	Hz	20,00		126	Multi-step speed 3
P2.1.18	Preset speed 4	0,00	P2.1.2	Hz	25,00		127	Multi-step speed 4
P2.1.19	Preset speed 5	0,00	P2.1.2	Hz	30,00		128	Multi-step speed 5
P2.1.20	Preset speed 6	0,00	P2.1.2	Hz	40,00		129	Multi-step speed 6
P2.1.21	Preset speed 7	0,00	P2.1.2	Hz	50,00		130	Multi-step speed 7

6.6.3   Input signals

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

Table 61. Input signals: basic settings, G2.2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
									Start signal 1 (Default: DIN1)	Start signal 2 (Default: DIN2)
P2.2.1.1	Start/Stop logic selection	0	7		0		300	**0** **1** **2** **3** **4** **5** **6** **7**	Start fwd Start/Stop Start/Stop Start pulse Start Start fwd* Start*/Stop Start*/Stop	Start rvs Reverse Run enable Stop pulse Mot.pot.UP Start rvs* Reverse Run enable
P2.2.1.2	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331			
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		
P2.2.1.4	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			

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

Table 62. Analogue input 1 parameters, G2.2.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.2.1	AI1 signal selection	0.1	E.10		A.1		377	TTF programming. See chapter 6.4
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	3		0		320	**0** = 0-10 V (0-20 mA*) **1** = 2-10 V (4-20 mA*) **2** = -10V...+10V* **3** = Custom range*
P2.2.2.4	AI1 custom minimum setting	-160,00	160,00	%	0,00		321	% of input signal range. e.g.3 V = 30 %
P2.2.2.5	AI1 custom maximum setting	-160,00	160,00	%	100,00		322	e.g.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	Dead zone for joystick input
P2.2.2.9	AI1 sleep limit	0,00	100,00	%	0,00		385	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	
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's Manual

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

Table 63. Analogue input 2 parameters, G2.2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.1	AI2 signal selection	0.1	E.10		A.2		388	TTF programming. See chapter 6.4.
P2.2.3.2	AI2 filter timeAI2 filter time	0,00	10,00	s	0,10		329	**0** = No filtering
P2.2.3.3	AI2 signal range	0	3		1		325	**0** = 0-20 mA (0-10 V *) **1** = 4-20 mA (2-10 V *) **2** = -10V...+10V* **3** = Custom range*
P2.2.3.4	AI2 custom minimum setting	-160,00	160,00	%	20,00		326	% of input signal range. e.g. 2 mA = 10 %
P2.2.3.5	AI2 custom maximum setting	-160,00	160,00	%	100,00		327	e.g. 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	Dead zone for joystick input, e.g. 10 % = +/- 5 %

Table 63. Analogue input 2 parameters, G2.2.3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.9	AI2 sleep limit	0,00	100,00	%	0,00		396	Drive goes to sleep mode if input is below this limit for set time.
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

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

Table 64. Analogue input 3 parameters, G2.2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.4.1	AI3 signal selection	0.1	E.10		0.1		141	TTF programming. See chapter 6.4
P2.2.4.2	AI3 filter time	0,00	10,00	s	0,00		142	**0** = No filtering
P2.2.4.3	AI3 signal range	0	3		0		143	**0** = 0-20 mA (0-10 V *) **1** = 4-20 mA (2-10 V *) **2** = -10V...+10V* **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's Manual.

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

Table 65. Analogue input 4 parameters, G2.2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.5.1	AI4 signal selection	0			0.1		152	TTF programming. See chapter 6.4
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	3		1		154	**0** =0-20 mA (0-10 V *) **1** = 4-20 mA (2-10 V *) **2** = -10V...+10V* **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

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

Table 66. Free analogue input signal selection, G2.2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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

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

Use TTF programming method for all these parameters. See chapter

Table 67. Digital input signals, G2.2.4

Code	Parameter	Min	Default	Cust	ID	Note
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 rese	0.1	A.3		414	All faults reset (cc)
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	Acc/Dec prohibited (cc)
P2.2.7.15	DC braking	0.1	0.1		416	DC braking active (cc)

Table 67. Digital input signals, G2.2.4

Code	Parameter	Min	Default	Cust	ID	Note
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 place to I/O terminal (cc)
P2.2.7.19	Control from keypad	0.1	0.1		410	Force control place to keypad (cc)
P2.2.7.20	Control from fieldbus	0.1	0.1		411	Force control place to fieldbus (cc)
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 par 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 6.5 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

6.6.4   Output signals

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

Table 68. Delayed digital output 1 parameters, G2.3.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1.1	Digital output 1 signal selection	0.1	E.10		0.1		486	TTF programming. See chapter 6.4 . Possible to invert with ID1084 (NXP only)
P2.3.1.2	Digital output 1 function	0	26		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 **22** = Therm. fault or warn. **23** = AI supervision **24** = Fieldbus DIN 1 **25** = Fieldbus DIN 2 **26** = Fieldbus DIN 3
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 = Off delay not in use

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

Table 69. Delayed digital output 2 parameters, G2.3.2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.2.1	Digital output 2 signal selection	0.1	E.10		0.1		489	TTF programming. See chapter 6.4 . Possible to invert with ID1084 (NXP only)
P2.3.2.2	Digital output 2 function	0	26		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 = Off delay not in use

6.6.4.3   Digital output signals (Control keypad: Menu M2 -> G2.3.3)

Use TTF programming method for all these parameters. See chapter.

Table 70. Digital output signals, G2.3.3

Code	Parameter	Min	Default	Cust	ID	Note
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 explanations on page 179.
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.
P2.3.3.17	Output frequency limit 2 supervision	0.1	0.1		448	See ID346.
P2.3.3.18	Reference limit supervision	0.1	0.1		449	See ID350.
P2.3.3.19	Temperature limit supervision	0.1	0.1		450	Drive temperature supervision. See ID354.
P2.3.3.20	Torque limit supervision	0.1	0.1		451	See ID348.
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
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	

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

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

Table 71. Limit settings, G2.3.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.4.1	Output frequency limit 1 supervision	0	3		0		315	**0** = Not used **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** = Not used **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** = Not used **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** = Not used **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
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	FC temperature supervision	0	2		0		354	**0** = Not used **1** = Low limit **2** = High limit
P2.3.4.12	FC 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.

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

Table 72. Analogue output 1 parameters, G2.3.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.5.1	Analogue output 1 signal selection	0.1	E.10		A.1		464	TTF programming. See chapter 6.4
P2.3.5.2	Analogue output 1 function	0	15		1		307	**0** = Not used (20 mA / 10 V) **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** = AI1 **10** = AI2 **11** = Output freq. (f_{min} - f_{max}) **12** = Motor torque (−2...+2xT_{Nmot}) **13** = Motor power (−2...+2xT_{Nmot}) **14** = PT100 temperature **15** = FB analogue output Pr ocessData4 (NXS)
P2.3.5.3	Analogue output 1 filter time	0,00	10,00	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)
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	

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

Table 73. Analogue output 2 parameters, G2.3.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.6.1	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming. See chapter 6.4.
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	

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

Table 74. Analogue output 3 parameters, G2.3.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	ID
P2.3.7.1	Analogue output 3 signal selection	0.1	E.10		0.1		478	TTF programming See chapter 6.2 and 6.4
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	

6.6.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 75. Drive control parameters, G2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		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	I_L	A	$0,7 \times I_H$		507	
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 **1** = On
P2.4.13	Flux braking current	0	I_L	A	I_H		519	
NXP drives only								
P2.4.14	DC-brake current at stop	0	I_L	A	$0,1 \times I_H$		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	-2,00		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

6.6.6 Prohibit frequency parameters (Control keypad: Menu M2 -> G2.5)

Table 76. Prohibit frequencies, (G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	

6.6.7 Motor control parameters (Control keypad: Menu M2 -> G2.6)

Table 77. Motor control parameters

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	2/4		0		600	**0** = Frequency control **1** = Speed control **2** = Torque control Additionally for 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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	$n\% \times U_{nmot}$
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	$n\% \times U_{nmot}$ Parameter max. value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	$n\% \times U_{nmot}$
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See 8-14 for exact values
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 to zero)
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	
P2.6.15	Load drooping	0,00	100,00	%	0,00		620	

Table 77. Motor control parameters

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.16	Identification	0	1/3		0		631	**0** = No action **1** = Identification w/o run <u>Additionally for NXP:</u> **2** = Identification with run **3** = Encoder ID Run (PMSM)
NXP drives only								
P2.6.17	Restart delay	0,000	65,535	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	-320,00	320,00	Hz	-320,00		1286	Alternative limit for negative direction
P2.6.20	Positive frequency limit	-320,00	320,00	Hz	320,00		1285	Alternative limit for positive direction
P2.6.21	Generator torque limit	0,0	300,0	%	300,0		1288	
P2.6.22	Motoring torque limit	0,0	300,0	%	300,0		1287	

6.6.7.1   Closed Loop parameters (Control keypad: Menu M2 ➔ G2.6.23)

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

Table 78. Closed Loop motor control parameters (G2.6.23)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	32000	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	%	0,0		633	
P2.6.23.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.23.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.23.17	Current control P gain	0,00	100,00	%	40,00		617	
P2.6.23.19	Generator power limit	0,0	300,0	%	300,0		1290	
P2.6.23.20	Motoring power limit	0,0	300,0	%	300,0		1289	
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	150,0	%	100,0		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	320,00	Hz	0,00		1300	
P2.6.23.27	SPC Kp f0	0	1000	%	100		1299	

Table 78. Closed Loop motor control parameters (G2.6.23)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.23.28	SPC Kp FWP	0	1000	%	100		1298	
P2.6.23.29	SPC torque minimum	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	
P2.6.23.34	Modulation limit	0	150	%	100		655	If sinus filter is used set this value to 96%

6.6.7.2   *NXP drives: PMS Motor control parameters (Control keypad: Menu M2 ‑> G2.6.24)*

Table 79. PMS Motor control parameters, NXP drives

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.24.1	Motor type	0	1		0		650	**0** = Induction Motor **1** = PMS Motor
P2.6.24.2	Flux Current Kp	0	32000		5000		651	
P2.6.24.3	Flux Current Ti	0	1000		25		652	
P2.6.24.4	PMSM ShaftPosi	0	65565		0		649	
P2.6.24.5	EnableRsIdentifi	0	1		1		654	**0** = No **1** = Yes

6.6.7.3   *NXP drives: Identification parameters (Control keypad: Menu M2 ‑> G2.6.25)*

Table 80. Identification parameters, NXP drives

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.25.1	Flux 10 %	0	2500	%	10		1355	
P2.6.25.2	Flux 20 %	0	2500	%	20		1356	
P2.6.25.3	Flux 30 %	0	2500	%	30		1357	
P2.6.25.4	Flux 40 %	0	2500	%	40		1358	
P2.6.25.5	Flux 50 %	0	2500	%	50		1359	
P2.6.25.6	Flux 60 %	0	2500	%	60		1360	
P2.6.25.7	Flux 70 %	0	2500	%	70		1361	
P2.6.25.8	Flux 80 %	0	2500	%	80		1362	
P2.6.25.9	Flux 90 %	0	2500	%	90		1363	
P2.6.25.10	Flux 100 %	0	2500	%	100		1364	
P2.6.25.11	Flux 110 %	0	2500	%	110		1365	
P2.6.25.12	Flux 120 %	0	2500	%	120		1366	
P2.6.25.13	Flux 130 %	0	2500	%	130		1367	
P2.6.25.14	Flux 140 %	0	2500	%	140		1368	
P2.6.25.15	Flux 150 %	0	2500	%	150		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	MotoeBEM Voltage	0,00	320,00	%			674	Motor-induced back voltage 10000 = 100.00%

Table 80. Identification parameters, NXP drives

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.25.21	Ls voltage drop	0	3000				673	Leakage inductance voltage drop with nominalcurrent and frequency of motor. Unit:256=10%
P2.6.25.22	Iu Offset	-32000	32000		0		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	0,0		1252	NCDrive speed tuning
P2.6.25.26	Torque step	-100,0	100,0	0,0	0,0		1253	NCDrive torque tuning

Table 81. Stabilators

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.26.1	Torque stabilator gain	0	1000		100		1412	
P2.6.26.2	Torque stabilator damping	0	1000		900		1413	For PMSM, use value 980
P2.6.26.3	Torque stabilator gain FWP	0	1000		50		1414	
P2.6.26.4	Torque stabilator limit ratio	0	2000	%	3,00		1720	Limit of torque stabilator output Limit[Hz]= Value/FreqScale
P2.6.26.5	Flux circle stabilator gain	0	32766		5000		1550	Gain for flux circle stabilizer
P2.6.26.6	Flux stabilator TC	0	32700		900		1551	Filter coefficient of id-current stabilizer.
P2.6.26.7	Flux stabilator gain	0	32000		800		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	1000	%	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

6.6.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 82. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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
P2.7.4	Input phase supervision	0	3		3		730	**2** = Fault, stop acc. to 2.4.7 **3** = Fault, stop by coasting
P2.7.5	Response to undervoltage fault	0	1		0		727	**0** = Fault stored in history **1** = 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	
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	1,00	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	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	Resp. to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	

Table 82. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	Cº	120,0		741	Set here the limit at which the PT100 board warning will be activated.
P2.7.27	PT100 fault limit	–30,0	200,0	Cº	130,0		742	Set here the limit at which the PT100 board 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	320,00	s	3,00		1352	
P2.7.32	Cooling fault delay	0,00	7,00	s	2,00		751	
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	10,00	S	0,50		754	
P2.7.36	Safe disable mode	1	2		1		755	**1** = Warning,stop by coast ing **2** = Fault,stop by coasting
P2.7.37	PT100 2 numbers	0	5	X			743	Second PT100 board 0 = Not used (ID Write, value of maximum temperature can be written from fieldbus) 1 = PT100 input 1 2 = PT100 input 1 & 2 3 = PT100 input 1 & 2 & 3 4 = PT100 input 2 & 3 5 = PT100 input 3
P2.7.38	PT100 2 warning limit	-30,0	200,0	Cº			745	See par. ID741.
P2.7.39	PT100 2 fault limit	-30,0	200,0	Cº			746	See par. ID742.

6.6.9   Autorestart parameters (Control keypad: Menu M2 -> G2.8)

Table 83. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**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	

.

6.6.10 Fieldbus parameters (Control Keypad: Menu M2 ->G2.9)

Table 84. Fieldbus parameters

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	Choose monitoring data with parameter ID Def: Output Frequency
P2.9.4	Fieldbus process data out 2 selection	0	10000		2		853	Choose monitoring data with parameter ID Def:Motor Speed
P2.9.5	Fieldbus process data out 3 selection	0	10000		45		854	Choose monitoring data with parameter ID Def: Motor Current to FB
P2.9.6	Fieldbus process data out 4 selection	0	10000		4		855	Choose monitoring data with parameter ID Def: Motor Torque
P2.9.7	Fieldbus process data out 5 selection	0	10000		5		856	Choose monitoring data with parameter ID Def: Motor Power
P2.9.8	Fieldbus process data out 6 selection	0	10000		6		857	Choose monitoring data with parameter ID Def: Motor Voltage
P2.9.9	Fieldbus process data out 7 selection	0	10000		7		858	Choose monitoring data with parameter ID Def: DC-Link Voltage
P2.9.10	Fieldbus process data out 8 selection	0	10000		37		859	Choose monitoring data with parameter ID Def: Last Active Fault
NXP drives only (In NXS, default values are not editable)								
P2.9.11	Fieldbus process data in 1 selection	0	10000		1140		876	Choose controlled data with parameter ID Def: FB Torque Reference
P2.9.12	Fieldbus process data in 2 selection	0	10000		46		877	Choose controlled data with parameter ID Def: FB Limit Scaling
P2.9.13	Fieldbus process data in 3 selection	0	10000		47		878	Choose controlled data with parameter ID Def: FB Adjust Reference
P2.9.14	Fieldbus process data in 4 selection	0	10000		48		879	Choose controlled data with parameter ID Def: FB Analogue Output.
P2.9.15	Fieldbus process data in 5 selection	0	10000		0		880	Choose controlled data with parameter ID
P2.9.16	Fieldbus process data in 6 selection	0	10000		0		881	Choose controlled data with parameter ID
P2.9.17	Fieldbus process data in 7 selection	0	10000		0		882	Choose controlled data with parameter ID
P2.9.18	Fieldbus process data in 8 selection	0	10000		0		883	Choose controlled data with parameter ID

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

Table 85. Torque control parameters, G2.10

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	0,0	32000		3000		610	Used only in Open Loop control mode
P2.10.3	Torque limit control I-gain	0,0	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 ...10 V) **7** = Torque reference from keypad, R3.5 **8** = Fieldbus torque ref.
P2.10.5	Torque reference max.	–300,0	300,0	%	100		642	
P2.10.6	Torque reference min.	–300,0	300,0	%	0,0		643	
P2.10.7	Torque speed limit (OL)	0	2		1		644	**0** = Max. frequency **1** = Selected frequency ref. **2** = Preset speed 7
P2.10.8	Minimum frequency for open loop torque control	0,00	50,00	Hz	3,00		636	
P2.10.9	Torque controller P gain	0	32000		150		639	
P2.10.10	Torque controller I gain	0	32000		10		640	
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	
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	

6.6.12 NXP drives: Master Follower parameters (Control keypad: Menu M2 -> G2.11)

Table 86. Master Follower parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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
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	%	100,00		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

6.6.13   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's manual.

Table 87. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	0	3		1		125	**0** = PC Control **1** = I/O terminal **2** = Keypad **3** = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
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			

6.6.14   SYSTEM MENU (CONTROL KEYPAD: MENU M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

6.6.15   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's manual.

7. Pump and Fan Control Application

Software code: ASFIFF07

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 frequency converter controls the speed of the variable speed drive and gives control signals to start and stop the auxiliary drives to control the total flow. In addition to the eight parameter groups provided as standard, a parameter group for multi-pump and fan control functions is available.

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

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

The application utilizes external contactors for switching between the motors connected to the frequency converter. The autochange feature provides the capability of changing the starting order of the auxiliary drives. Autochange between 2 drives (main drive + 1 auxiliary drive) is set as default, see chapter 7.4.1.

- 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. of this manual. The explanations are arranged according to the individual ID number of the parameter.

7.2   Control I/O

Table 87. Pump and fan control application default I/O configuration and connection example (with 2-wire transmitter).

Reference potentiometer,
1...10 kΩ

2 wire
Transmitter

Actual
value (0) 4...20
mA

OPTA1			
Terminal		**Signal**	**Description**
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1 Voltage range 0—10V DC	Analogue input 1 PID reference from I/O Default reference from keypad P3.4
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2	Analogue input 2 PID actual value 1
5	AI2-	Current range 0—20mA Programmable (P2.2.1.9)	
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Place A: Start/Stop Programmable (G2.2.6)	Start signal for control place A PID Controller.
9	DIN2	Interlock 1 Programmable (G2.2.6)	Contact closed = Interlock used Contact open = Interlock not used
10	DIN3	Interlock 2 Programmable (G2.2.6)	Contact closed = Interlock used Contact open = Interlock not used
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Place B: Start/Stop Programmable (G2.2.6)	Contact closed = Start
15	DIN5	Jogging speed selection Programmable (G2.2.6)	Contact closed = Jogging speed active
16	DIN6	Control place A/B selection Programmable (G2.2.6)	Contact open = Control place A is active Contact closed = Control place B is active
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Analogue output 1	See chapters , and
19	AO1- (GND)	Output frequency Programmable (P2.3.3.2)	Range 0—20 mA/R$_L$, max. 500Ω
20	DO1	Digital output FAULT Programmable (G2.3.1)	Open collector, I≤50mA, U≤48 VDC
OPTA2			
21	RO1	Relay output 1	See Chapter 7.5.4.1
22	RO1	Aux/Autochange 1	
23	RO1	Programmable (G2.3.1)	
24	RO2	Relay output 2	See Chapter 7.5.4.1
25	RO2	Aux/Autochange 2	
26	RO2	Programmable (G2.3.1)	

Fault

Note: See jumper selections below. More information in the product's user's manual.

Jumper block X3:
CMA and CMB grounding

CMB connected to GND
CMA connected to GND

CMB isolated from GND
CMA isolated from GND

CMB and CMA internally connected together, isolated from GND

= Factory default

7090.emf

Figure 15.
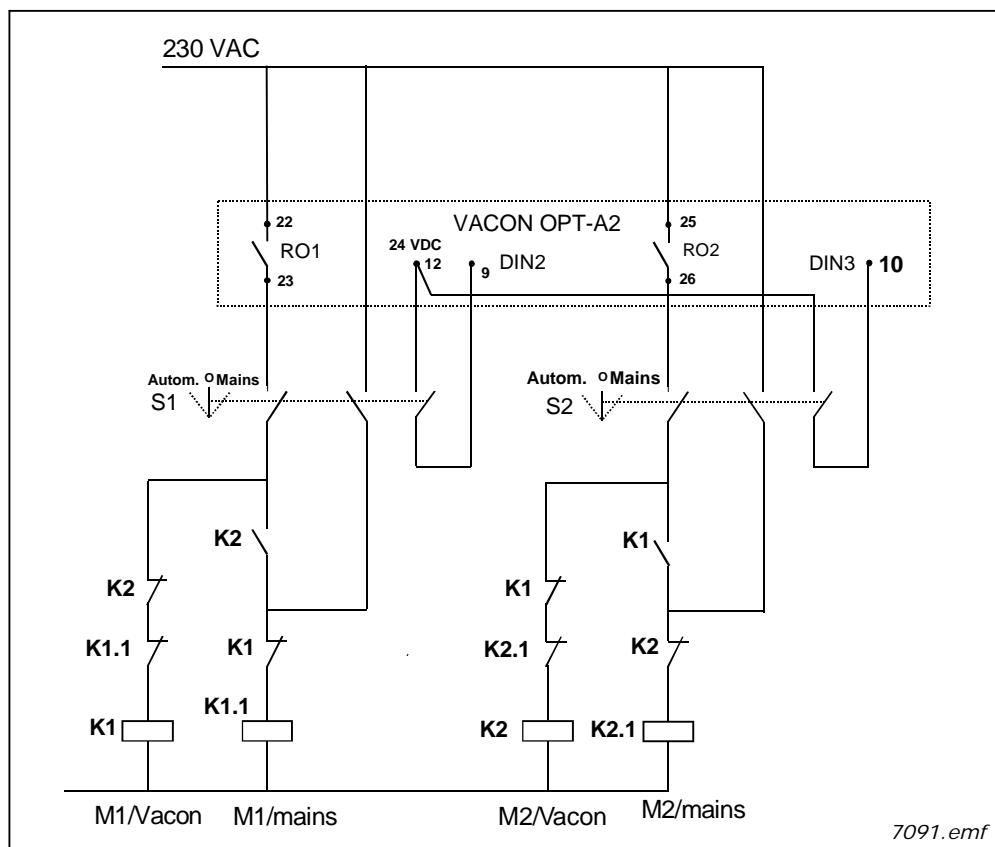
Figure 16. pump autochange system, principal control diagram
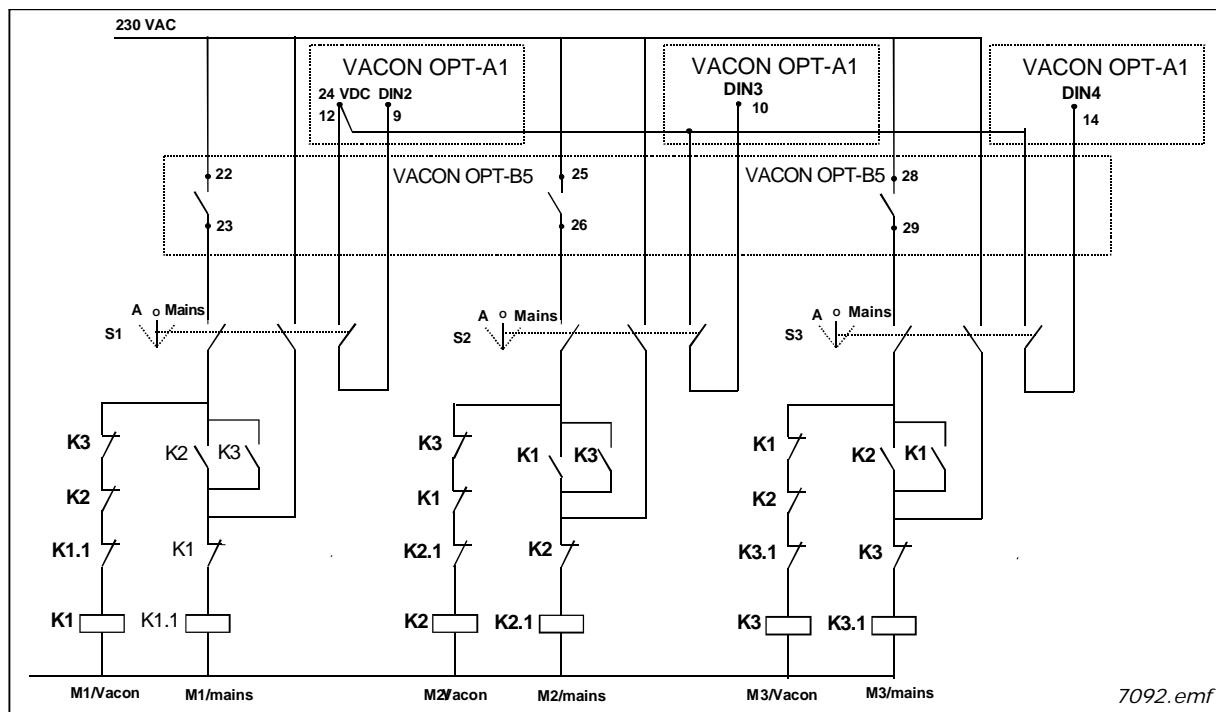
Figure 17. pump autochange system, principal control diagram

7.3   Control signal logic in Pump and Fan Control Application
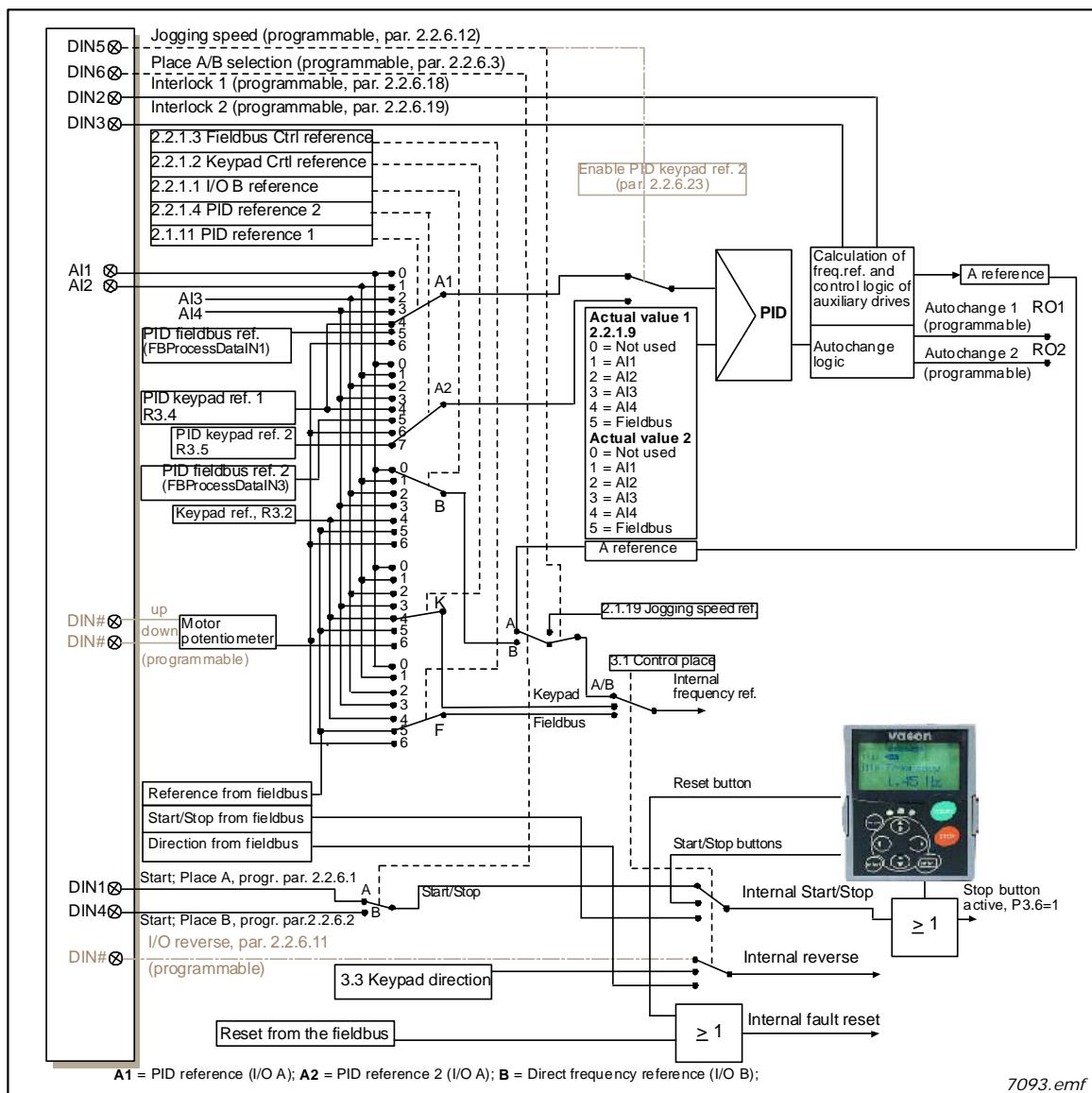
Figure 18. Control signal logic of the Pump and Fan Control Application

7.4 Short description of function and essential parameters

7.4.1 Automatic changing between drives (Autochange, P2.9.24)

The *Autochange function* allows the starting and stopping order of drives controlled by the pump and fan automatics to be changed at desired intervals. The drive controlled by frequency converter can also be included in the automatic changing and locking sequence (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 frequency converter connect the drives to the frequency converter or to the mains. If the motor controlled by the frequency converter is included in the autochange sequence, it is always controlled through the relay output activated first. The other relays activated later control the auxiliary drives (see Figure 20 and Figure 21).

Parameter 2.9.24, Autochange

        0 Autochange not used

        1 Autochange used

The automatic change of starting and stopping order is activated and applied to either the auxiliary drives only or the auxiliary drives and the drive controlled by the frequency converter. depending on the setting of parameter 2.9.25, *Automatics selection*. By default, the Autochange is activated for 2 drives. See Figure 16 and Figure 20.

Parameter 2.9.25, Autochange/Interlockings automatics selection

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

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

        1 All drives included in the autochange/interlockings sequence

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

Parameter 2.9.26, Autochange interval

After the expiry of the time defined with this parameter, the autochange function takes place if the capacity used lies below the level defined with parameters 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

***Parameters 2.9.27, Maximum number of auxiliary drives and
        2.9.28, Autochange frequency limit***

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

This level is defined as follows:

- If the number of running auxiliary drives is smaller than the value of parameter 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.

7.4.2   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 frequency converter.
- If the interlock of the controlled drive is inactivated, all motors will be stopped and re-started 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*:

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 7.4.3 , Examples.

7.4.3 Examples

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 frequency converter 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).

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.
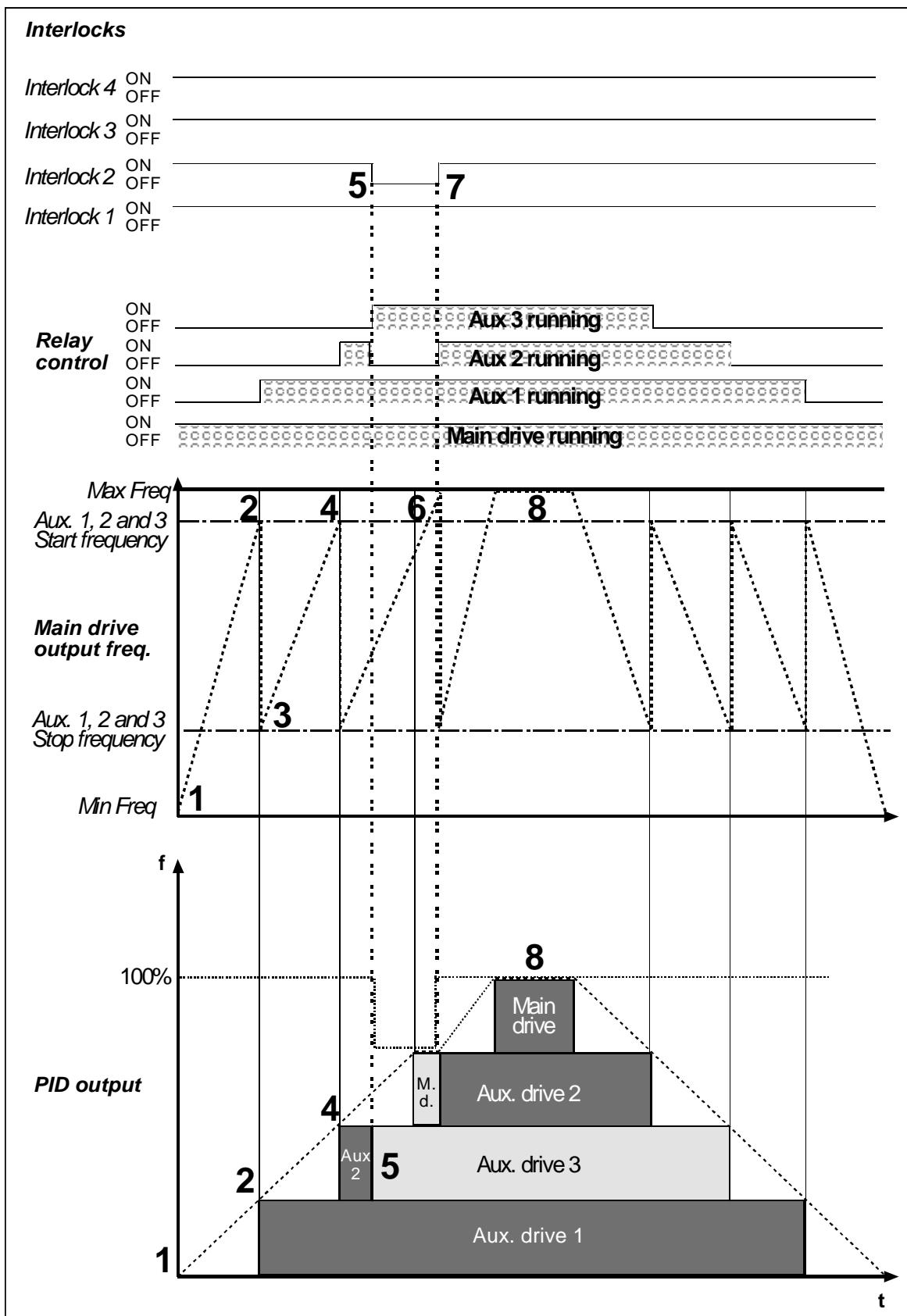
7094.emf

Figure 19. Example of the function of the PFC application with three aux. drives
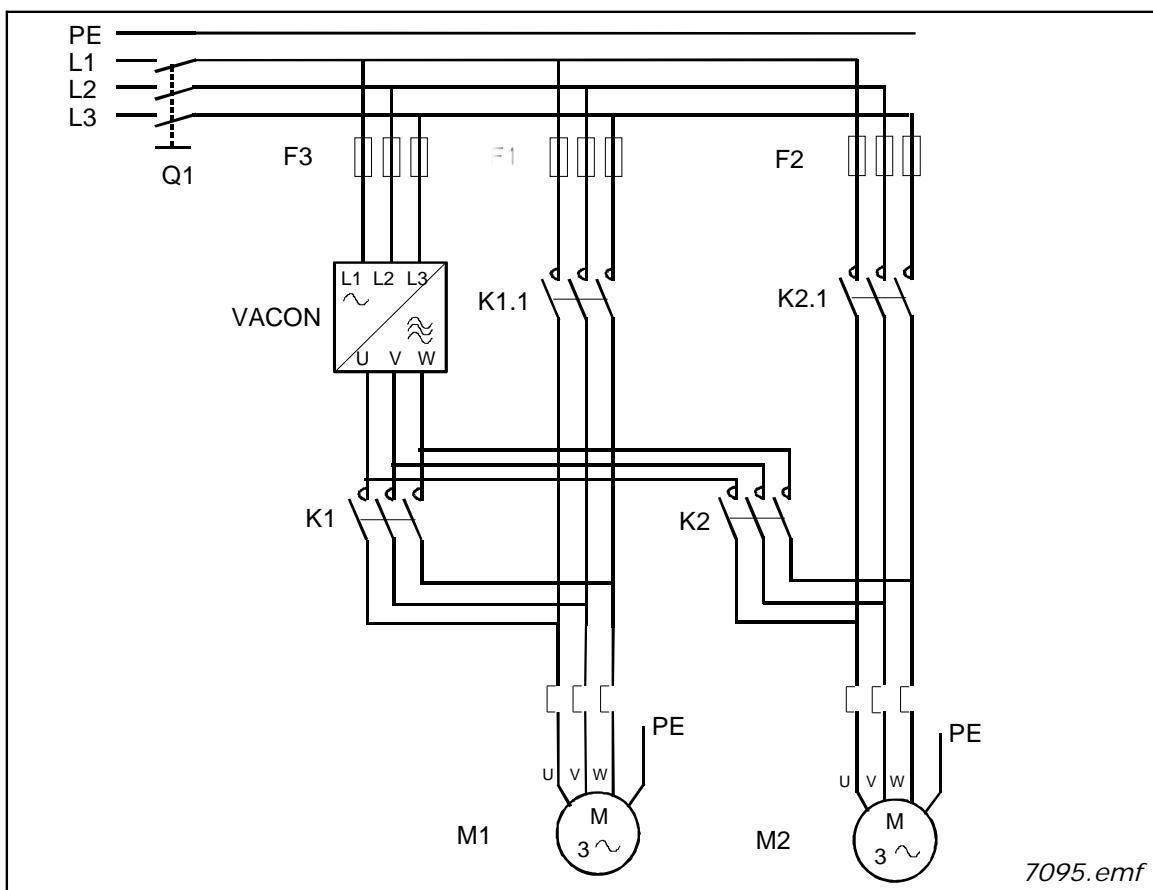
Figure 20. Example of 2-pump autochange, main diagram
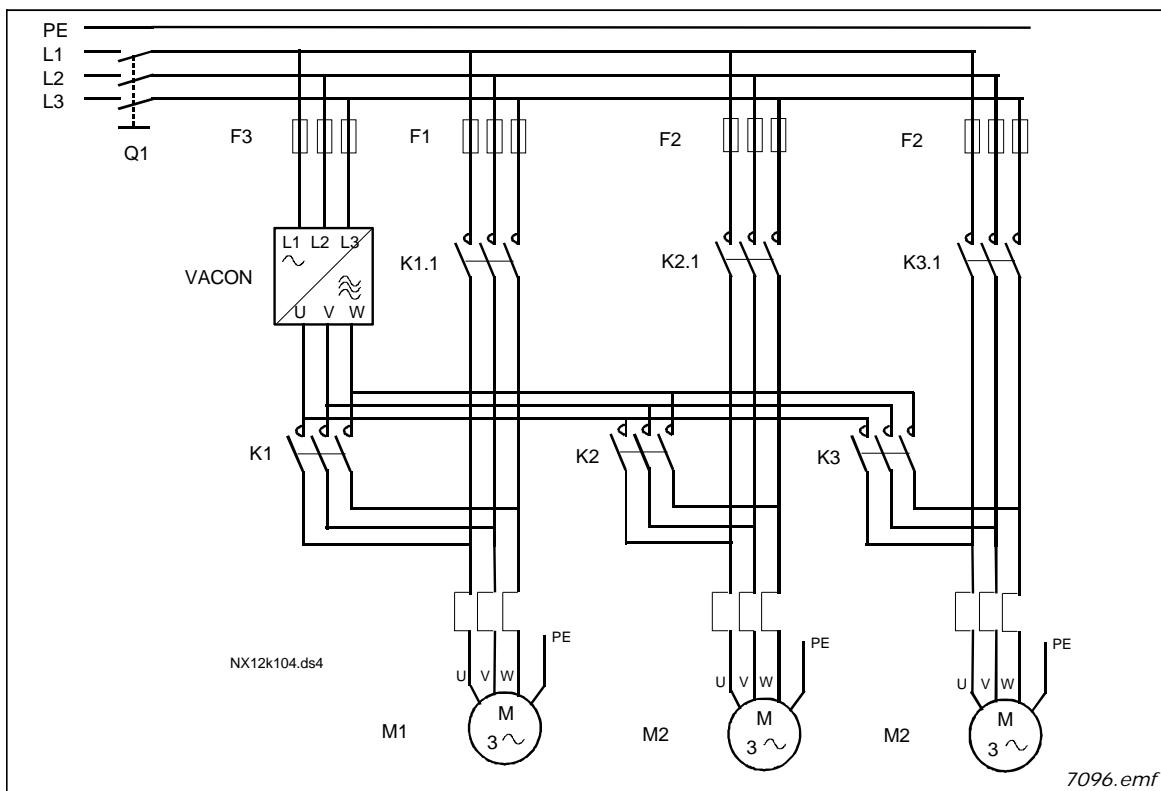
Figure 21. Example of 3-pump autochange, main diagram

7.5   Pump and Fan Control Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on 131 to 229.

Column explanations:

Code   = Location indication on the keypad; Shows the operator the present param. number
Parameter   = Name of parameter
Min   = Minimum value of parameter
Max   = Maximum value of parameter
Unit   = Unit of parameter value; Given if available
Default   = Value preset by factory
Cust   = Customer's own settings
ID   = ID number of the parameter
                = On parameter code: Parameter value can only be changed after the FC has been stopped.
                = Apply the Terminal to Function method (TTF) to these parameters (see Chapter 6.4)

7.5.1   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.

See the product's user's manual for more information. Note that the monitoring values V1.18 to V1.23 are available in the PFC control application only.

Table 88. Monitoring values

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1 input value
V1.12	Analogue input 2	V/mA	14	AI2 input value
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
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

Table 88. Monitoring values

Code	Parameter	Unit	ID	Description
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	C°	42	Highest temperature of used PT100 inputs
G1.25	Multimonitoring items			Displays 3 selectable monitor. values

7.5.2   Basic parameters (Control keypad: Menu M2 -> G2.1)

Table 89. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	**NOTE:** If f_{max} > 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	
P2.1.4	Deceleration time 1	0,1	3000,0	s	1,0		104	
P2.1.5	Current limit	$0,1 \times I_H$	$2 \times I_H$	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$0,1 \times I_H$	$2 \times I_H$	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check 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	
P2.1.13	PID controller I-time	0,00	320,00	s	1,00		119	
P2.1.14	PID controller D-time	0,00	10,00	s	0,00		132	
P2.1.15	Sleep frequency	0	P 2.1.2	Hz	10,00		1016	
P2.1.16	Sleep delay	0	3600	s	30		1017	
P2.1.17	Wake up level	0,00	100,00	%	25,00		1018	

Table 89. Basic parameters G2.1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	

7.5.3 Input signals

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

Table 90. Input signals, Basic settings

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	0,0	100,0	s	5,0		341	Time for reference value to change from 0% to 100%
P2.2.1.7	PID reference falling time	0,0	100,0	s	5,0		342	Time for reference value to change from 100% to 0%
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(Actual1, Actual2) **7** = Sqrt (Act1) + Sqrt (Act2) See P2.2.1.9 and P2.2.1.10

Table 90. Input signals, Basic settings

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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
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 max. value

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

Table 91. Input signals, Analogue input 1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.2.1	AI1 signal selection	0.1	E.10		A.1		377	TTF programming See Chapter 6.4
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

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

Table 92. Input signals, Analogue input 2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.1	AI2 signal selection	0.1	E.10		A.2		388	TTF programming See Chapter 6.4
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—20 mA (0—10 V)* **1** = 4—20 mA (2—10 V)* **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's Manual.

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

Table 93. Input signals, Analogue input 3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.4.1	AI3 signal selection	0.1	E.10		0.1		141	TTF programming See Chapter 6.4
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—20 mA (0—10 V)* **1** = 4—20 mA (2—10 V)* **2** = Customised*
P2.2.4.4	AI3 custom minimum setting	-160,00	160,00	%	0,00		144	
P2.2.4.5	AI3 custom maximum setting	-160,00	160,00	%	100,00		145	
P2.2.4.6	AI3 inversion	0	1		0		151	**0** = Not inverted **1** = Inverted

7.5.3.5   Analogue input 4, (Control keypad: Menu M2 -> G2.2.5)

Table 94. Input signals, Analogue input 4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.5.1	AI4 signal selection	0.1	E.10		0.1		152	TTF programming See Chapter 6.4
P2.2.5.2	AI4 filter time	0,00	10,00	s	0,10		153	**0** = No filtering
P2.2.5.3	AI4 signal range	0	2		1		154	**0** =0 —20 mA (0—10 V)* **1** = 4—20 mA (2—10 V)* **2** = Customised*
P2.2.5.4	AI4 custom minimum setting	-160,00	160,00	%	0,00		155	
P2.2.5.5	AI4 custom minimum setting	-160,00	160,00	%	100,00		156	
P2.2.5.6	AI4 custom minimum setting	0	1		0		162	**0** = Not inverted **1** = Inverted

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

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Use TTF programming method for all these parameters. See Chapter 6.4 .

Table 95. Input signals, Digital inputs

Code	Parameter	Min	Default	Cust	ID	Note
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 keypad	0.1	0.1		410	Force control place to keypad (cc)
P2.2.6.10	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 potentiometer reference DOWN	0.1	0.1		417	Mot.pot. reference decreases (cc)
P2.2.6.17	Motor potentiometer 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
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

7.5.4   Output signals

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

Use TTF programming method for all these parameters. See Chapter 6.4.

Table 96. Output signals, Digital outputs

Code	Parameter	Min	Default	Cust	ID	Note
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 explanations on page
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.
P2.3.1.17	Output frequency limit 2 supervision	0.1	0.1		448	See ID346.
P2.3.1.18	Reference limit supervision	0.1	0.1		449	See ID350.
P2.3.1.19	Drive temperature limit supervision	0.1	0.1		450	Drive temperature supervision. See ID354
P2.3.1.20	Torque limit supervision	0.1	0.1		451	See ID348.
P2.3.1.21	Motor thermal protection	0.1	0.1		452	Thermistor fault or wrng
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	

⚠️ Be ABSOLUTELY sure not to connect two functions to one and same <u>output</u> in order to avoid function overruns and to ensure flawless operation.
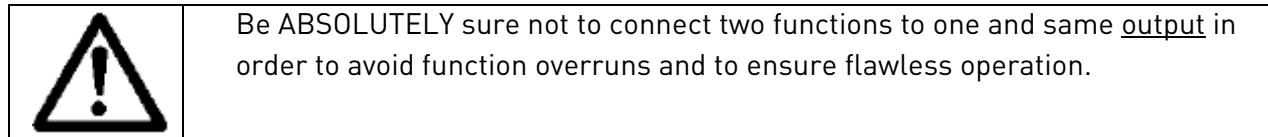
7.5.4.2 Limit settings (Control keypad: Menu M2 -> G2.3.2)

Table 97. Output signals, Limit settings

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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 freq. 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 freq. limit 2; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.2.5	Torque limit supervi- sion	0	2		0		348	**0** = Not used **1** = Low limit supervision **2** = High limit supervision
P2.3.2.6	Torque limit supervi- sion value	-300,0	300,0	%	100,0		349	
P2.3.2.7	Reference limit super- vision	0	2		0		350	**0** = Not used **1** =Low limit **2** = High limit
P2.3.2.8	Reference limit super- vision 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
P2.3.2.12	FC temperature supervised value	−10	100	°C	40		355	
P2.3.2.13	Supervised analogue input	0	3		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 super- vised value	0,00	100,00	%	0,00		374	

7.5.4.3   Analogue output 1 (Control keypad: Menu M2 ‑➤ G2.3.3)

Table 98. Output signals, Analogue output 1

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.3.1	Analogue output signal selection	0.1	E.10		A.1		464	TTF programming See Chapter 6.4.
P2.3.3.2	Analogue output function	0	14		1		307	**0** = Not used (20 mA / 10 V) **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
P2.3.3.3	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	
P2.3.3.7	Analogue output offset	–100,00	100,00	%	0,00		375	

7.5.4.4   Analogue output 2 (Control keypad: Menu M2 ‑➤ G2.3.4)

Table 99. Output signals, Analogue output 2

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.4.1	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming See Chapter 6.4
P2.3.4.2	Analogue output 2 function	0	14		0		472	See P2.3.3.2
P2.3.4.3	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0** = No filtering
P2.3.4.4	Analogue output 2 inversion	0	1		0		474	**0** = Not inverted **1** = Inverted
P2.3.4.5	Analogue output 2 minimum	0	1		0		475	**0** = 0 mA (0 V) **1** = 4 mA (2 V)
P2.3.4.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.4.7	Analogue output 2 offset	–100,00	100,00	%	0,00		477	

7.5.4.5   Analogue output 3 (Control keypad: Menu M2 ➔ G2.3.5)

Table 100. Output signals, Analogue output 3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.5.1	Analogue output 3 signal selection	0.1	E.10		0.1		478	TTF programming See Chapter 6.4.
P2.3.5.2	Analogue output 3 function	0	14		0		479	See P2.3.3.2
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 3 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	

7.5.5   Drive control parameters (Control keypad: Menu M2 -> G2.4)

Table 101. Drive control parameters, G2.4

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		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	
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 **1** = On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

7.5.6 Prohibit frequency parameters (Control keypad: Menu M2 -> G2.5)

Table 102. Prohibit frequency parameters, G2.5

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	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	

7.5.7 Motor control parameters (Control keypad: Menu M2 -> G2.6)

Table 103. Motor control parameters, G2.6

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	$n\% \times U_{nmot}$
P2.6.6	U/f curve midpoint frequency	0,00	P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	$n\% \times U_{nmot}$ Parameter max. value = P2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	$n\% \times U_{nmot}$
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 121 for exact values
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

7.5.8   Protections (Control keypad: Menu M2 -> G2.7)

Table 104. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA 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	4mA 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 under-voltage fault	0	1		0		727	**0** = Fault stored in history **1** = 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	
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	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	25,0		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	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		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	

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Table 104. Protections, G2.7

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.25	Response to PT100 fault	0	3		2		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	C°	120,0		741	
P2.7.27	PT100 fault limit	–30,0	200,0	C°	130,0		742	

7.5.9 Autorestart parameters (Control keypad: Menu M2 -> G2.8)

Table 105. Autorestart parameters, G2.8

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**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	

7.5.10   Pump and fan control parameters (Control keypad: Menu M2 -> G2.9)

Table 106. Pump and fan control parameters

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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	0,0	100,0	%	0,0		1012	
P2.9.13	Reference step, auxiliary drive 2	0,0	100,0	%	0,0		1013	
P2.9.14	Reference step, auxiliary drive 3	0,0	100,0	%	0,0		1014	
P2.9.15	Reference step, auxiliary drive 4	0,0	100,0	%	0,0		1015	
P2.9.16	PID controller bypass	0	1		0		1020	**1** = PID contr. bypassed
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	%	30,00		1022	
P2.9.19	Input pressure low limit	0,0	100,0	%	20,00		1023	
P2.9.20	Output pressure drop	0,0	100,0	%	30,00		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

Table 106. Pump and fan control parameters

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
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
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 page 220.

7.5.11   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's manual.

Table 107. Keypad control parameters, M3

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1** = I/O terminal **2** = Keypad **3** = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2		Hz			
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

7.5.12   System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

7.5.13   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's manual.

8.   Description of parameters

On the following pages you will find the parameter descriptions arranged according to the individual ID number of the parameter. A shaded parameter ID number (e.g. *418 Motor potentiometer UP*) indicates that the *TTF programming method* shall be applied to this parameter (see Chapter 6.4).

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

101	*Minimum frequency*	*(2.1, 2.1.1)*
102	*Maximum frequency*	*(2.2, 2.1.2)*

Defines the frequency limits of the frequency converter.
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)*
104	*Deceleration time 1*	*(2.4, 2.1.4)*

These limits define the time required for the output frequency to increase from the zero frequency to the set maximum frequency (par. ID102).

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 appropriate digital inputs are activated.

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

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 108. 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 determines the maximum motor current from the frequency converter. The parameter value range differs from size to size. 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 is decreased.

NOTE: This is not an overcurrent trip limit.

108 **U/F RATIO SELECTION 234567** *(2.6.3)*

Linear: 0

The voltage of the motor changes linearly as a function of output frequency from zero frequency voltage (ID606) to the field weakening point (FWP) voltage (ID603) at FWP frequency (ID602) This default setting should be used if there is no special need for another setting.

Squared: 1

The voltage of the motor changes from zero point voltage (ID606) following a squared curve form from zero to the field weakening point (ID602) The motor runs undermagnetised below the field weakening point and produces less torque. Squared U/f ratio can be used in applications where torque demand is proportional to the square of the speed, e.g. in centrifugal fans and pumps.
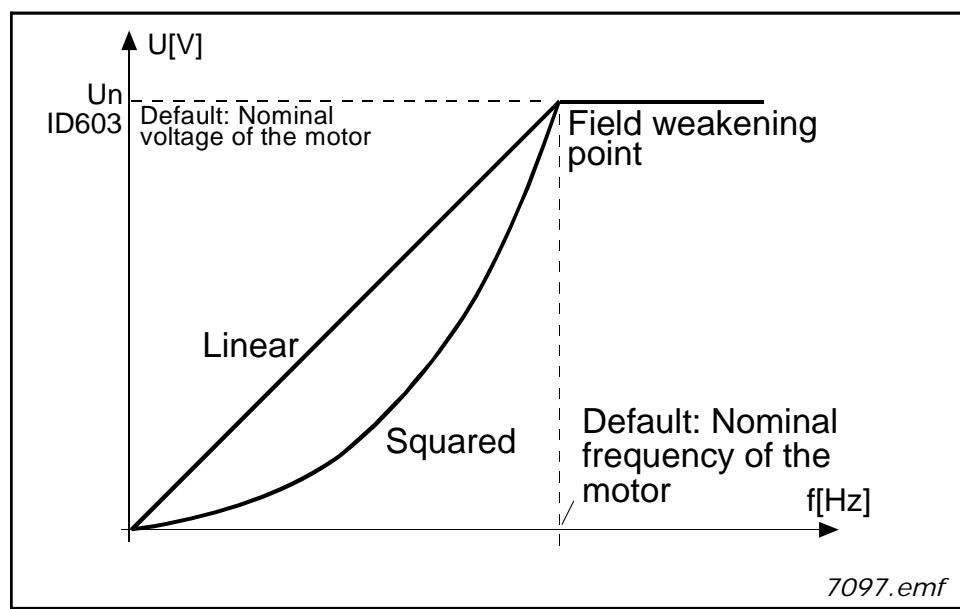
Figure 22. Linear and squared change of motor voltage

Programmable U/f curve:

2

The U/f curve can be programmed with three different points: Zero frequency voltage (P1), Midpoint voltage/frequency (P2) and Fieldweakening point (P3). Programmable U/f curve can be used if more torque is needed at low frequencies. The optimal settings can automatically be achieved with Motor identification run (ID631).

8
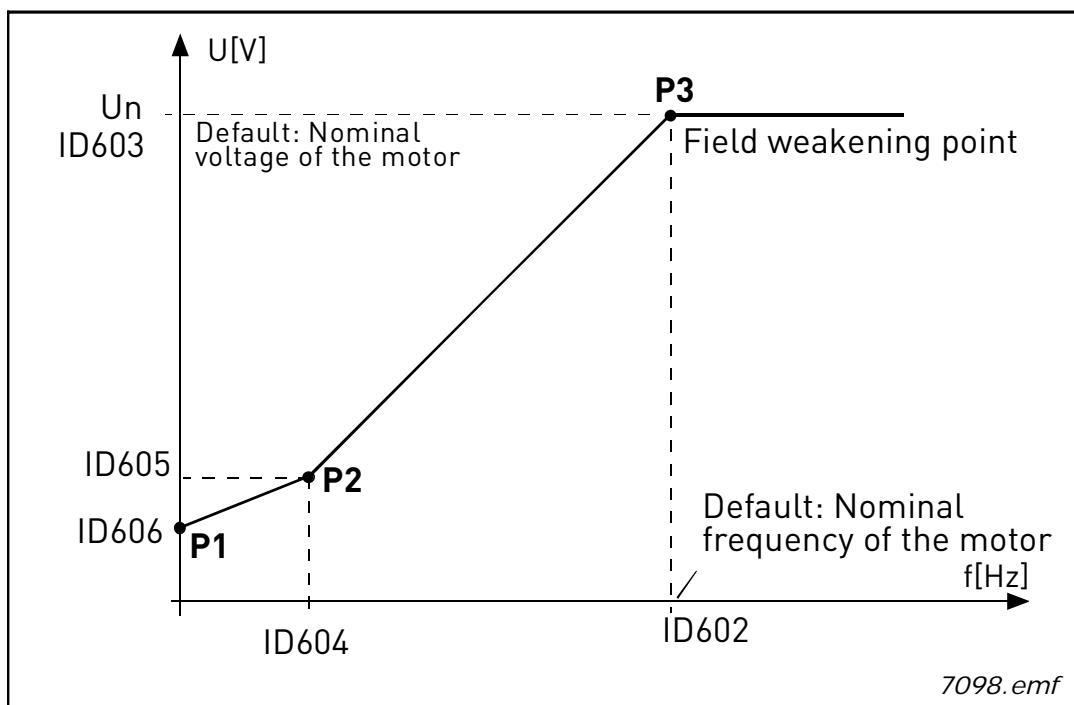
Figure 23. Programmable U/f curve

Linear with flux optimisation:

3   The frequency converter 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.

109   U/f optimisation   (2.13, 2.6.2)

Automatic torque boost   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, e.g. in conveyors.

EXAMPLE:

<u>What changes are required to start with high torque from 0 Hz?</u>

• <u>First set the motor nominal values (Parameter group 2.1).</u>

<u>Option 1</u>: Automatic functions.

<u>Step 1</u>: Make identification run (ID631, P2.6.16)

<u>Step 2</u>: Activate this parameter by setting value 1.

<u>Option 2</u>: Manual tuning

Use programmable U/f curve by giving the parameter 2.6.3 (ID108) value 2.

To get torque you need to set the zero point voltage (ID606) and midpoint voltage/ frequency (ID604 and ID605) so that the motor takes one third of nominal current at low frequencies. Use higher current if more torque is needed.

First set par. ID108 to *Programmable U/f curve* (value 2). Increase zero point voltage to get enough current at zero speed. Set then the midpoint voltage (ID605) to 1.4142*ID606 and midpoint frequency (ID604) to value ID606/100%*ID111.

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 also used connection Delta/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 par. 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 109. 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

Table 109. Selections for parameter ID117

Applic. Sel.	1 to 4	6
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.

See examples on Page 137.

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 second a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00 s the PID controller will operate as PD controller.

See examples on Page 137 .

120   *MOTOR COS PHI   (2.10, 2.1.10)*

Find this value "cos phi" 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)*

Defines which frequency reference source is selected when controlled from the keypad.

Table 110. Selections for parameter ID121

Applic. Sel.	2–4	5	6	7
0	Analogue input 1 (AI1)	Analogue input 1 (AI1)	Analogue input 1 (AI1)	Analogue input 1 (AI1)

Table 110. Selections for parameter ID121

Applic. / Sel.	2–4	5	6	7
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)

Defines which frequency reference source is selected when controlled from the fieldbus.

For selections in different applications, see ID121.

---

123   KEYPAD DIRECTION   (3.3)

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's 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's 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).

0 PC Control, (activated by NCDrive)

1 I/O terminal

2 Keypad

3 Fieldbus

126	*PRESET SPEED*	*346*	*(2.1.17)*
127	*PRESET SPEED*	*446*	*(2.1.18)*
128	*PRESET SPEED*	*546*	*(2.1.19)*
129	*PRESET SPEED*	*646*	*(2.1.20)*
130	*PRESET SPEED*	*746*	*(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 111. 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 parameter ID's 105 and 106.

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 frequency converter 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.
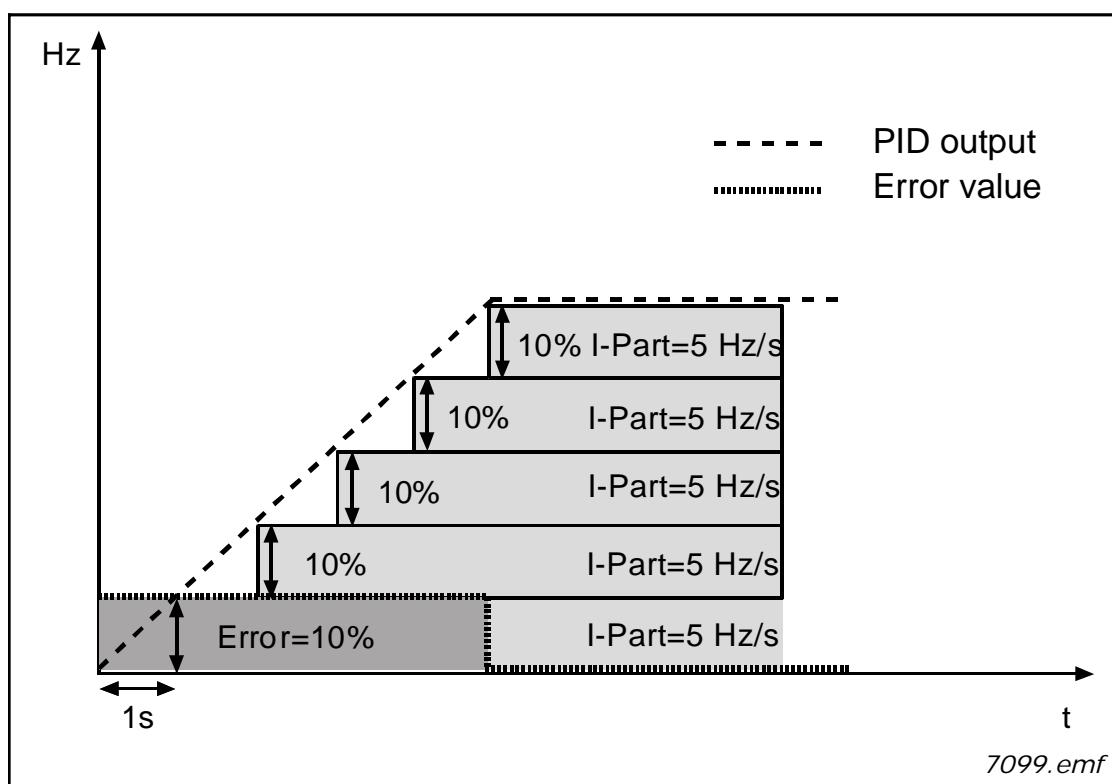
Figure 24. PID controller function as I-controller.

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 frequency converter reacts reducing the output correspondingly. See Figure 25
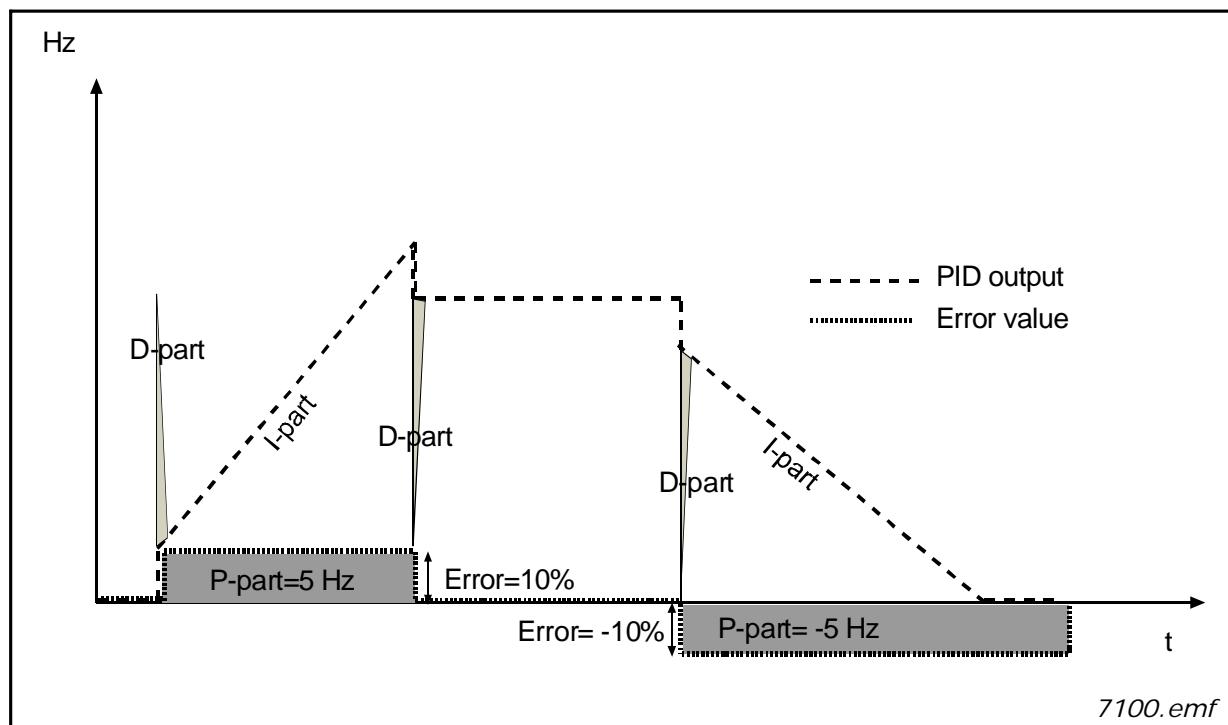
Figure 25. PID output curve with the values of Example 2.

Example 3:

<u>Given values:</u>

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)
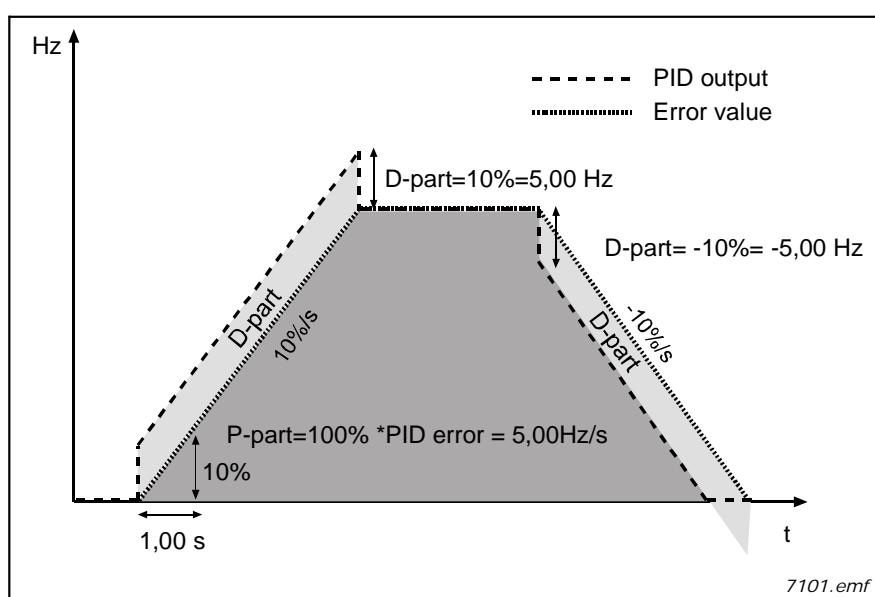
Figure 26. PID output with the values of Example 3.

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 112. 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 6.4 "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.

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 113. Selections for parameter ID143

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

8

Table 113. Selections for parameter ID143

Applic.	5	6	7
Sel.			
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)**

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 ID's 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 1/26**	**(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 ID's 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 par. ID165.

167   *PID REFERENCE 1*   *57*   *(3.4)*

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

169   *FIELDBUS DIN 4 (FBFIXEDCONTROLWORD, BIT 6)*   *6*   *(2.3.3.27)*
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 frequency con-
verter. 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.

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)*

0   DIN1: closed contact = start forward

    DIN2: closed contact = start reverse
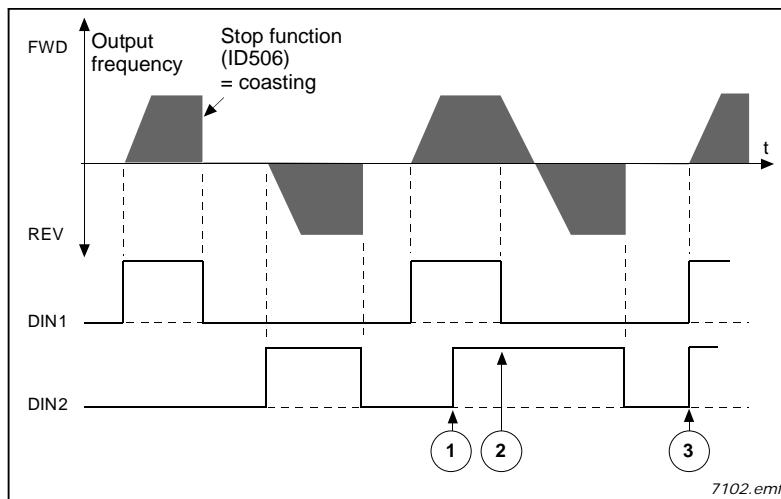
Figure 27. Start forward/Start reverse

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.

1 DIN1: closed contact = startopen contact = stop

   DIN2: closed contact = reverseopen contact = forward

See below
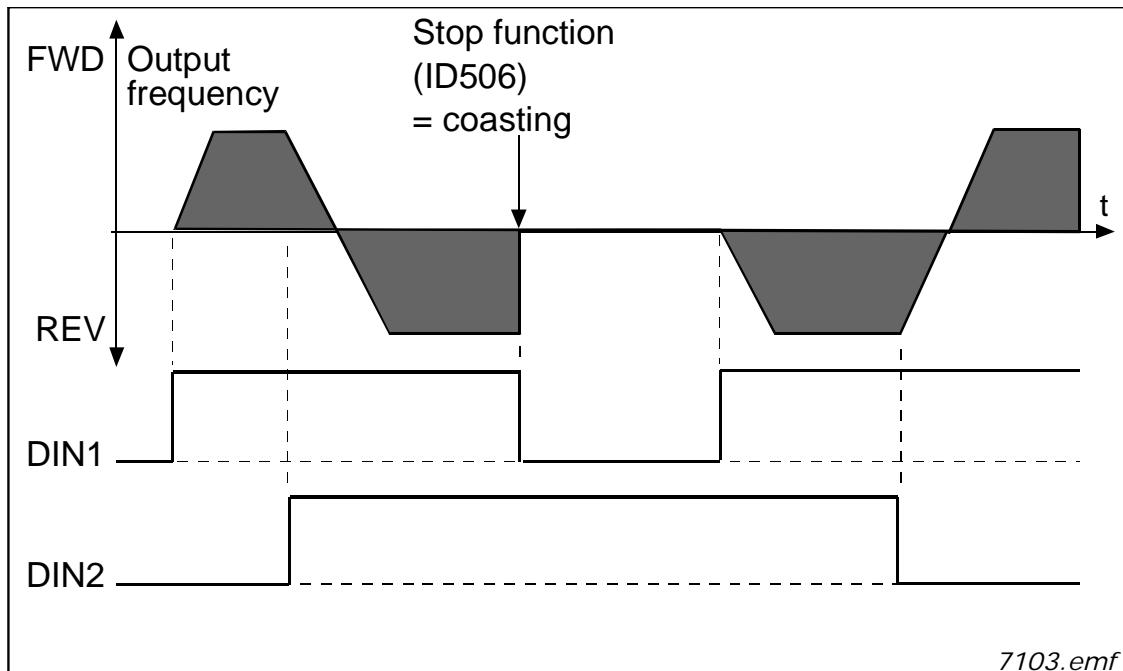
Figure 28. Start, Stop, Reverse

2 DIN1: closed contact = startopen contact = stop

   DIN2: closed contact = start enabledopen contact = start disabled and drive stopped if running

   (DIN3 can be programmed for reverse command)

3 3-wire connection (pulse control):

   DIN1: closed contact= start pulse

   DIN2: open contact = stop pulse

   (DIN3 can be programmed for reverse command)

    See Figure 29
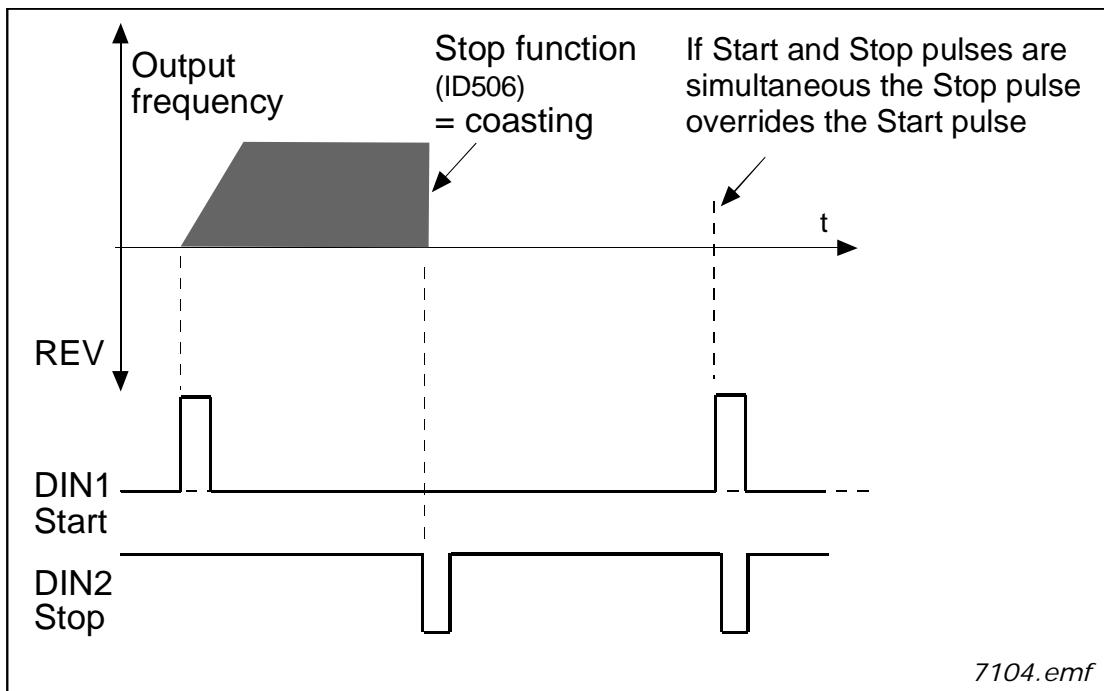
Figure 29. Start pulse/ Stop pulse.

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

Applications 2 and 4:

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

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

5   DIN1:closed contact = start (Rising edge required to start)

       open contact = stop

   DIN2:closed contact = reverse

       open contact = forward

6   DIN1:closed contact = start (Rising edge required to start)

       open contact = stop

   DIN2:closed contact = start enabled

       open contact = start disabled and drive stopped if running

   (DIN3 can be programmed for reverse command unless selected for DIN2)

Applications 3 and 6:

4 DIN1: closed contact = start forward

   DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if par. ID117 is set to 4 [Application 4]).

5 DIN1: closed contact = start forward (Rising edge required to start)

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

6 DIN1:closed contact = start (Rising edge required to start)

      open contact = stop

   DIN2:closed contact = reverse

      open contact = forward

7 DIN1:closed contact = start (Rising edge required to start)

      open contact = stop

   DIN2:closed contact = start enabled

      open contact = start disabled and drive stopped if running

Application 3:

8 DIN1: closed contact = start forward (Rising edge required to start)

   DIN2: closed contact = reference increases (motor potentiometer reference

301   *DIN3 function*   *12345*   *(2.17, 2.2.2)*

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 enablecontact open = Motor start enabled

   contact closed = Motor start disabled and the motor is stopped

Applications 2 to 5:

4 Acc./Deccontact open = Acceleration/deceleration time 1 selected

    time select.contact closed = Acceleration/deceleration time 2 selected

5 Closing contact: Force control place to I/O terminal

6 Closing contact: Force control place to keypad

7 Closing contact: Force control place to fieldbus

When the control place is forced to change the values of Start/Stop, Direction and
Reference valid in the respective control place are used (reference according to
parameters 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.

Applications 2 to 5:

8   Reversecontact open = Forward

    contact closed = Reverse

> Can be used for reversing if par. ID300 value is set to either 2,3, or 6

Applications 3 to 5:

9   Jogging sp.contact closed=Jogging speed selected for frequency reference

10   Fault resetcontact 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
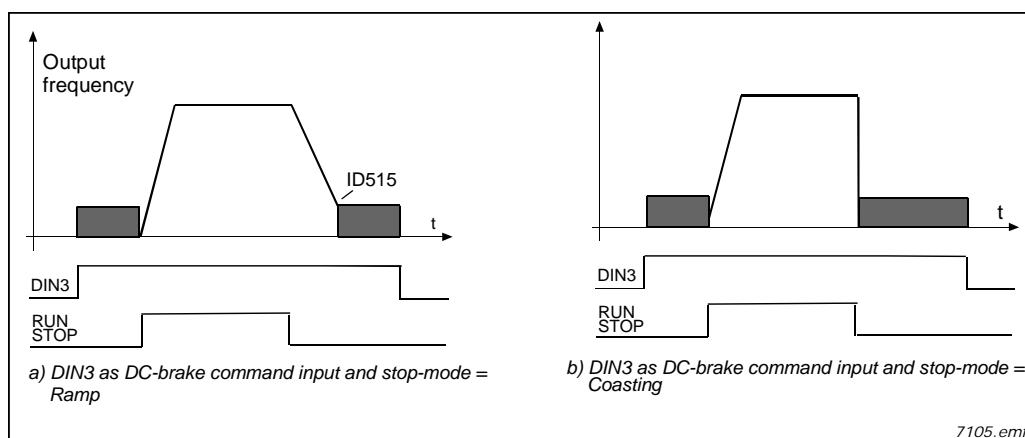
Figure 30. DIN3 as DC-brake command input: a) Stop mode = Ramp, b) Stop mode = coasting

302   Analogue input 2, reference offset   12   (2.15, 2.2.3)

0   No offset: 0—20mA

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.

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* (par. ID101) and *Maximum frequency* (par. ID102).
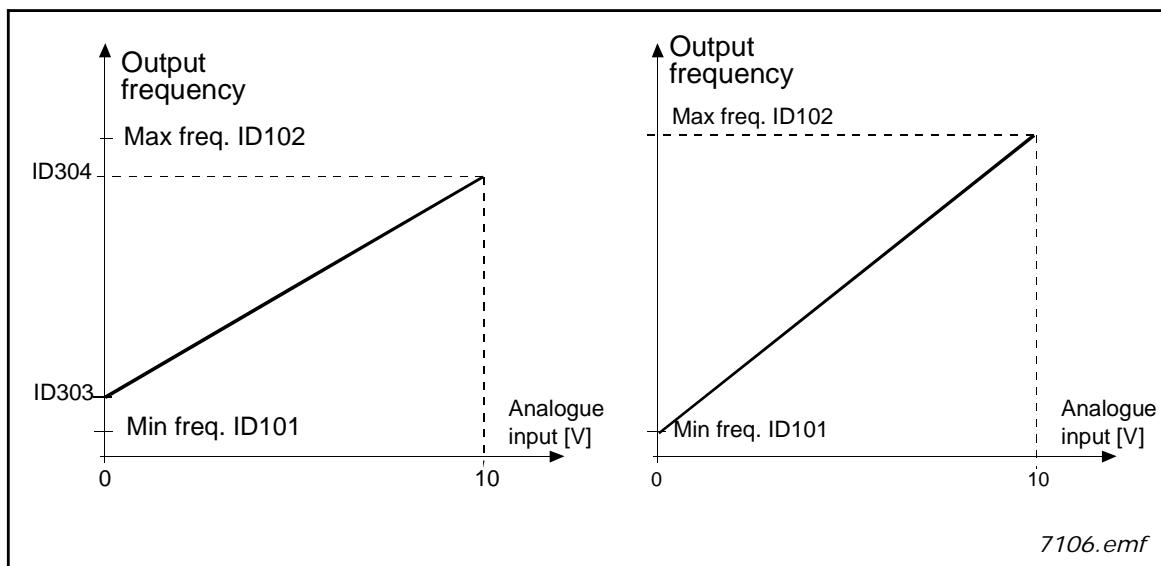
Figure 31. **Left**: *Reference scaling;* **Right**: *No scaling used (par. ID303 = 0)*

305   *REFERENCE INVERSION 2   (2.2.6)*

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

0   No inversion

1   Reference inverted
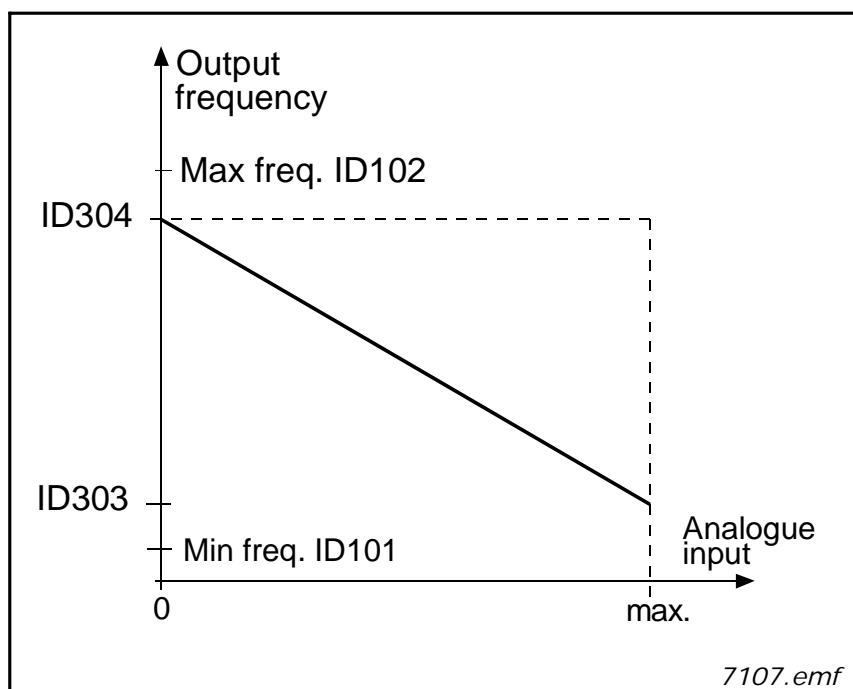
Figure 32. Reference invert

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.
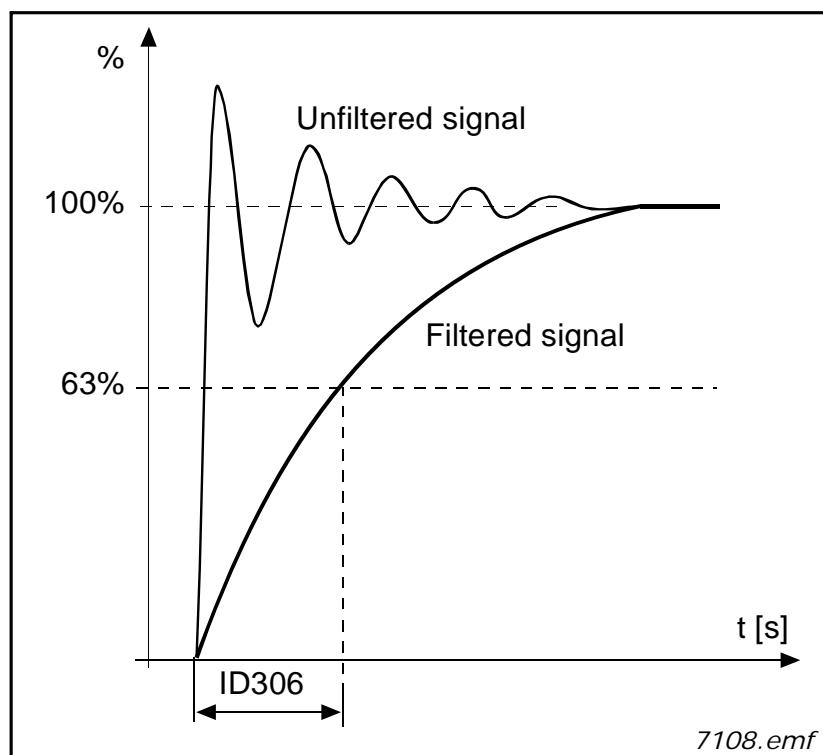
Figure 33. Reference filtering

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.

Table 114. Parameter ID307 selections

Applic. Sel.	1 to 4	5 and 7	6
0	Not used	Not used	Not used
1	Output freq. $(0—f_{max})$	Output freq. $(0—f_{max})$	Output freq. $(0—f_{max})$
2	Freq. reference $(0—f_{max})$	Freq. reference $(0—f_{max})$	Freq. reference $(0—f_{max})$
3	Motor speed (0—Motor nominal speed)	Motor speed (0—Motor nominal speed)	Motor speed (0—Motor nominal speed)
4	Output current $(0-I_{nMotor})$	Output current $(0-I_{nMotor})$	Output current $(0-I_{nMotor})$
5	Motor torque $(0—T_{nMotor})$	Motor torque $(0—T_{nMotor})$	Motor torque $(0—T_{nMotor})$
6	Motor power $(0—P_{nMotor})$	Motor power $(0—P_{nMotor})$	Motor power $(0—P_{nMotor})$
7	Motor voltage $(0-U_{nMotor})$	Motor voltage $(0-U_{nMotor})$	Motor voltage $(0-U_{nMotor})$
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

8

Table 114. Parameter ID307 selections

Applic.	1 to 4	5 and 7	6
Sel.			
11		PID contr. act. value 2	Output freq. (f_{min} - f_{max})
12		PID contr. error value	Motor torque ($-2...+2xT_{Nmot}$)
13		PID controller output	Motor power ($-2...+2xT_{Nmot}$)
14		PT100 temperature	PT100 temperature
15			FB analogue output ProcessData4 (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.
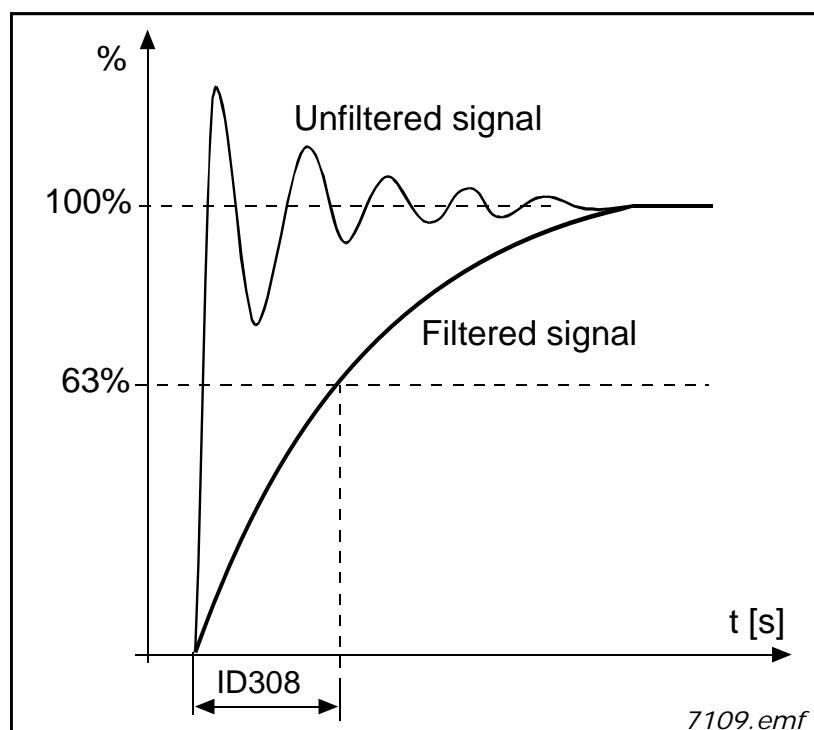
Figure 34. Analogue output filtering

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.
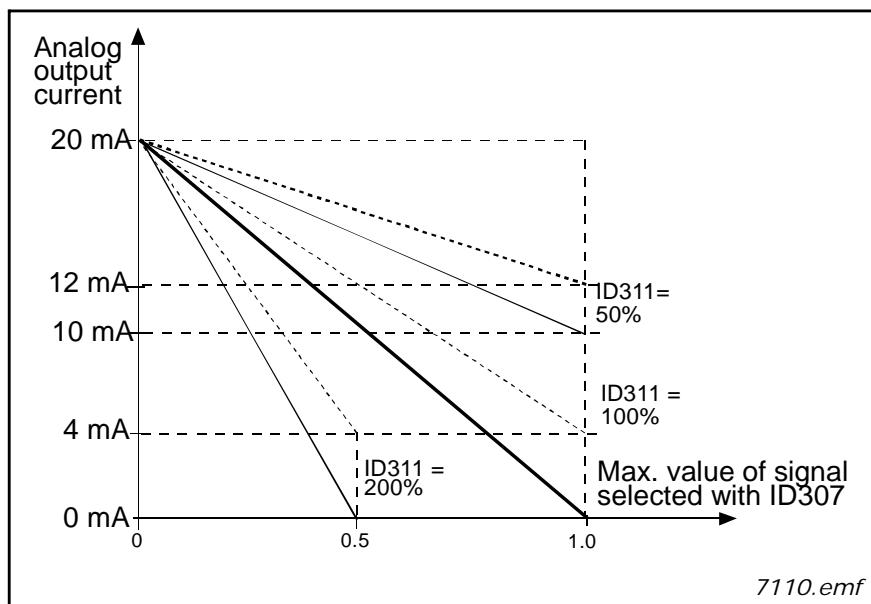
Figure 35. Analogue output invert

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).

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 115. Analogue output scaling

Signal	Max. value of the signal
Output frequency	Max frequency (par.ID102)
Freq. Reference	Max frequency (par.ID102)
Motor speed	Motor nom. speed $1 \times n_{mMotor}$
Output current	Motor nom. current $1 \times I_{nMotor}$
Motor torque	Motor nom. torque $1 \times T_{nMotor}$
Motor power	Motor nom. power $1 \times P_{nMotor}$
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.
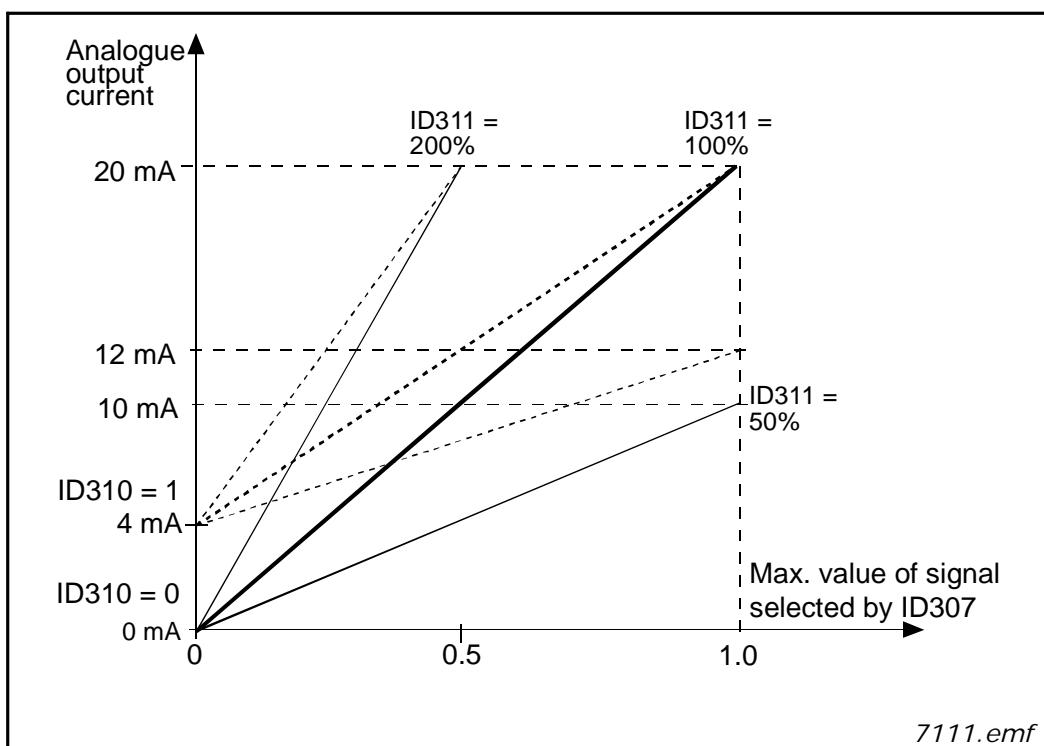
Figure 36.Analogue output scaling

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

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)
314	**RELAY OUTPUT 2 FUNCTION**	**2345**	(2.3.9)

Table 116. 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 program-mable relay (RO1, RO2) is activated when:
1 = Ready	The frequency converter is ready to operate
2 = Run	The frequency converter 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 par. ID701
7 = Reference fault or warning	Fault or warning depending on par. ID700 - if analogue reference is 4—20 mA and signal is <4mA
8 = Warning	Always if a warning exists
9 = Reversed	The reverse command has been selected
10 = Preset speed 1 (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

Table 116. Output signals via DO1 and output relays RO1 and RO2

Setting value	Signal content
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 parameter ID's 315 and 316 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 parameter ID's 346 and 347 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 par ID732. The motor torque goes beyond the set supervision low limit/high limit (par. ID348 and ID349).
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 (par. ID350 and ID351)
17 = External brake control (Appl. 3456)	External brake ON/OFF control with programmable delay (par. 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)	Frequency converter heatsink temperature goes beyond the set supervision limits (par. 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 (par. 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 par. 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)

  0   No supervision

  1   Low limit supervision

  2   High limit supervision

  3   Brake-on control (Application 6 only, see chapter Chapter 9.1 on Page 230)

If the output frequency goes under/over the set limit (ID316) this function gener
ates 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. See Figure 37.
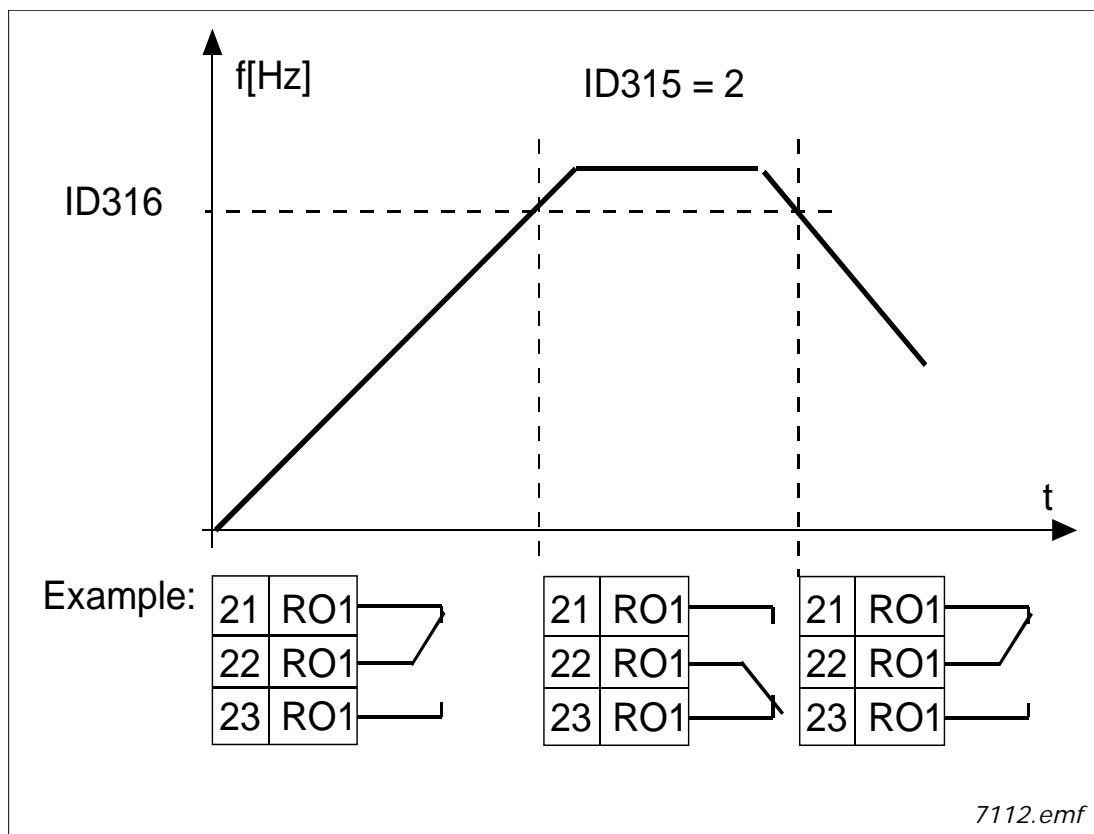
Figure 37. Output frequency supervision

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.

  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

6   Closing contact: Force control place to keypad

7   Closing contact: Force control place to fieldbus

When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used (reference according to parameters 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.

8   Reverse

Contact open:Forward

Contact closed:Reverse

> If several inputs are programmed to reverse, one active contact is enough to set the direction to reverse.

9   Jogging speed (see par. ID124)

Contact closed: Jogging speed selected for frequency reference

10 Fault reset

Contact closed: All faults reset

11   Acceleration/Deceleration prohibited

Contact closed: No acceleration or deceleration possible until the contact is opened

12   DC braking command

Contact closed: In Stop mode, the DC braking operates until the contact is opened. See .Figure 38

13   Motor potentiometer UP

Contact closed: Reference increases until the contact is opened.
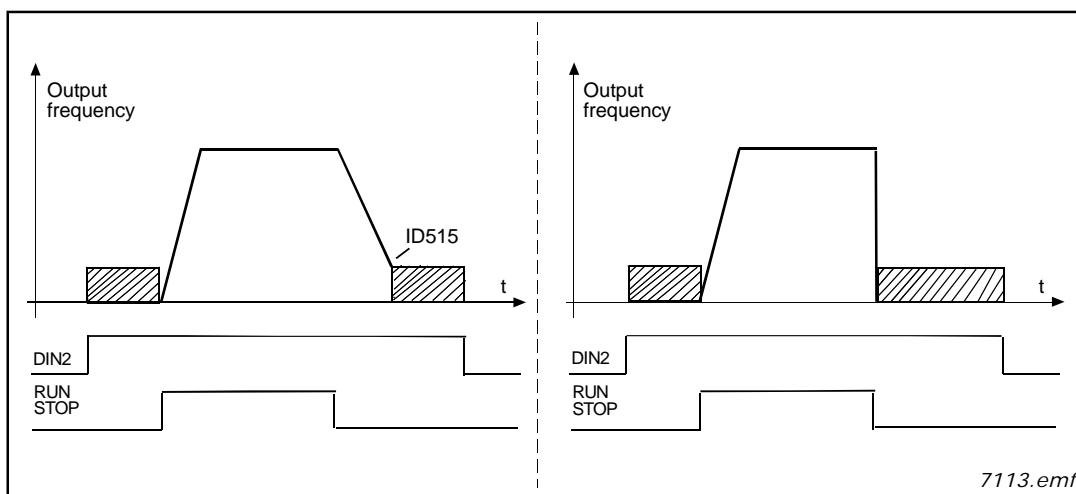
Figure 38. DC braking command (selection 12) selected for DIN2.
Left: Stop mode = Ramp; Right: Stop mode = Coasting

320   *AI1 SIGNAL RANGE*   *34567*   *(2.2.4, 2.2.16, 2.2.2.3)*

Table 117. Selections for parameter ID320

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

These parameters set the analogue input 1 signal for any input signal span within -160—160%.

Example: If signal input scaling is set to 40%...80% the reference changes between minimum frequency (ID101) and maximum frequency (ID102) following a signal intensity of 8...16mA.

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).
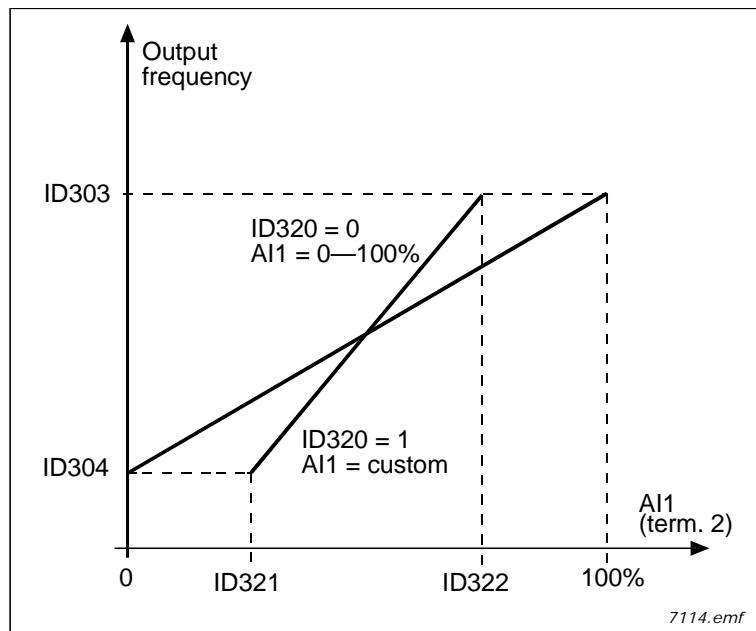
Figure 39. AI1 no signal inversion

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

Max. AI1 signal = minimum frequency ref.
Min. AI1 signal = maximum frequency ref.
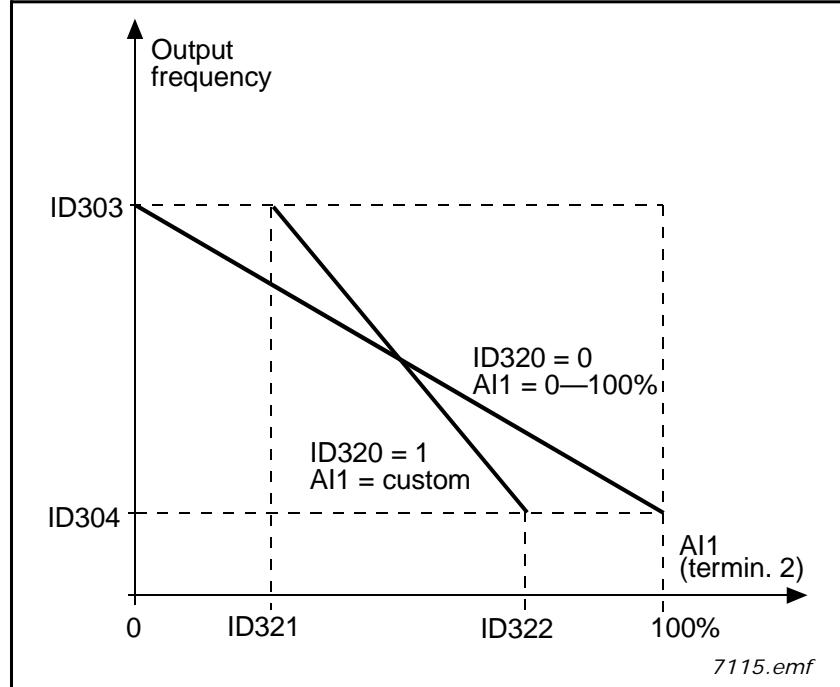
Figure 40. AI1 signal inversion

324   ***AI1 signal filter time***   *34567*   *(2.2.8, 2.2.20, 2.2.2.2)*

When this parameter is given a value greater than 0 the function that filters out disturbances from the incoming analogue signal is activated.

Long filtering time makes the regulation response slower. See Figure 41.
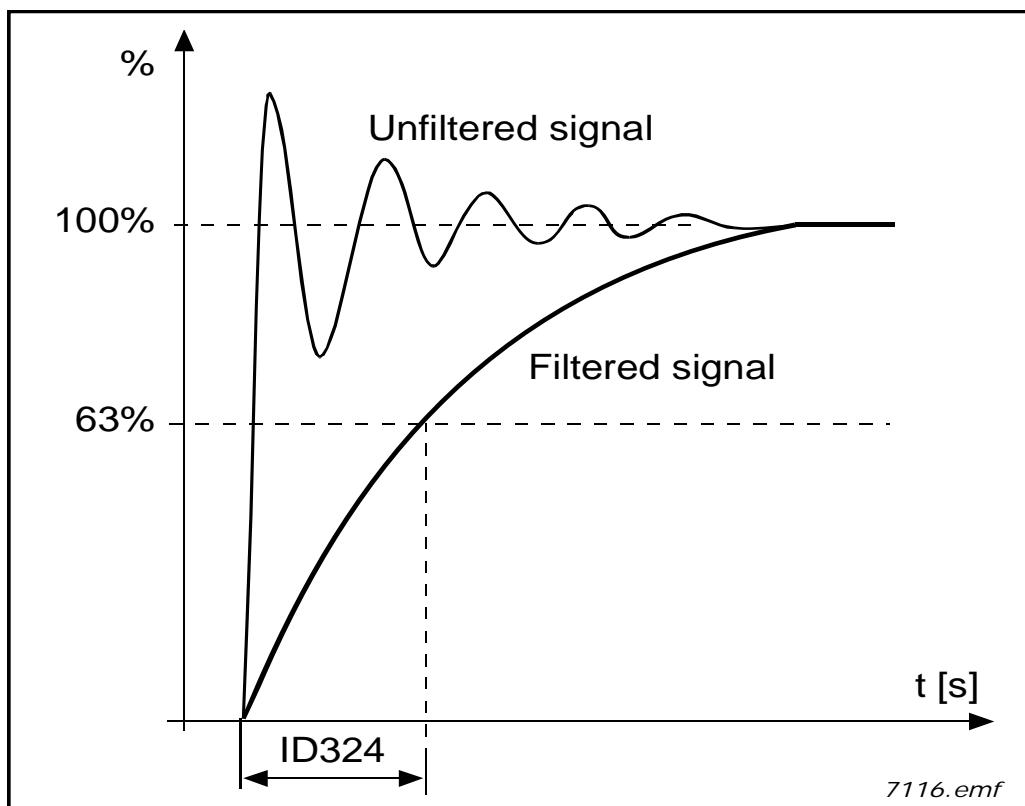
Figure 41. AI1 signal filtering

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

Table 118. Selections for parameter ID325

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

These parameters set AI2 for any input signal span within -160...160%. See ID321.
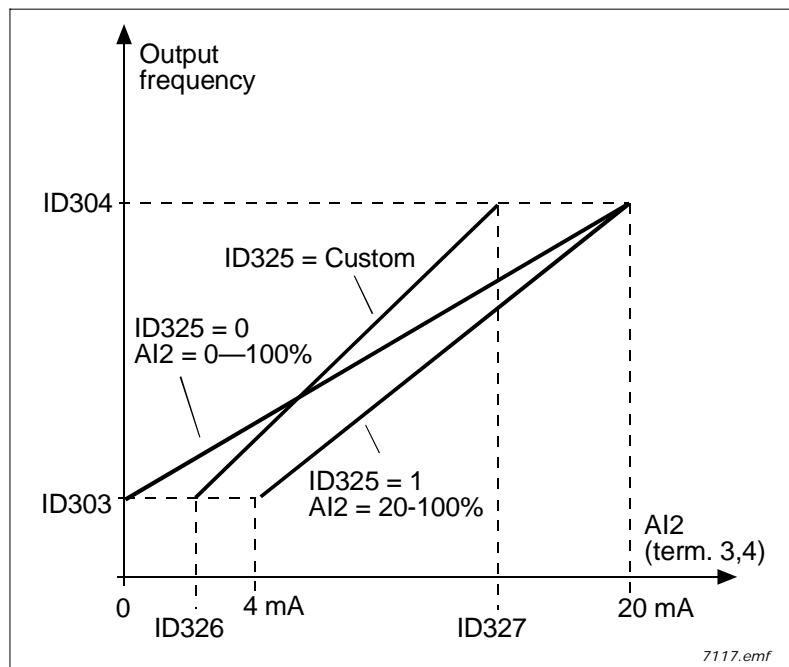
Figure 42. Analogue input AI2 scaling

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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)

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329   **Analogue input 2 filter time**   **34567**   **(2.2.14, 2.2.26, 2.2.3.2)**

See ID324.

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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.

Table 119. Selections 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, par.P3.4	AI3
3	Fieldbus ref. (FBProcessDataIN1) See chapter 9.6	AI4
4	Motor potentiometer reference	PID ref. from menu M3, par. P3.4
5		Fieldbus ref. (FBProcessDataIN1) See chapter 9.6
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.

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)

0   Not used

1   AI1

2   AI2

3   AI3

4   AI4

5   Fieldbus (*Actualvalue 1*: FBProcessDataIN2; *Actual value 2*:
    FBProcessDataIN3). See Chapter 9.6 .

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 Figure 43

337   *Actual value 1 maximum scale*   *57*   *(2.2.12, 2.2.1.12)*

Sets the maximum scaling point for Actual value 1. See Figure 43

338   *Actual value 2 minimum scale*   *57*   *(2.2.13, 2.2.1.13)*

Sets the minimum scaling point for Actual value 2. See Figure 43

339   *Actual value 2 maximum scale*   *57*   *(2.2.14, 2.2.1.14)*

Sets the maximum scaling point for Actual value 2. See Figure 43
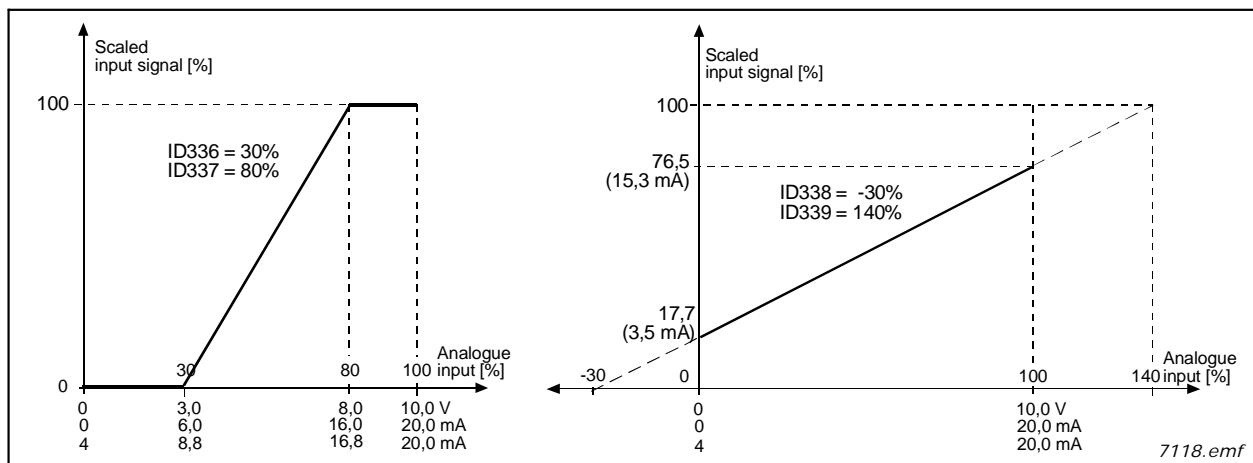
Figure 43. Examples of actual value signal scaling

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).

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 B reference selection*   *57*   *(2.2.5, 2.2.1.1)*

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

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 (par. ID333 to ID339) and the PID control reference (par. 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 (par. ID101) and Maximum frequency (par. ID102).
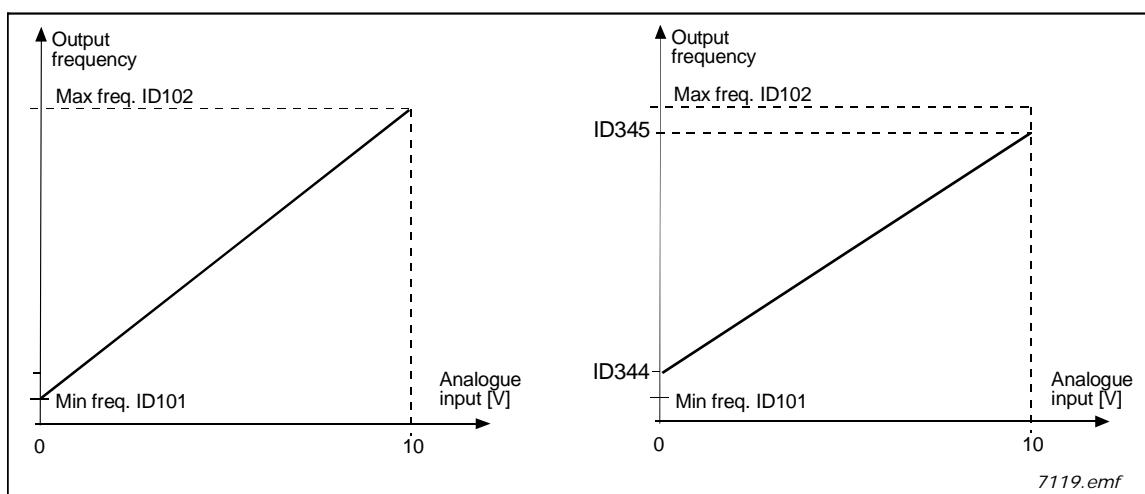
Figure 44. Left: Par. ID344=0 (No reference scaling) Right: Reference scaling

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

0   No supervision

1   Low limit supervision

2   High limit supervision

3   Brake-on control (Application 6 only, see Chapter 9.1 on Page 230)

4   Brake-on/off control (Application 6 only, see Chapter 9.1 on Page 230)

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 Figure 37.

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

0 = No supervision

1 = Low limit supervision

2 = High limit supervision

3 = Brake-off control (Application 6 only, see Chapter 9.1 on Page 230)

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 (par. 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)**

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 (par. ID449) is connected (applications 6 and 7).

The supervised reference is the current active reference. It can be place A or B reference depending on DIN6 input, 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 Figure 45 and Chapter 9.1 on Page 230.

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.
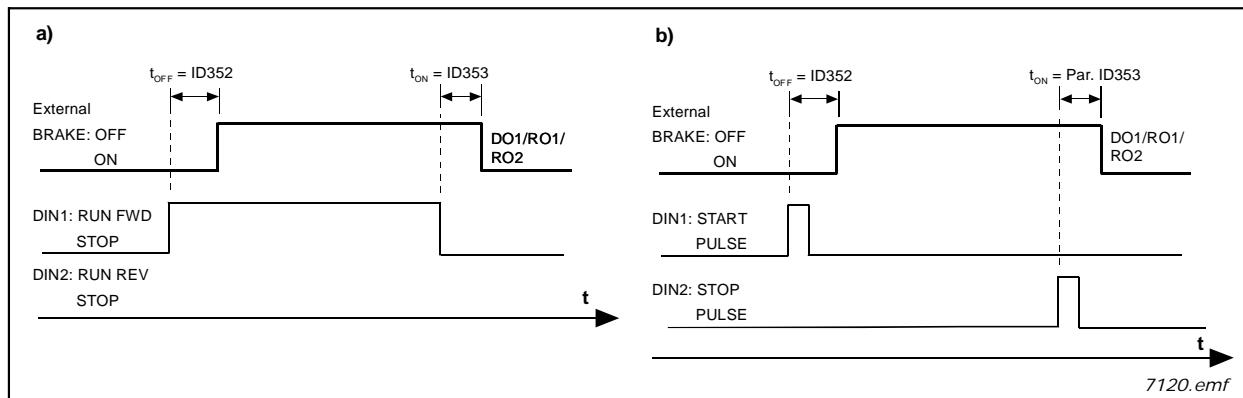
Figure 45. External brake control:
a) Start/Stop logic selection, ID300 = 0, 1 or 2
b) Start/Stop logic selection, ID300= 3

354	*FREQUENCY CONVERTER TEMPERATURE LIMIT SUPERVISION*	34567

(2.3.20, 2.3.4.11, 2.3.2.11)

0 = No supervision

1 = Low limit supervision

2 = High limit supervision

If the temperature of the frequency converter unit falls below or exceeds the set limit (ID355), this function generates a 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 (par. 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.

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 par. ID356. See Figure 46
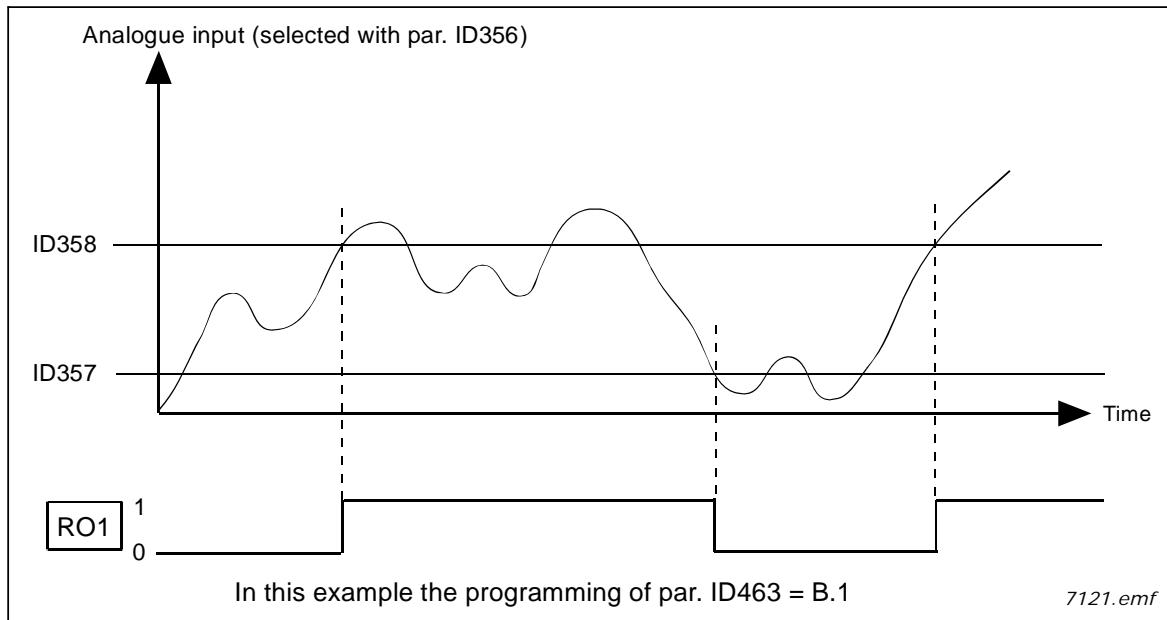
Figure 46. An example of On/Off-control

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 D-time 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):

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:

0 = Function is not in use

1 = Reduces motor current limit (ID107)

8

This signal will adjust the maximum motor current between 0 and max. limit set with ID107. See Figure 47.
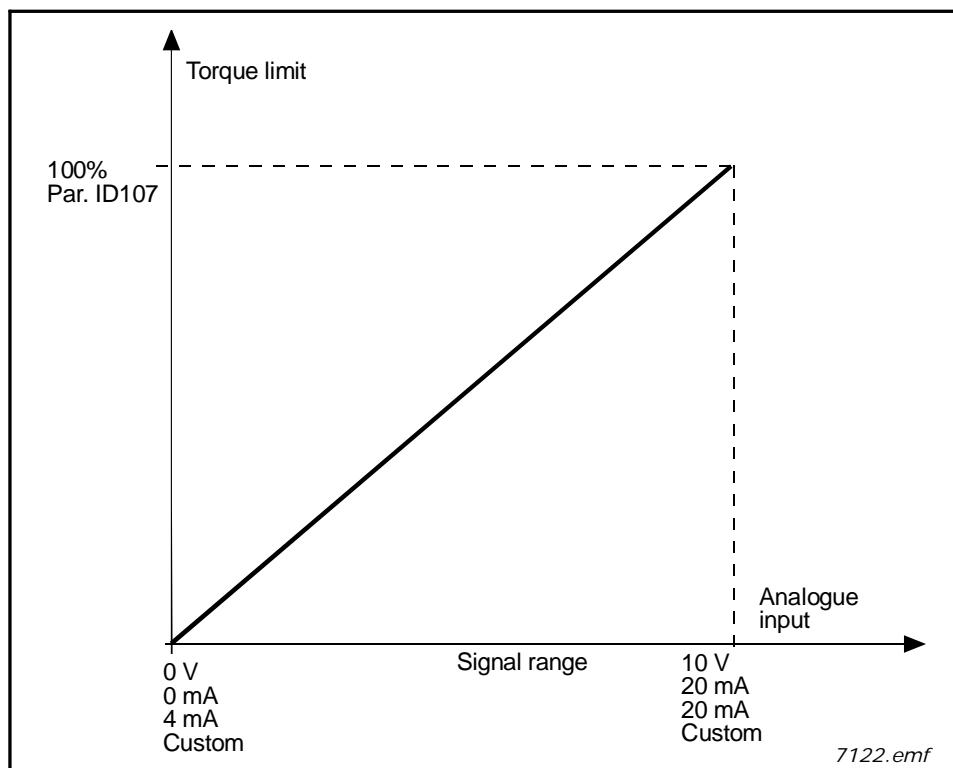
Figure 47. Scaling of max. motor current

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 Figure 48.
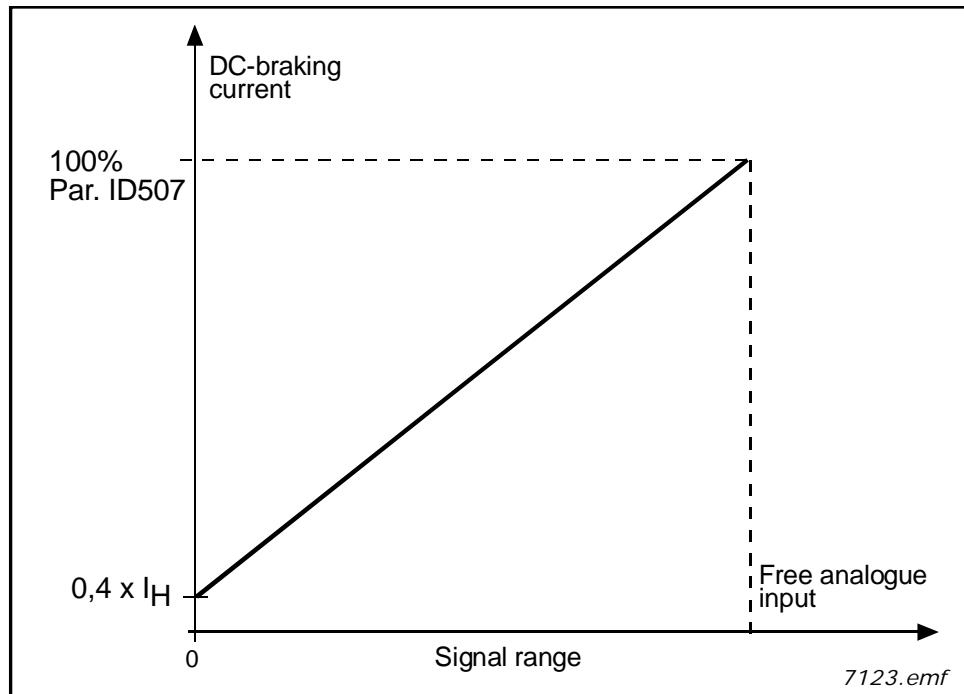

Figure 48. Reduction of DC braking current

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 (par.ID103, ID104; ID502, ID503) divided by the factor R in Figure 49.
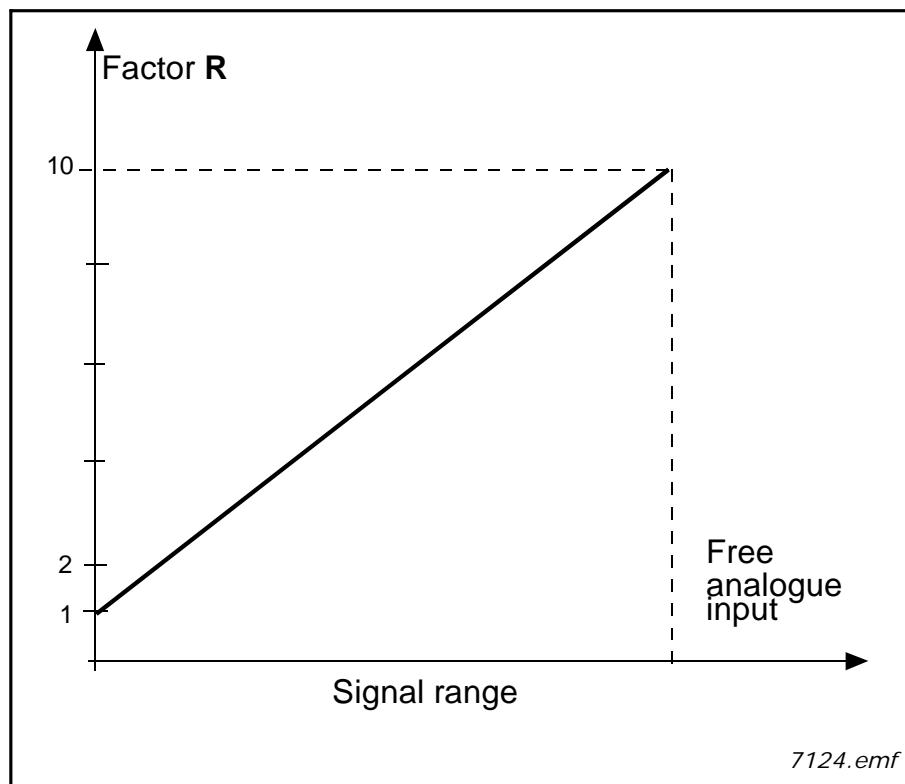
Figure 49. Reduction of acceleration and deceleration times

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 Figure 50.

Phone: 800.894.0412 - Fax: 888.723.4773 - Web: www.clrwtr.com - Email: info@clrwtr.com
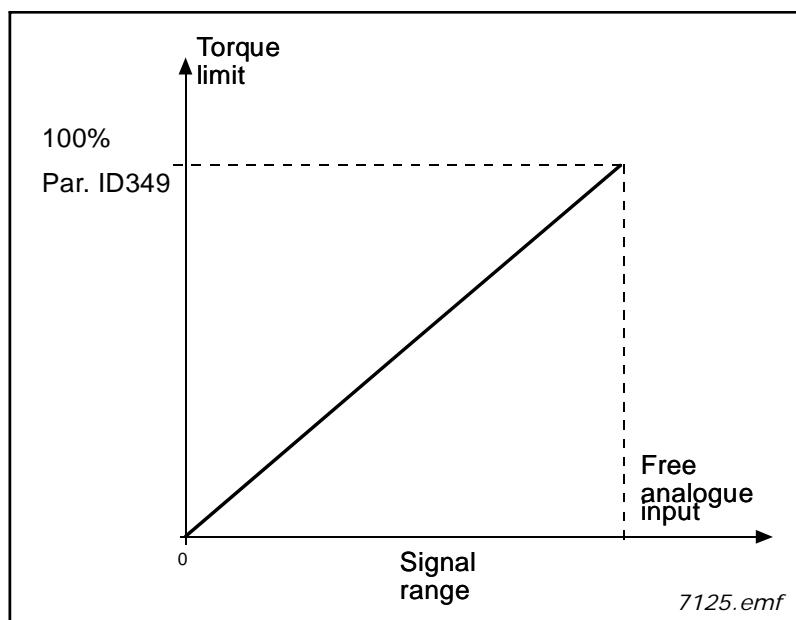
Figure 50. Reduction of torque supervision limit

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

   0 DIN4: closed contact = start forward

      DIN5: closed contact = start reverse
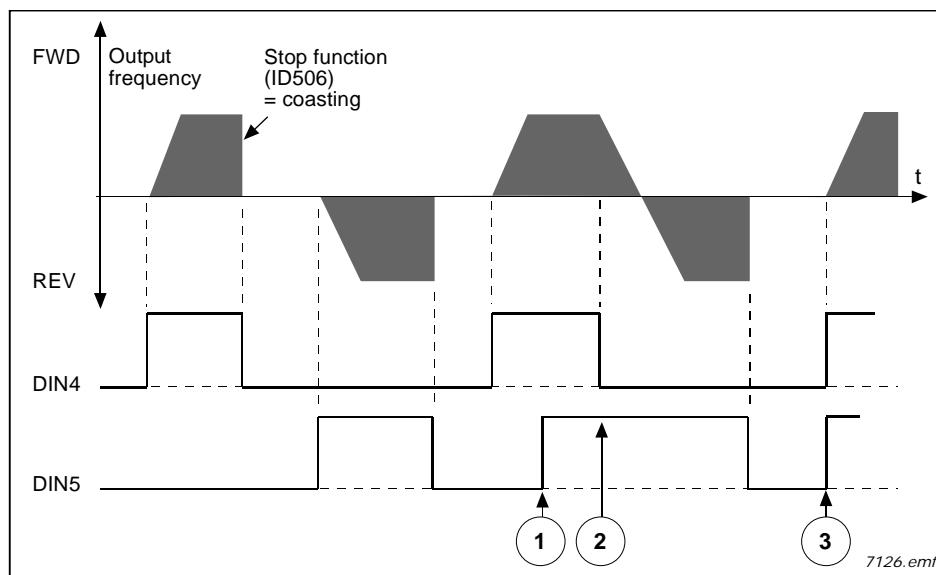
Figure 51. Start forward/Start reverse

①

②   The first selected direction has the highest priority.

③   When the DIN4 contact opens the direction of rotation starts the change.

If Start forward (DIN4) and Start reverse (DIN5) signals are active simultaneously
 the Start forward signal (DIN4) has priority.

   1 DIN4: closed contact = startopen contact = stop
      DIN5: closed contact = reverseopen contact = forward

      See Figure 52
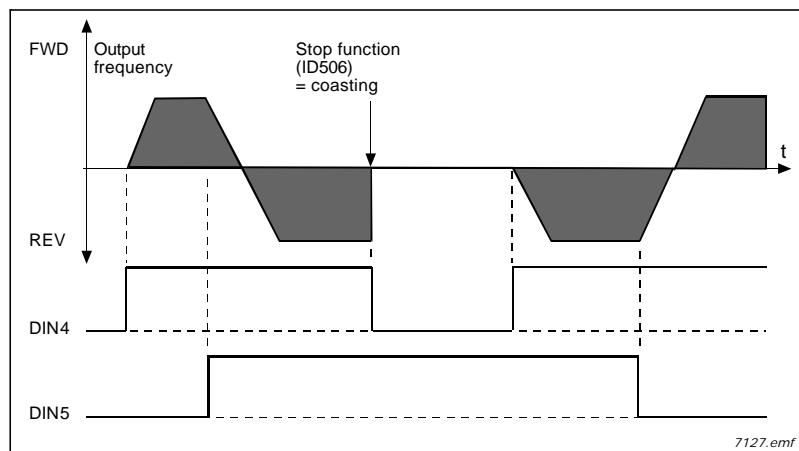
Figure 52. Start, Stop, Reverse

   2 DIN4: closed contact = start   open contact = stop

      DIN5: closed contact = start enabled   open contact = start disabled and drive
                                    stopped if running

3 3-wire connection (pulse control):

DIN4: closed contact= start pulse

DIN5: open contact = stop pulse

(DIN3 can be programmed for reverse command)

See Figure 53
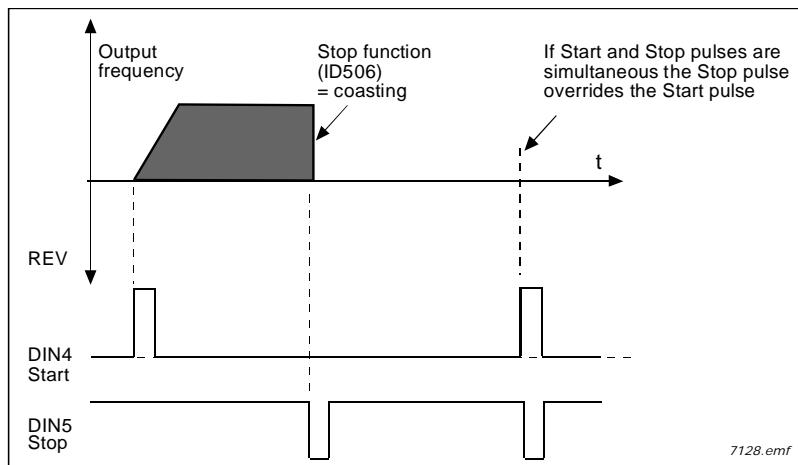
Figure 53. Start pulse/ Stop pulse

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

4 DIN4: closed contact = start forward (Rising edge required to start)
   DIN5: closed contact = start reverse (Rising edge required to start)

5 DIN4:closed contact = start (Rising edge required to start)
        open contact = stop
   DIN5:closed contact = reverse
        open contact = forward

6 DIN4:closed contact = start (Rising edge required to start)
        open contact = stop
   DIN5:closed contact = start enabled
        open contact = start disabled and drive stopped if running

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.

366   **Easy changeover   5   (2.2.37)**

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 (par. 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)

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)

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.

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 9.6

6 = Motor potentiometer

7 = PID reference 2 from keypad

If value 6 is selected for this parameter, the functions *Motor potentiometer DOWN* and *Motor potentiometer UP* must be connected to digital inputs (parameters ID417 and ID418).

372   *SUPERVISED ANALOGUE INPUT   7   (2.3.2.13)*

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 (par. ID374) this function generates a message through the digital output or the relay outputs depending on to which output the analogue input supervision function (par. ID463) is connected.

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.

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 9.6

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. See Figure 54.
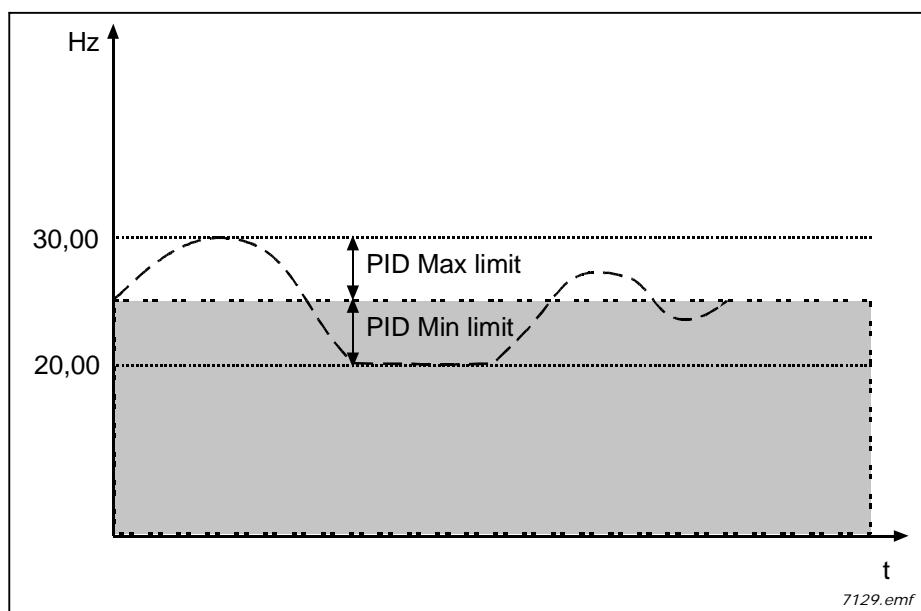
Figure 54. PID sum point reference

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 6.4.

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. See Figure 55.
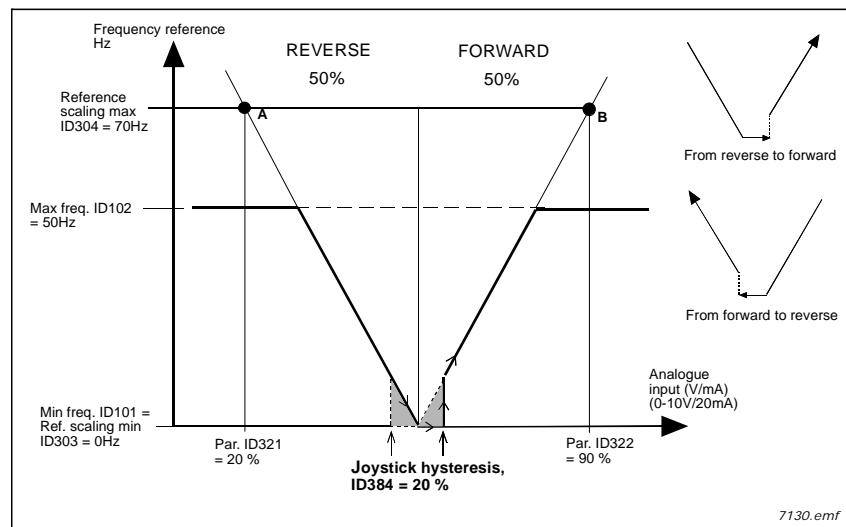
Figure 55. An example of joystick hysteresis. In this example, the value of par. ID385 (Sleep limit) = 0

385   *AI1 SLEEP LIMIT*   *6*   *(2.2.2.9)*

The frequency converter is stopped if the AI signal level falls below the *Sleep limit* defined with this parameter. See also par. ID386 and Figure 56.
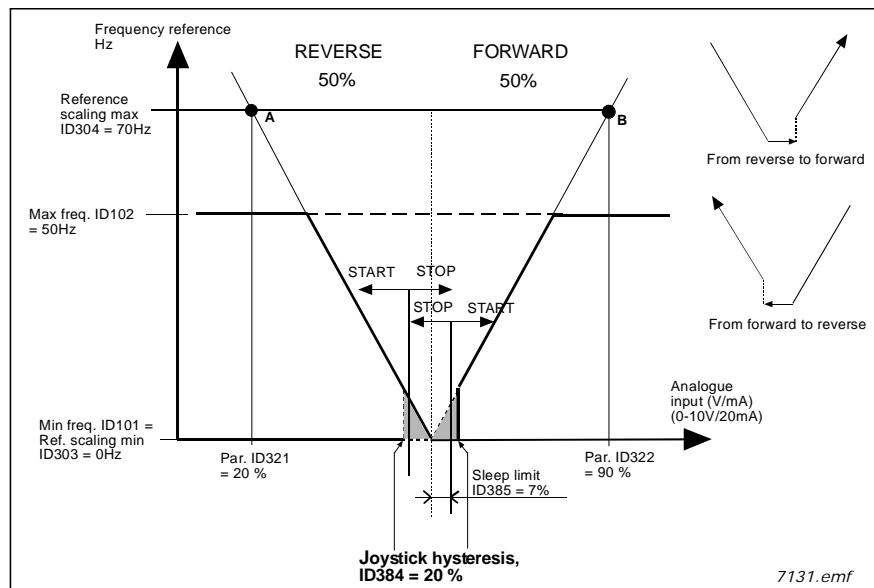
Figure 56. Example of sleep limit function
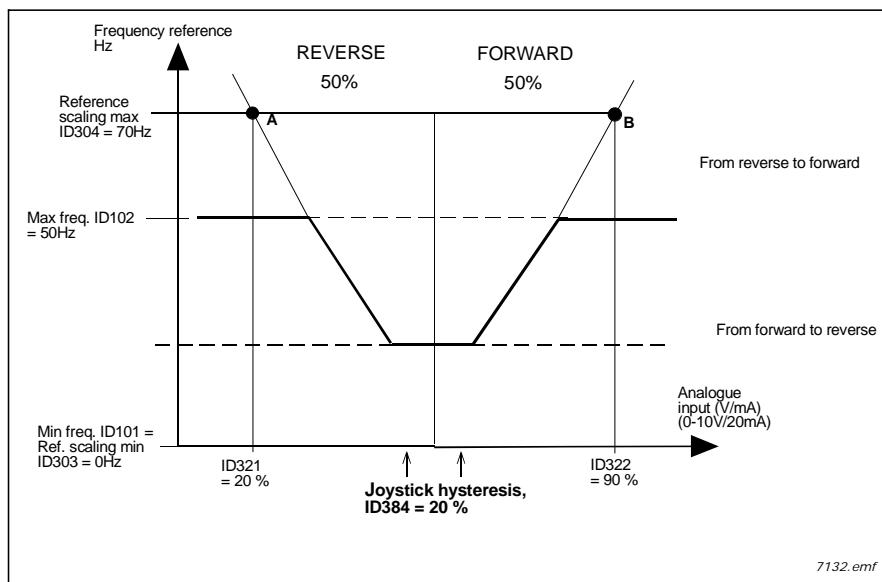
Figure 57. Joystick hysteresis with minimum frequency at 35Hz

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 frequency converter.

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

8

Connect the AI2 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see Chapter 6.4.

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 par. ID's 303 and 304.

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 frequency converter is stopped if the AI signal level falls below the S*leep limit* defined with this parameter. See also par. ID397 and Figure 57.

See ID385.

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 frequency converter.

399 *Scaling of current limit*   6   (2.2.6.1)

0 = Not used

1 = AI1

2 = AI2

3 = AI3

4 = AI4

5 = Fieldbus (FBProcessDataIN2); see Chapter 9.6.

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 par. 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. See Figure 58.
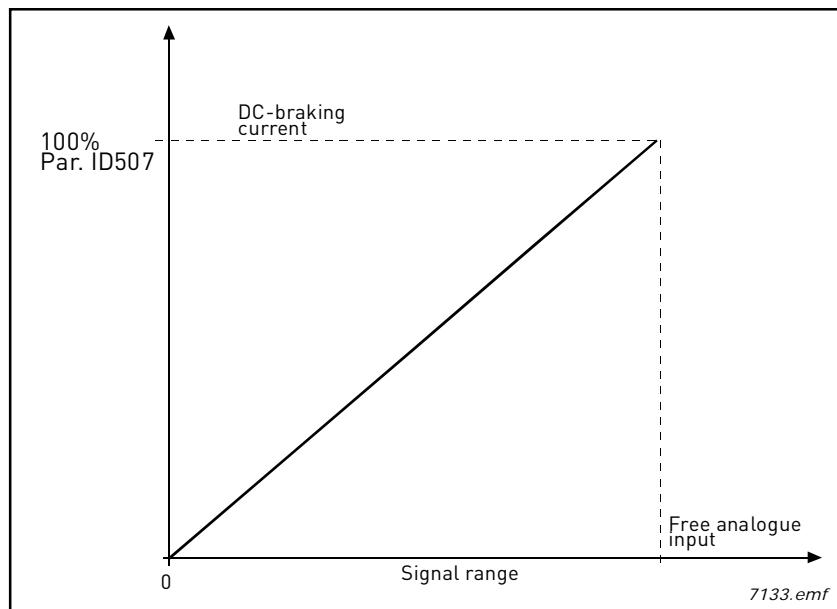
Figure 58. Scaling of DC-braking current

401   ***Scaling of acceleration and deceleration times   6   (2.2.6.3)***

See par. 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 (par. ID103, ID104; ID502, ID503) divided by the factor R from Figure 59.

Analogue input level zero corresponds to ramp times set by parameters. Maximum level means a tenth of value set by parameter.
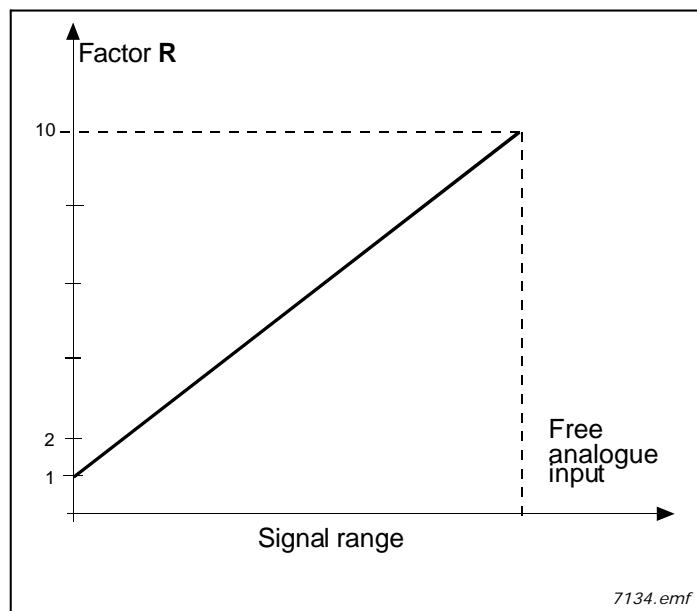
Figure 59. Reducing of acceleration and deceleration times

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. See Figure 60.
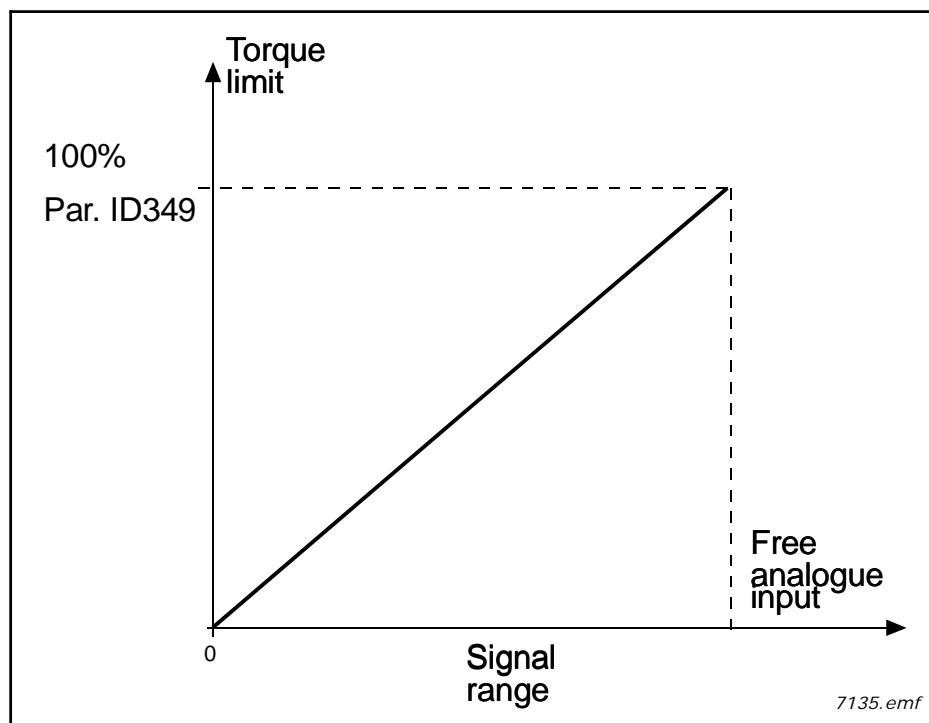
Figure 60. Reducing torque supervision limit

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.

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)

Contact open:Start of motor disabled

Contact closed:Start of motor enabled

The frequency converter is stopped according to the selected function at par. ID506. The follower drive will always coast to stop.

408   *Acceleration/Deceleration time selection 67   (2.2.7.13, 2.2.6.7)*

Contact open: Acceleration/Deceleration time 1 selected

Contact closed: 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)*

Contact closed:All faults are reset.

415   *Acceleration/Deceleration prohibited   67   (2.2.7.14, 2.2.6.14)*

Contact closed:No acceleration or deceleration possible until the contact is opened.

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.

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 par. ID371.

432   *Ready   67   (2.3.3.1, 2.3.1.1)*

The frequency converter is ready to operate.

433   *Run   67   (2.3.3.2, 2.3.1.2)*

The frequency converter 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 par. 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 9.1 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).

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 9.1 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)**

Frequency converter 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).

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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   167   (2.3.3.24, 2.3.1.24)**
456   **Fieldbus Digital input   267   (2.3.3.25, 2.3.1.25)**
457   **Fieldbus Digital input   367   (2.3.3.26, 2.3.1.26)**

The data from the fieldbus (Fieldbus Control Word) can be led to frequency converter 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 6.4.

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 6.4.

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

473   *ANALOGUE OUTPUT 2 FILTER TIME*   **234567**   *(2.3.14, 2.3.24, 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 on pages Page 148 to Page 150 .

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)*

0 = Not used

1 = AI1

2 = AI2

3 = AI3

4 = AI4

5 = Fieldbus (FBProcessDataIN2); see Chapter 9.6.
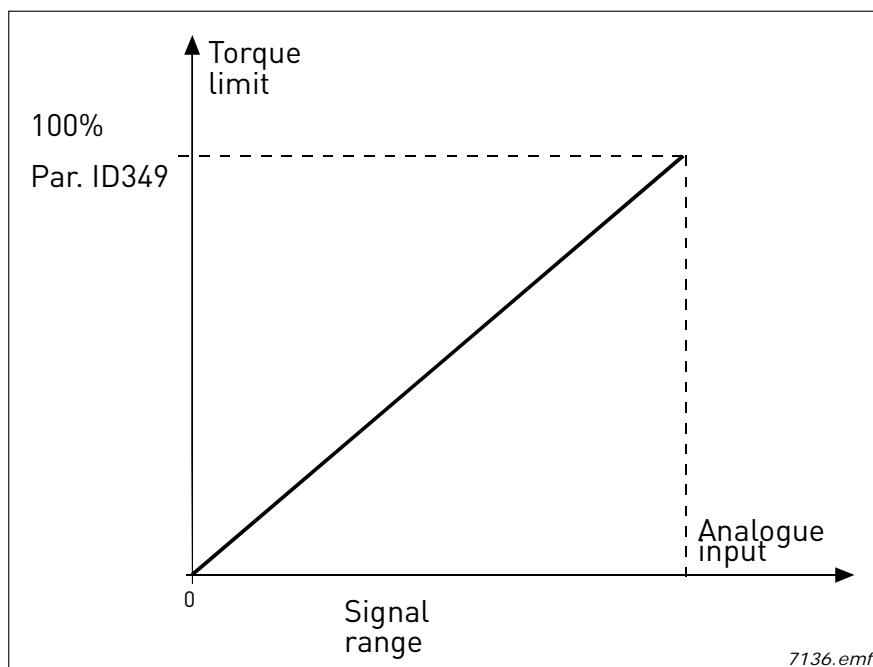
Figure 61. Scaling of motoring torque limit

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 6.4. Digital output function can be inverted by Control options, par. ID1084.

487   *DIGITAL OUTPUT 1 ON-DELAY   6   (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.
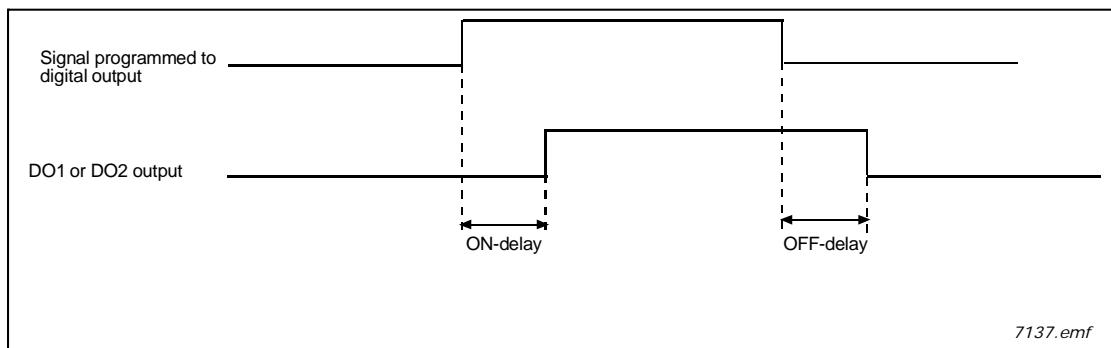
Figure 62. Digital outputs 1 and 2, on- and off-delays

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| 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.

    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 9.6 and parameter group G2.9.
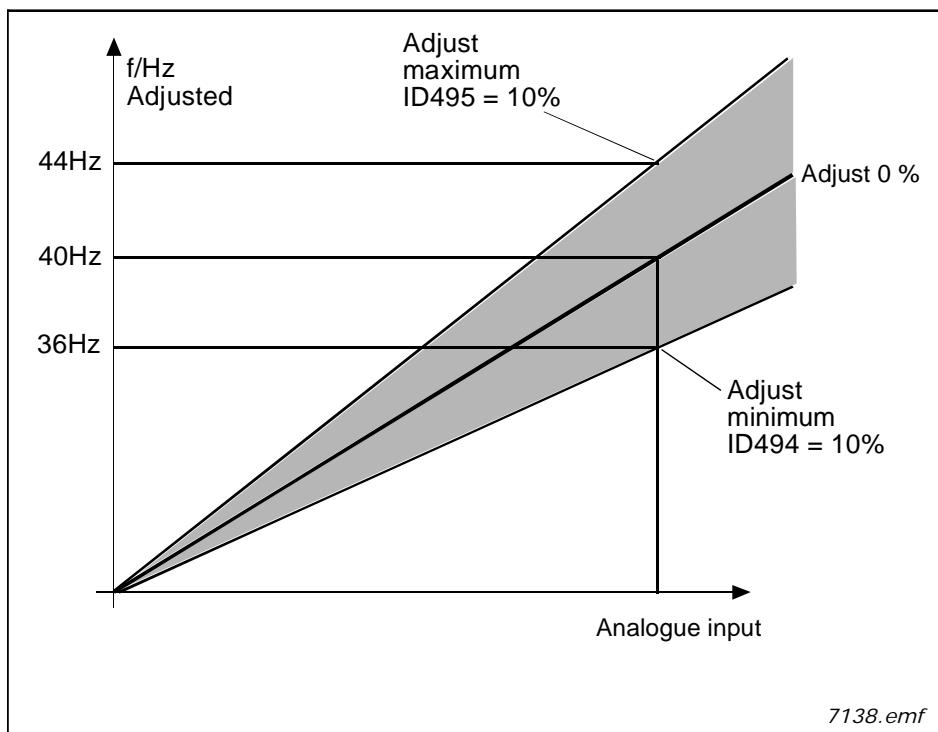
Figure 63. An example of adjust input

| 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 Figure 63. **NOTE:** The adjustment is made to the basic reference signal.

496	*Parameter Set 1/Set 2 selection*	6	(2.2.7.21)

With this parameter you can select between Parameter Set 1 and Set 2. The input for this function can be selected from any slot. The procedure of selecting between the sets is explained in the product's user's 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*.

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.

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/Deceleration ramp 1 shape*	234567	(2.4.1)
501	*Acceleration/Deceleration ramp 2 shape*	234567	(2.4.2)

The start and end of acceleration and deceleration ramps can be smoothed with these parameters. Setting value 0 gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal.

Setting value 0.1...10 seconds for this parameter produces an S-shaped acceleration/deceleration. The acceleration time is determined with parameters ID103/ID104 (ID502/ID503).

These parameters are used to reduce mechanical erosion and current spikes when the reference is changed.
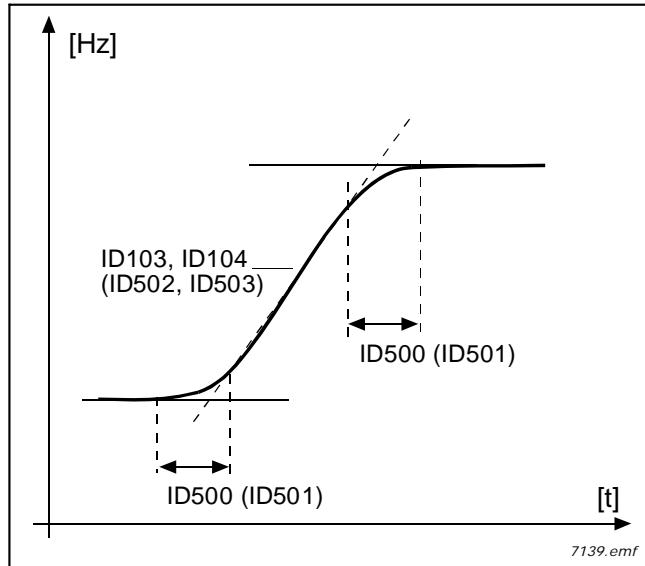
Figure 64. Acceleration/Deceleration (S-shaped)

| *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 (par. 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 (par. ID301).

504   *Brake chopper*   *234567*   *(2.4.5)*

0 = No brake chopper used

1 = Brake chopper in use and tested when running. Can be tested also in READY state

2 = External brake chopper (no testing)

3 = Used and tested in READY state and when running

4 = Used when running (no testing)

When the frequency converter is decelerating the motor, the inertia of the motor and the load are fed into an external brake resistor. This enables the frequency converter to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected).

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.

505   *Start function*   *(2.4.6)*

Ramp:

0   The frequency converter starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time. (Load inertia or starting friction may cause prolonged acceleration times).

Flying start:

1   The frequency converter is able to start into a running motor by applying 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.

Conditional flying start:

2   With this mode it is possible to disconnect and connect the motor from the frequency converter 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)*

Coasting:

0   The motor coasts to a halt without any control from the frequency con-
           verter, after the Stop command.

Ramp:

1   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.

Normal stop: Ramp/ Run Enable stop: coasting

2   After the Stop command, the speed of the motor is decelerated according
           to the set deceleration parameters. However, when Run Enable is select-
           ed, the motor coasts to a halt without any control from the frequency con-
           verter.

Normal stop: Coasting/ Run Enable stop: ramping

3   The motor coasts to a halt without any control from the frequency con-
           verter. 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)*

Defines the current injected 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 par. 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.

0   DC-brake is not used

>0   DC-brake is in use and its function depends on the Stop function,
           (param. ID506). The DC-braking time is determined with this parameter.

Par. ID506 = 0; Stop function = Coasting:

After the stop command, the motor coasts to a stop without control of the
frequency converter.

With DC-injection, the motor can be electrically stopped in the shortest possible
time, without using an optional external braking resistor.

The braking time is scaled according to the frequency when the DC-braking starts.
If the frequency is ≥ the nominal frequency of the motor, the set value of parameter

ID508 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter ID508.
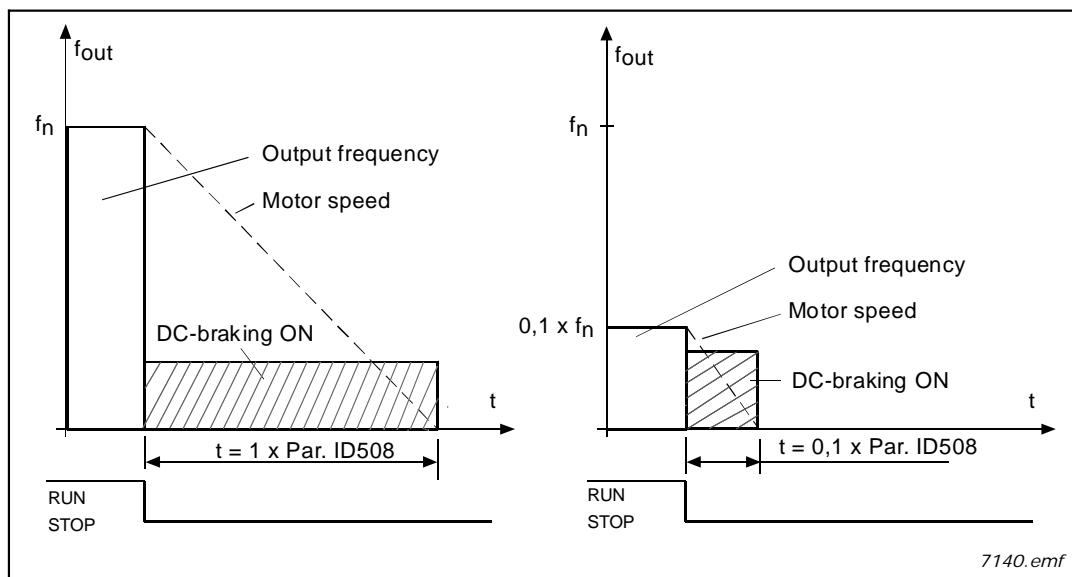
Figure 65. DC-braking time when Stop mode = Coasting

Par. ID506 = 1; Stop function = Ramp:

After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with 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. See Figure 66.
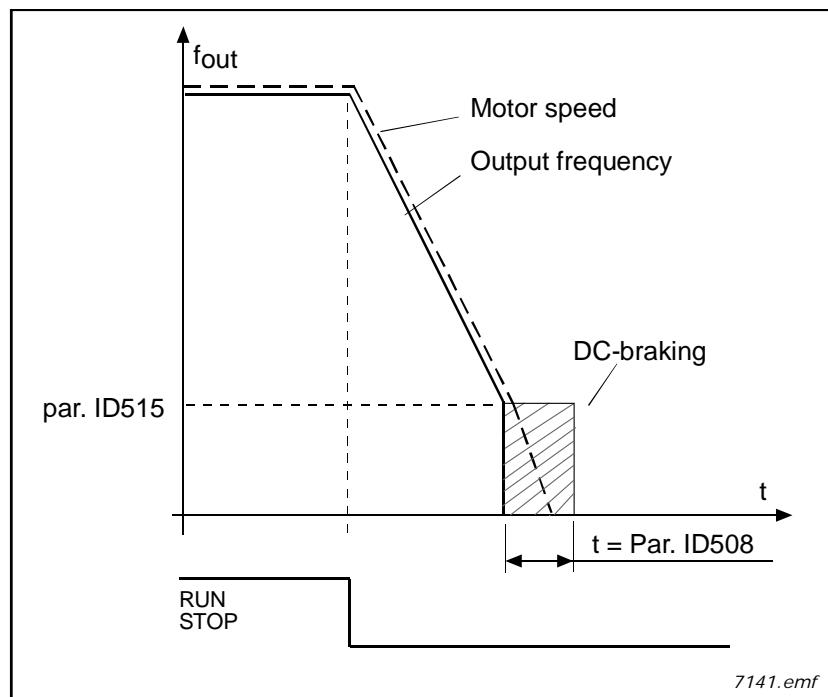
Figure 66. DC-braking time when Stop mode = Ramp

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. See Figure 67.
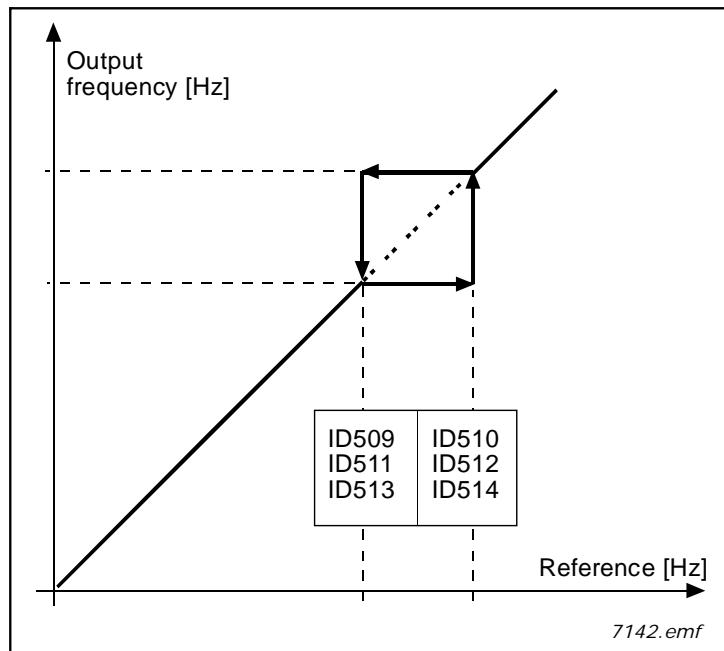
Figure 67. Example of prohibit frequency area setting

515   *DC-braking frequency at stop*   *234567*   *(2.4.10)*

The output frequency at which the DC-braking is applied. See Figure 67.

516   *DC-braking time at start*   *234567*   *(2.4.11)*

DC-brake is activated when the start command is given. This parameter defines the time for how long DC current is fed to motor before 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 par. ID507.

NOTE: When Flying Start (see par. 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.
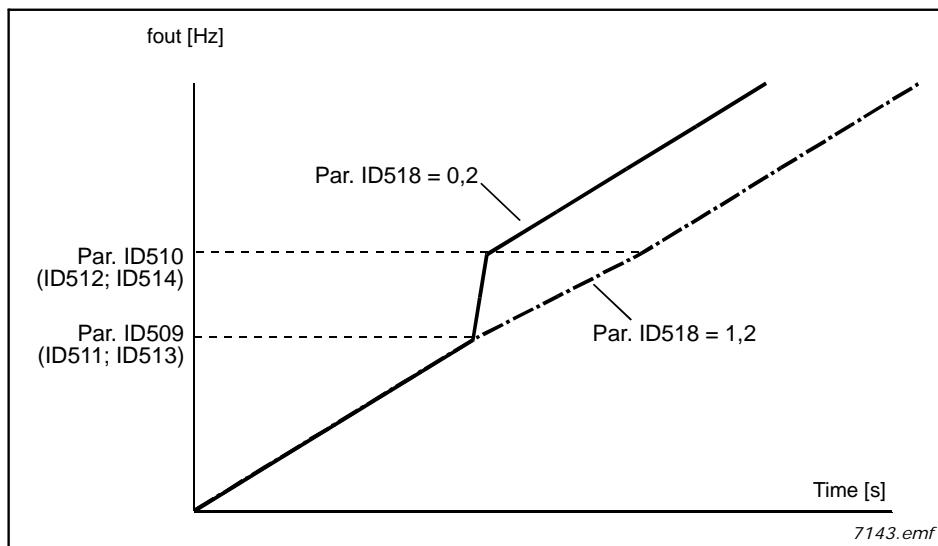
Figure 68. Ramp speed scaling between prohibit frequencies

519 **FLUX BRAKING CURRENT** **234567** **(2.4.13)**

Defines the flux braking current value. The value setting range depends on the used application.

520 **FLUX BRAKE** **234567** **(2.4.12)**

Instead of DC braking, flux braking is a useful way to raise the braking capacity in cases where additional brake resistors are not needed.

When braking is needed, the frequency is reduced and the flux in the motor is increased, which in turn increases the motor's capability to brake. Unlike DC braking, the motor speed remains controlled during braking.

The flux braking can be set ON or OFF.

0 = Flux braking OFF

1 = Flux braking ON

NOTE: Flux braking converts the energy into heat at the motor, and should be used intermittently to avoid motor damage.

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.

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** **16** **(2.2.7.27)**
531 **INCHING REFERENCE** **26** **(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 120. Selections for motor control mode in different applications

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

Selections:

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)*

Motor noise can be minimised using a high switching frequency. Increasing the switching frequency reduces the capacity of the frequency converter unit. It is recommended to use a lower frequency when the motor cable is long in order to minimize capacitive currents in the cable.

The range of this parameter depends on the size of the frequency converter:

Table 121. Size-dependent switching frequencies

Type	Min. [kHz]	Max. [kHz]	Default [kHz]
0003—0061 NX_5 0003—0061 NX_2	1.0	160.0	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

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 (ID603).

603   VOLTAGE AT FIELD WEAKENING POINT   *234567*   *(2.6.5)*

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the U/f curve parameters. See parameters ID109, ID108, ID604 and ID605.

When the parameters ID110 and ID111 (nominal voltage and nominal frequency of the motor) are set, the parameters ID602 and ID603 are automatically given the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting the parameters ID110 and ID111.

604   U/F CURVE, MIDDLE POINT FREQUENCY   *234567* *(2.6.6)*

If the programmable U/f curve has been selected with parameter ID108 this parameter defines the middle point frequency of the curve. See Figure 23 and parameter ID605.

605   U/F CURVE, MIDDLE POINT VOLTAGE   *234567* *(2.6.7)*

If the programmable U/f curve has been selected with parameter ID108 this parameter defines the middle point voltage of the curve. See Figure 23.

606   OUTPUT VOLTAGE AT ZERO FREQUENCY   *234567* *(2.6.8)*

This parameter defines the zero frequency voltage of the U/f curve. The default value varies according to unit size.
NOTE: If the value of parameter ID108 is changed this parameter is set to zero. See Figure 23.

607   **Overvoltage controller**   **234567**   **(2.6.10)**

These parameters allow the under-/overvoltage controllers to be switched out of operation. This may be useful, for example, if the mains supply voltage varies more than –15% to +10% and the application will not tolerate this over-/undervoltage. In this case, the regulator controls the output frequency taking the supply fluctuations into account.

0   Controller switched off

1   Controller switched on (no ramping) = Minor adjustments of OP frequency are made

2   Controller switched on (with ramping) = Controller adjusts OP freq. up to max.freq.

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 par. ID607.

Note: Over-/undervoltage trips may occur when controllers are switched out of operation.

0   Controller switched off

1   Controller switched on (no ramping) = Minor adjustments of output frequency are made

2   Controller switched on (with ramping) = Controller adjusts output frequency up to zero speed (NXP only)

When a value other than 0 is selected also the Closed Loop undervoltage control becomes active in the 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.

610   **Torque limit control P-gain**   **6**   **(2.10.1)**

This parameter defines the gain of the torque limit controller. It is used in Open Loop control mode only.

611   **Torque limit control I-gain**   **6**   **(2.10.2)**

This parameter determines the I-gain of the torque limit controller. It is used in Open Loop control mode only.

612   **CL: Magnetizing current**   **6**   **(2.6.23.1)**

Set here the motor magnetizing current (no-load current). In NXP, the values of the U/f parameters are identified according to the magnetizing current if given before identification. See Chapter 9.2 .

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 9.2 .

614   *CL: SPEED CONTROL I TIME   6   (2.6.23.3)*

Sets the integral time constant for the speed controller. See Chapter 9.2 .

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 9.2 .

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 9.2.

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 9.2 .

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 9.2 .

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 9.2.

620   *LOAD DROOPING   23456   (2.6.12, 2.6.15)*

The drooping function enables speed drop as a function of load. This parameter sets that amount corresponding to the nominal torque of the motor.

E.g. if load drooping is set to 10% using motor with a nominal frequency of 50 Hz and the motor is loaded with nominal load (100 % of torque) the output frequency is allowed to decrease 5 Hz from the frequency reference. This feature is used e.g. when load is needed to balance motors that are mechanically connected.

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 9.2 .

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.

$$AccelCompensationTC = J \cdot \frac{2\pi \cdot f_{nom}}{T_{nom}} = J \cdot \frac{(2\pi \cdot f_{nom})^2}{P_{nom}}$$

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 par. 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)*

Identification Run is a part of tuning the motor and the drive specific parameters. It is a tool for commissioning and service of the drive with the aim to find as good parameter values as possible for most drives. The automatic motor identification calculates or measures the motor parameters that are needed for optimum motor and speed control.

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.

The basic motor name plate data has to be set correctly before performing the identification run:

ID110 Nominal voltage of the motor (P2.1.6)

ID111 Nominal frequency of the motor (P2.1.7)

ID112 Nominal speed of the motor (P2.1.8)

ID113 Nominal current of the motor (P2.1.9)

ID120 Motor cos phi (P2.1.10)

When in closed loop and with an encoder installed, also the parameter for pulses / revolutions (in Menu M7) has to be set.

The automatic identification is activated by setting this parameter to the appropriate value followed by a start command in the requested direction. The start command to the drive has to be given within 20 s. If no start command is given within 20 s the identification run is cancelled and the parameter will be reset to its default setting.

The identification run can be stopped any time with normal stop command and the parameter is reset to its default setting. In case identification run detects fault or other problems, the identification run is completed if possible. After the identification is finished, the application checks the status of the identification and generates fault/ warning if any.

During Identification Run, the brake control is disabled (see Chapter 9.1).

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 par. ID621.

---

634   *CL: Start-up torque, reverse*   *23456*   *(2.6.23.13)*

Sets the start-up torque for reverse direction if selected with par. ID621.

---

636   *Minimum frequency for Open Loop torque control*   *6*   *(2.10.7)*

Defines the frequency limit below which the frequency converter operates in 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.

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)

Defines the P gain of the torque controller in Open Loop control mode..

640   Torque controller I gain   6   (2.10.9)

Defines the I gain of the torque controller in Open Loop control mode.

641   Torque reference selection   6   (2.10.3)

Defines the source for torque reference. See Chapter 9.6.

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 9.6.

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.

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 page Page 224.

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)*

Select used motor type with this parameter.

0   Induction motor

1   Permanent magnet synchronous 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%.

656   *LOAD DROOPING TIME*   *6*   *(2.6.18)*

This function is used in order to achieve a dynamic speed drooping because of changing load. The parameter defines the time during which the speed is restored to the level it was before the load increase.

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)*

Scaling factor for generator side IR-compensation 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)*

0 = No response

1 = Warning

2 = Warning, the frequency from 10 seconds back is set as reference

3 = Warning, the 4mA fault frequency (par. 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)*

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)*

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.

---

703   **Earth fault protection**   *234567*   *(2.7.7)*

0 = No response

1 = Warning

2 = Fault, stop mode after fault according to ID506

3 = Fault, stop mode after fault always by coasting

Earth fault protection ensures that the sum of the motor phase currents is zero. The overcurrent protection is always working and protects the frequency converter from earth faults with high currents.

---

704   **Motor thermal protection**   *234567*   *(2.7.8)*

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 9.3 .

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 9.3.

706 **Motor thermal protection: Motor cooling factor at zero speed** **234567** **(2.7.10)**

Defines the cooling factor at zero speed in relation to the point where the motor is running at nominal speed without external cooling. See Figure 69.

The default value is set assuming that there is no external fan cooling the motor. If an external fan is used this parameter can be set to 90% (or even higher).

If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value.

Setting this parameter does not affect the maximum output current of the drive which is determined by parameter ID107 alone. See Chapter 9.3.

The corner frequency for the thermal protection is 70% of the motor nominal frequency (ID111).
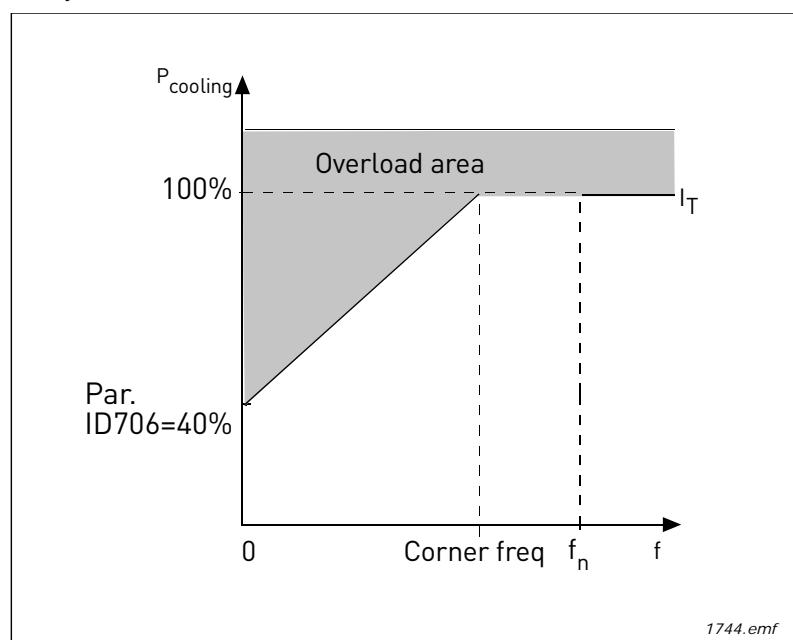
Figure 69. Motor thermal current I_T curve

707 **Motor thermal protection: Time constant** **234567** **(2.7.11)**

This time can be set between 1 and 200 minutes.

This is the thermal time constant of the motor. The bigger the motor, the bigger the time constant. The time constant is the time within which the calculated thermal stage has reached 63% of its final value.

The motor thermal time is specific to the motor design and it varies between different motor manufacturers. The default value varies from size to size.

If the motor's t6–time (t6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set basing on it. As a rule of thumb, the motor thermal time constant in minutes equals to 2xt6. If the drive is in stop stage the time constant is internally increased to three times the set parameter value. The cooling in the stop stage is based on convection and the time constant is increased. See also Figure 70.

708   Motor thermal protection: Motor duty cycle   234567   (2.7.12)

The value can be set to 0%...150%. See Chapter 9.3.

Setting value to 130% means that the nominal temperature will be reached with 130% of motor nominal current.
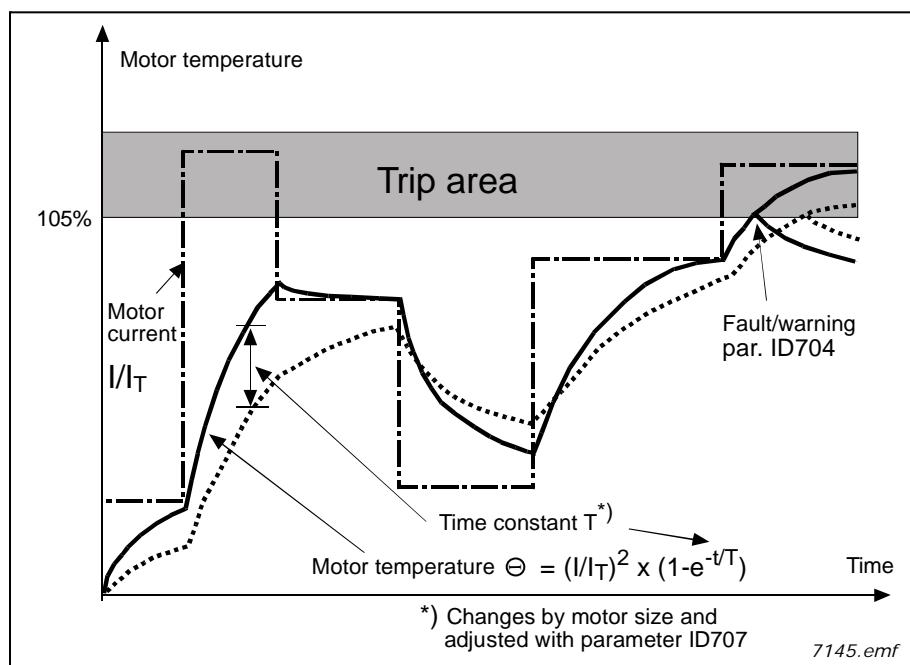
Figure 70. Motor temperature calculation

709   Stall protection   234567   (2.7.13)

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 9.4 .

710   Stall current limit   234567   (2.7.14)

The current can be set to 0.0...2*I_H. For a stall stage to occur, the current must have exceeded this limit. See Figure 71. If parameter ID107 Nominal current limit of motor is changed, this parameter is automatically calculated to 90% of the current limit. See Chapter 9.4.

NOTE: In order to guarantee desired operation, this limit must be set below the current limit.
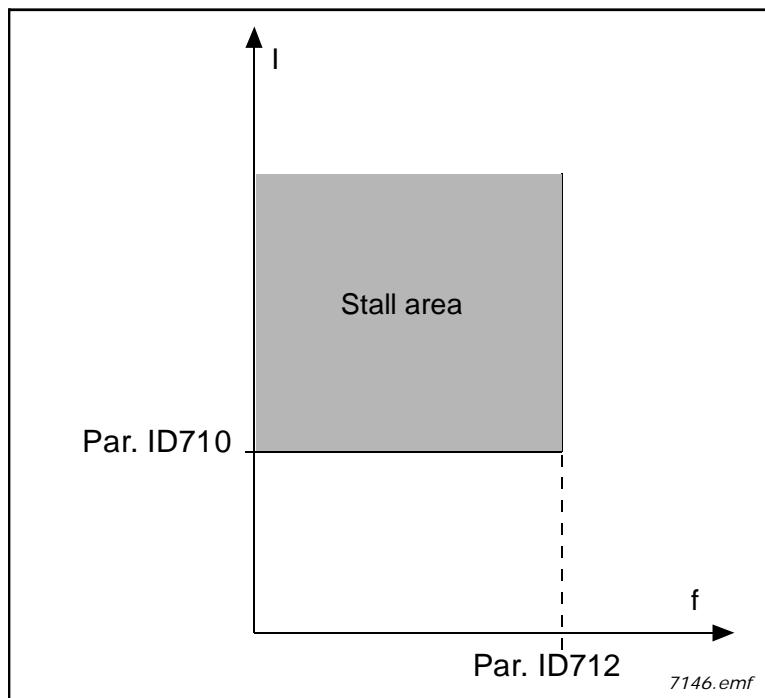
Figure 71. Stall characteristics settings

711   STALL TIME   234567   (2.7.15)

This time can be set between 1.0 and 120.0s.

This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter.If the stall time counter value goes above this limit the protection will cause a trip (see ID709). See Chapter 9.4 .
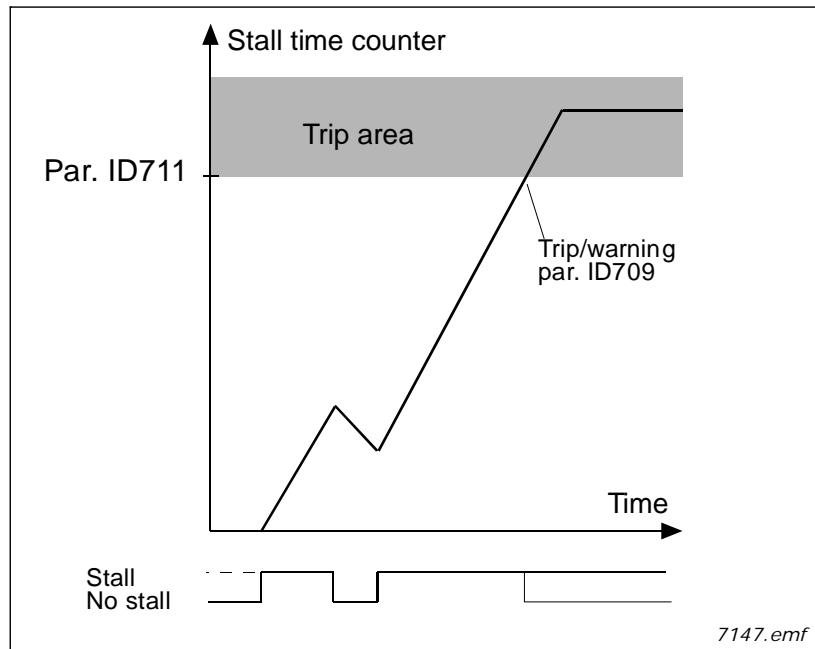
Figure 72. Stall time count

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 have remained below this limit
for a certain time. See Chapter 9.4.

713   **Underload protection**   *234567*   *(2.7.17)*

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 9.5.

714   **Underload protection, field weakening area load**   *234567*
(2.7.18)

The torque limit can be set between 10.0—150.0 % x T$_{nMotor}$.

This parameter gives the value for the minimum torque allowed when the output
frequency is above the field weakening point. See Figure 73.

If you change parameter ID113 (Motor nominal current) this parameter is automat-
ically restored to the default value. See Chapter 9.5 .
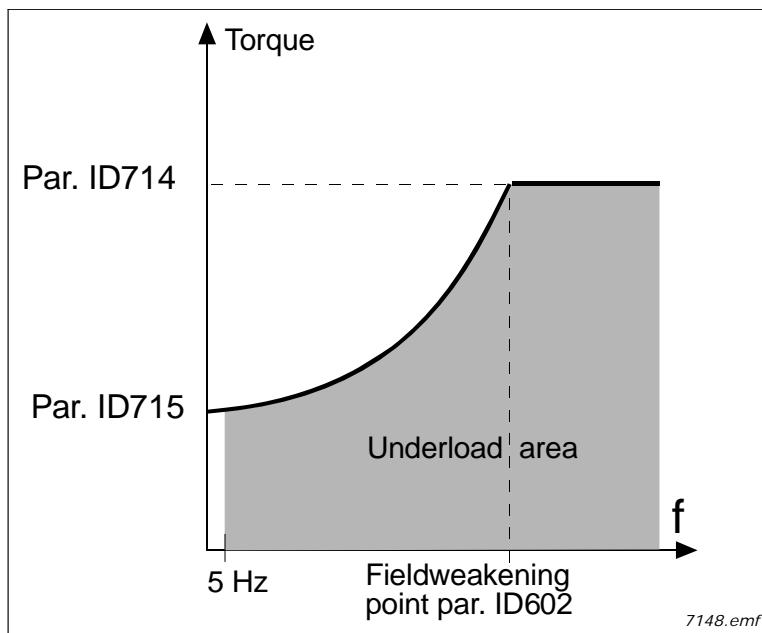
Figure 73. Setting of minimum load

715   **Underload protection, zero frequency load**   *234567*   *(2.7.19)*

The torque limit can be set between 5.0—150.0 % x TnMotor.

This parameter gives value for the minimum torque allowed with zero frequency.
See Figure 73.

If you change the value of parameter ID113 (Motor nominal current) this parameter
is automatically restored to the default value. See Chapter 9.5.

716   UNDERLOAD TIME   234567   (2.7.20)

This time can be set between 2.0 and 600.0 s.

This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to parameter ID713). If the drive is stopped the underload counter is reset to zero. See Figure 74 and Chapter 9.5.
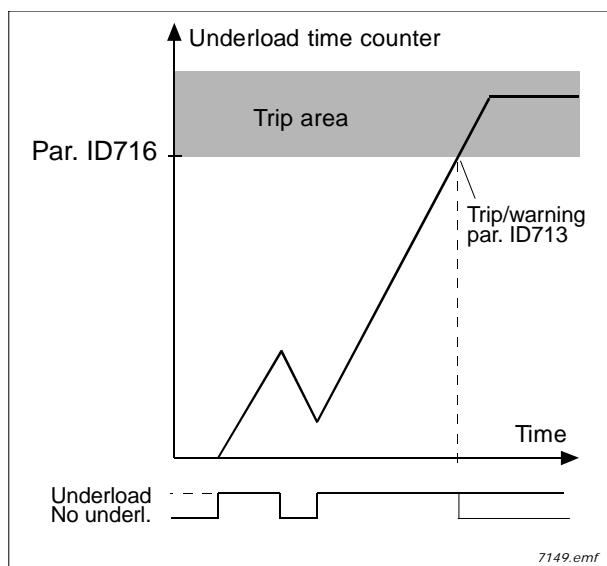
Figure 74. Underload time counter function

717   AUTOMATIC RESTART: WAIT TIME   234567   (2.8.1)

Defines the time before the frequency converter tries to automatically reset the fault.

718   AUTOMATIC RESTART: TRIAL TIME   234567   (2.8.2)

The Automatic restart function keeps trying to reset the faults appearing during the time set with this parameter. 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.
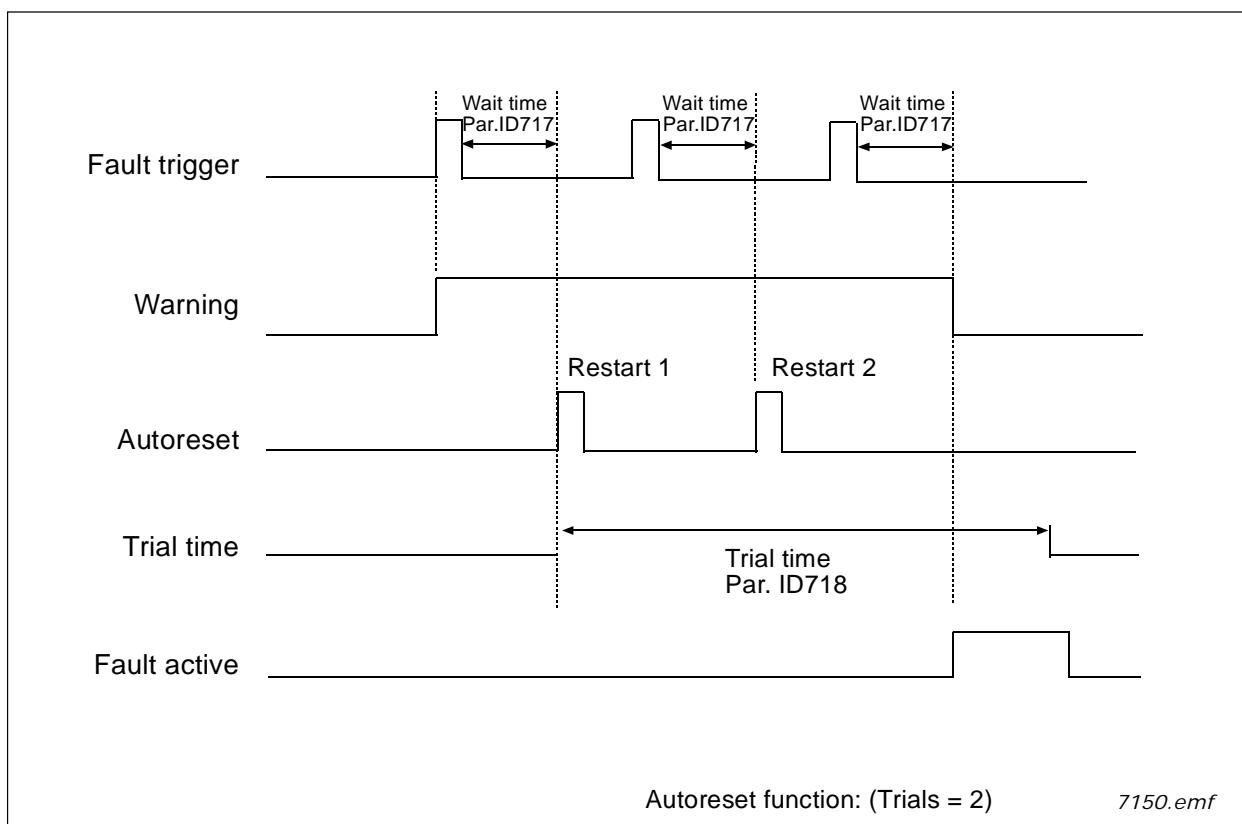
Figure 75. Example of Automatic restarts with two restarts

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 Start function for Automatic restart is selected with this parameter. The parameter defines the start mode:

0 = Start with ramp

1 = Flying start

2 = Start according to ID505

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.

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.

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.

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.

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 ($\geq$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.

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.

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)*

0 = Fault stored in fault history

1 = Fault not stored in fault history

For the undervoltage limits, see the product's user's 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.

730   *Input phase supervision*   *234567*   *(2.7.4)*

0 = No response

1 = Warning

2 = Fault, stop mode after fault according to ID506

3 = Fault, stop mode after fault always by coasting

The input phase supervision ensures that the input phases of the frequency converter have an approximately equal current.

731   *Automatic restart*   *1*   *(2.20)*

The Automatic restart is taken into use with this parameter.

0 = Disabled

1 = Enabled

The function resets the following faults (max. three times) (see the product's user's 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)*

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.

0 = No automatic restart after Underload fault trip

>0 = Number of automatic restarts after Underload fault trip

739   *NUMBER OF PT100 INPUTS IN USE   567   (2.7.24)*

PT100 protection function is used to measure temperature and give a warning and/or a fault when set limits are exceeded.

If you have a PT100 input board installed in your frequency converter you can choose here the number of PT100 inputs in use. See also the Vacon I/O boards manual.

0 = Not used

1 = PT100 input 1

2 = PT100 inputs 1 and 2

3 = PT100 inputs 1, 2 and 3

4 = PT100 inputs 2 and 3

5 = PT100 input 3

NOTE: If the selected value is greater than the actual number of used PT100 inputs, the display will read 200ºC. If the input is short-circuited the displayed value is −30ºC.

740   *RESPONSE TO PT100 FAULT   567   (2.7.25)*

0 = No response

1 = Warning

2 = Fault, stop mode after fault according to ID506

3 = Fault, stop mode after fault always by coasting

741   *PT100 WARNING LIMIT   567   (2.7.26)*

Set here the limit at which the PT100 warning will be activated.

742   *PT100 FAULT LIMIT   567   (2.7.27)*

Set here the limit at which the PT100 fault (F56) will be activated.

743   *PT100 2 NUMBERS   6   (2.7.37)*

PT100 protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. Some applications support two PT100 boards of which one can be used to the motor winding and the other for the motor bearings.

If you have a second PT100 input board installed in your AC drive you can choose here the number of PT100 inputs in use. For more information, see par ID739 and the I/O boards manual.

745   *PT100 2 WARNING LIMIT*   *6*   *(2.7.38)*

Set here the limit at which the second PT100 warning will be activated.

746   *PT100 2 FAULT LIMIT*   *6*   *(2.7.39)*

Set here the limit at which the second PT100 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's 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.

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)*

IMPORTANT: See Vacon manual ud01066 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 Figure 31. See also Chapter 9.6 .

NOTE: Using this custom scaling function also affects the scaling of the actual val-ue.

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 9.6.

Some typical values:

Table 122.

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 6.6.1 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 val-ues from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters. See Table 51.

1001   NUMBER OF AUXILIARY DRIVES   7   (2.9.1)

With this parameter the number of auxiliary drives in use will be defined. The func-tions controlling the auxiliary drives (parameters ID458 to ID462) can be pro-grammed 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 frequency converter must exceed the limit defined with these parameters with 1 Hz before the auxiliary drive is started. The 1 Hz overdraft makes a hysteresis to avoid unnecessary starts and stops. See Figure 76 ID101 and ID102, Page 131.

1003 **STOP FREQUENCY, AUXILIARY DRIVE   17   (2.9.3)**

The frequency of the drive controlled by the frequency converter must fall with 1Hz 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 frequency converter is dropped after starting the auxiliary drive. See Figure 76.

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 ID's 1002 and 1003.

1010 **START DELAY OF AUXILIARY DRIVES   7   (2.9.10)**

The frequency of the drive controlled by the frequency converter must remain above the start frequency of the auxiliary drive for the time defined with this parameter before the auxiliary drive is started. The delay defined applies to all auxiliary drives. This prevents unnecessary starts caused by momentary start limit exceedings. See Figure 76.

1011 **STOP DELAY OF AUXILIARY DRIVES   7   (2.9.11)**

The frequency of the drive controlled by the frequency converter must remain below the stop limit of the auxiliary drive for the time defined with this parameter before the drive is stopped. The delay defined applies to all auxiliary drives. This prevents unnecessary stops caused by momentary falls below the stop limit. See Figure 76
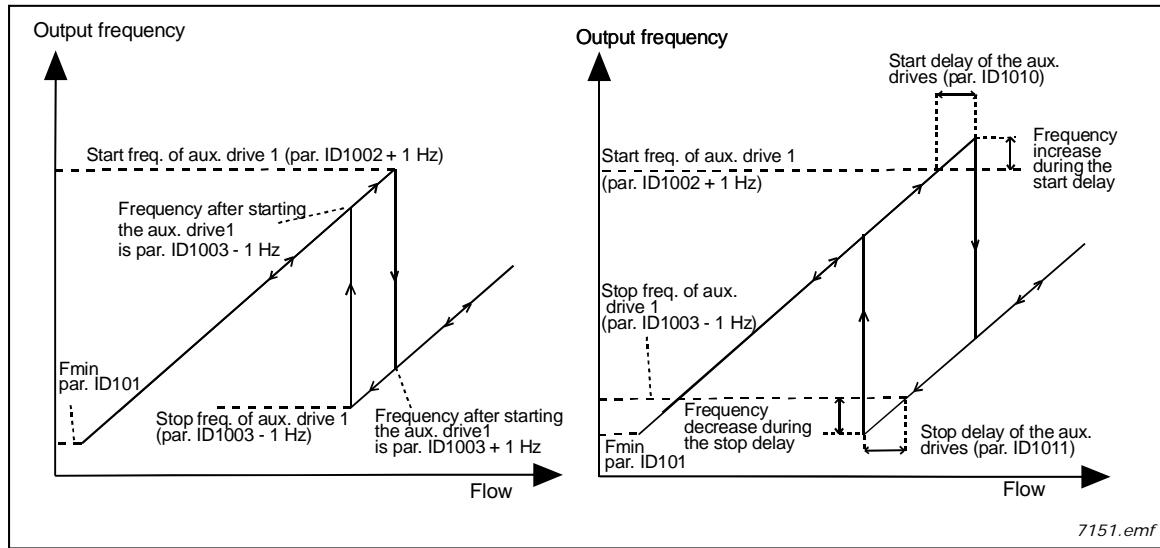
Figure 76. Example of parameter setting; Variable speed drive and one auxiliary drive

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. See Figure 77.
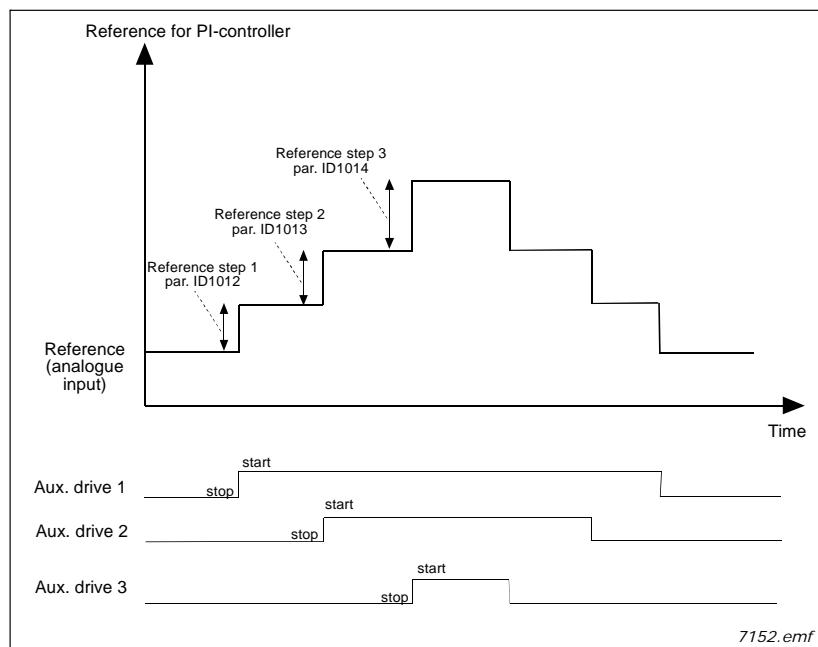
Figure 77. Reference steps after starting auxiliary drives

1016   Sleep frequency   57   (2.1.15)

The frequency converter is stopped automatically if the frequency of the drive falls below the S*leep level* defined with this parameter for a time greater than that determined by parameter ID1017. During the Stop state, the PID controller is operating switching the frequency converter to Run state when the actual value signal either falls below or exceeds (see par. ID1019) the *Wake-up level* determined by parameter ID1018. See Figure 78.

1017   Sleep delay   57   (2.1.16)

The minimum amount of time the frequency has to remain below the Sleep level before the frequency converter is stopped. See Figure 78.

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 frequency converter is restored. See Figure 78.
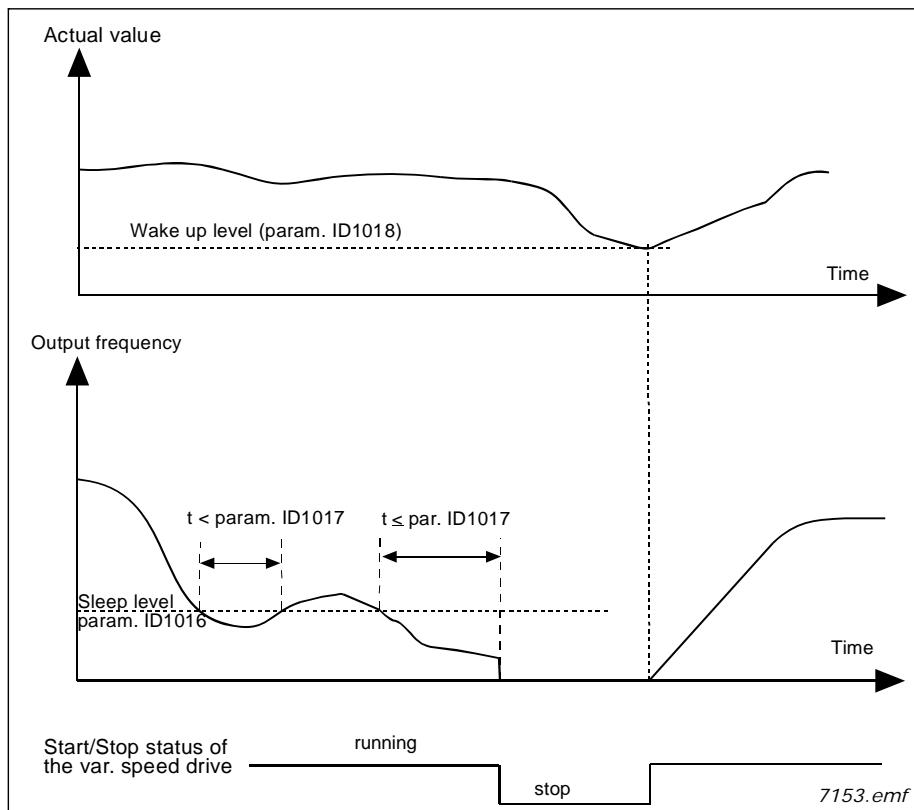
Figure 78. Frequency converter sleep function

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* (par. ID1018). See Figure 78 and Figure 79 on Page 213.

The application 5 has selections 0-1 and application 7 selections 0-3 available.

Par. value	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	Actual value signal — 100% — Par. ID1018=30% — time — Start Stop
1	Wake-up happens when actual value exceeds the limit	The limit defined with parameter ID1018 is in percent of the maximum actual value	Actual value signal — 100% — Par. ID1018=60% — time — Start Stop
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	Actual value signal — 100% — reference=50% — Par.ID1018=60% limit=60%*reference=30% — time — Start Stop
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	Actual value signal — 100% — Par.ID1018=140% limit=140%*reference=70% — reference=50% — time — Start Stop
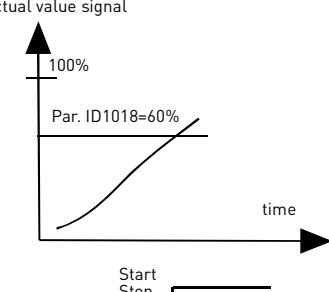
7154.emf

Figure 79. Selectable wake-up functions

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. See Figure 80.
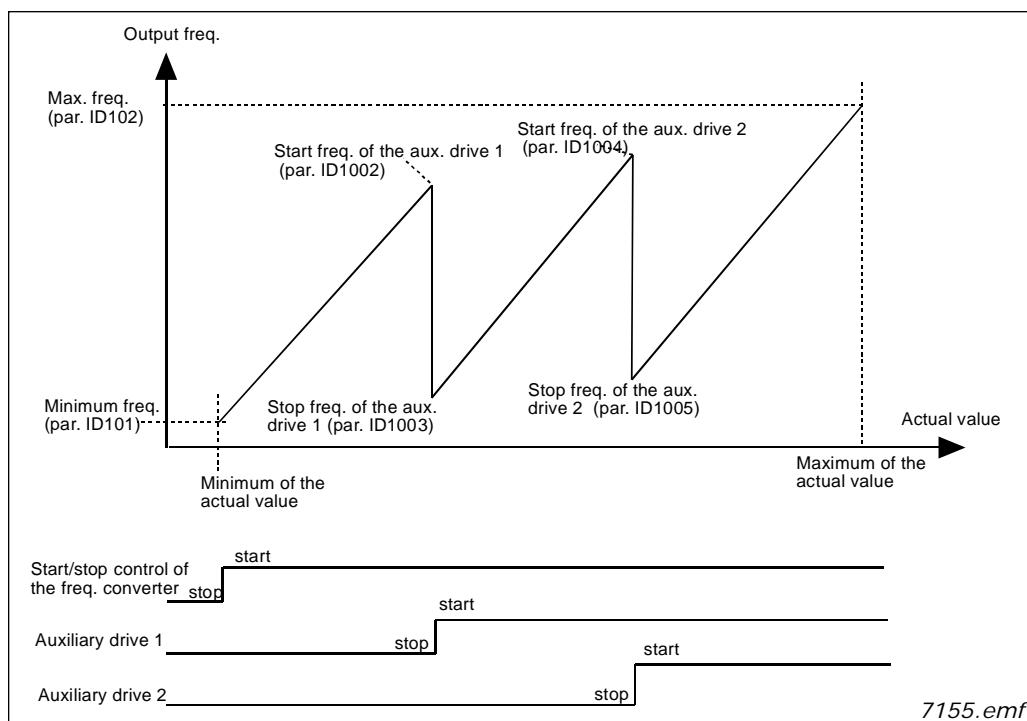
Figure 80. Example of variable speed drive and two auxiliary drives with bypassed PID controller

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. See Figure 81.
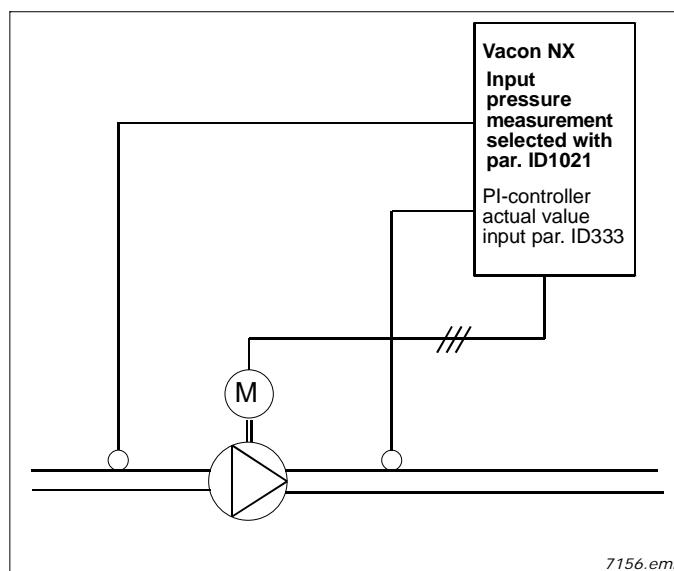
Figure 81. Input and output pressure measuring

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. See Figure 82.
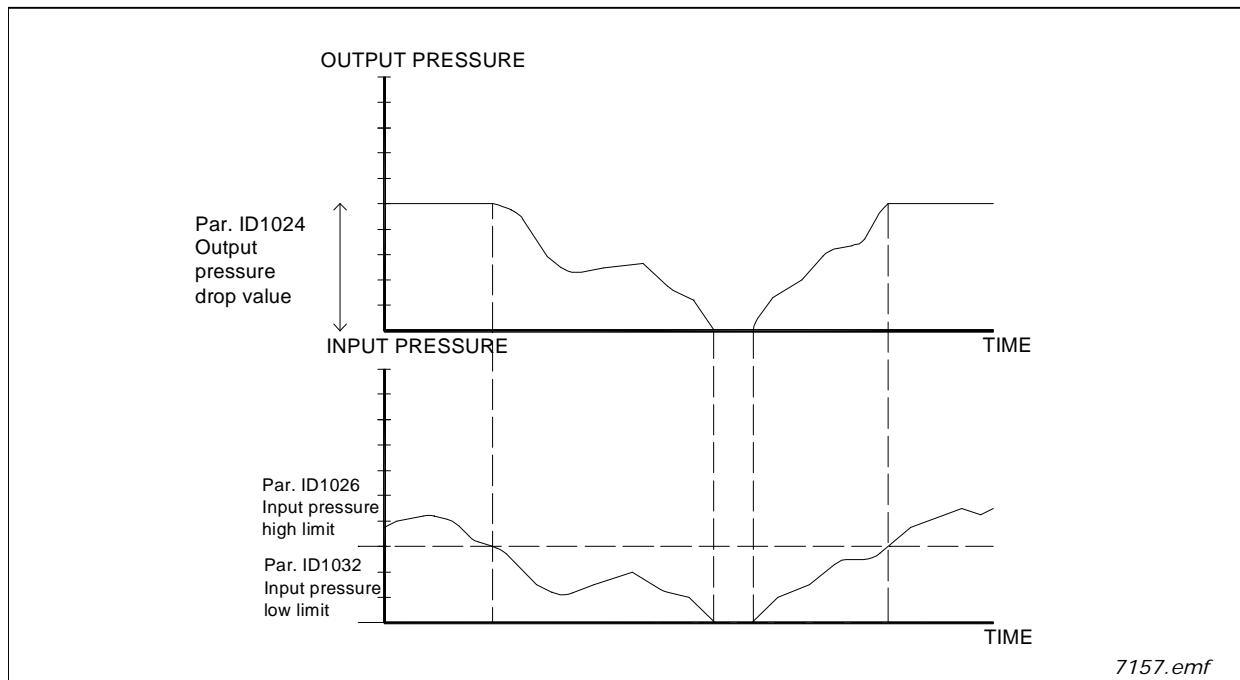
Figure 82. Output pressure behaviour depending on input pressure and parameter settings

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. See Figure 83.

If either of the values of parameters ID1025 and ID1026 is set to maximum (300,0 s) no frequency drop nor increase takes place.
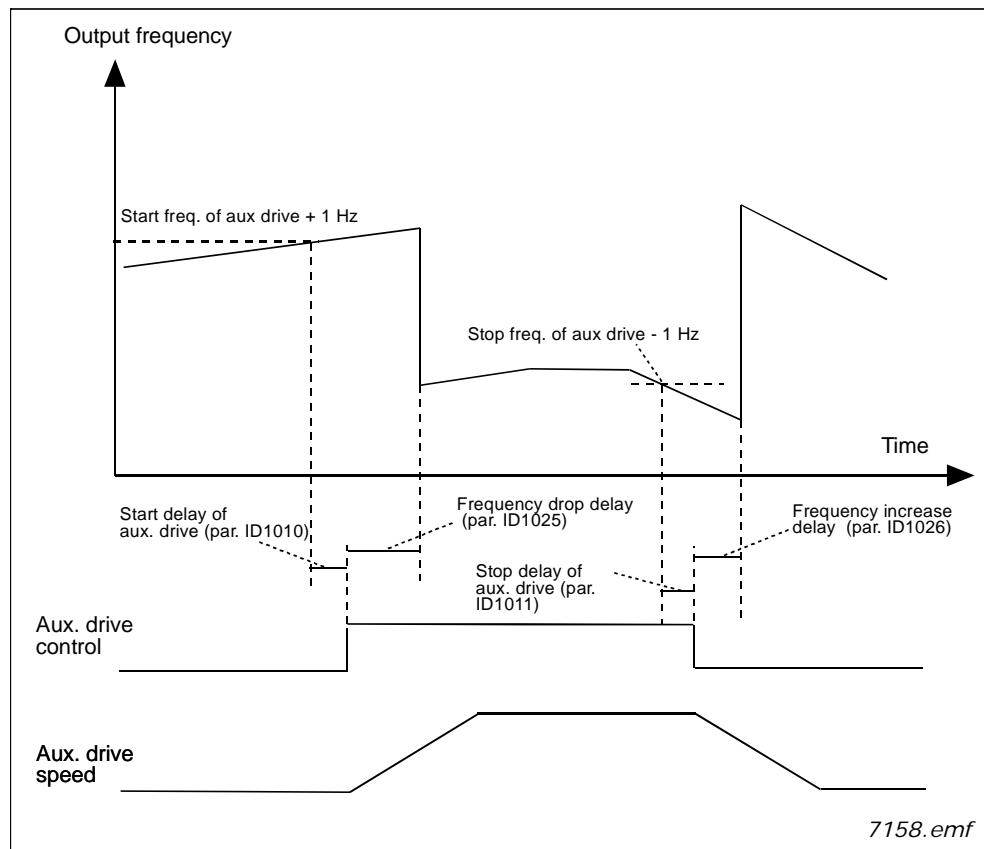
Figure 83. Frequency drop and increase delays

1027   AUTOCHANGE   7   (2.9.24)

0   Autochange not used

1   Autochange used

1028   AUTOCHANGE/INTERLOCKS AUTOMATICS SELECTION   7   (2.9.25)

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

The drive controlled by the frequency converter remains the same. Only the mains contactor is needed for each drive. See Figure 84.
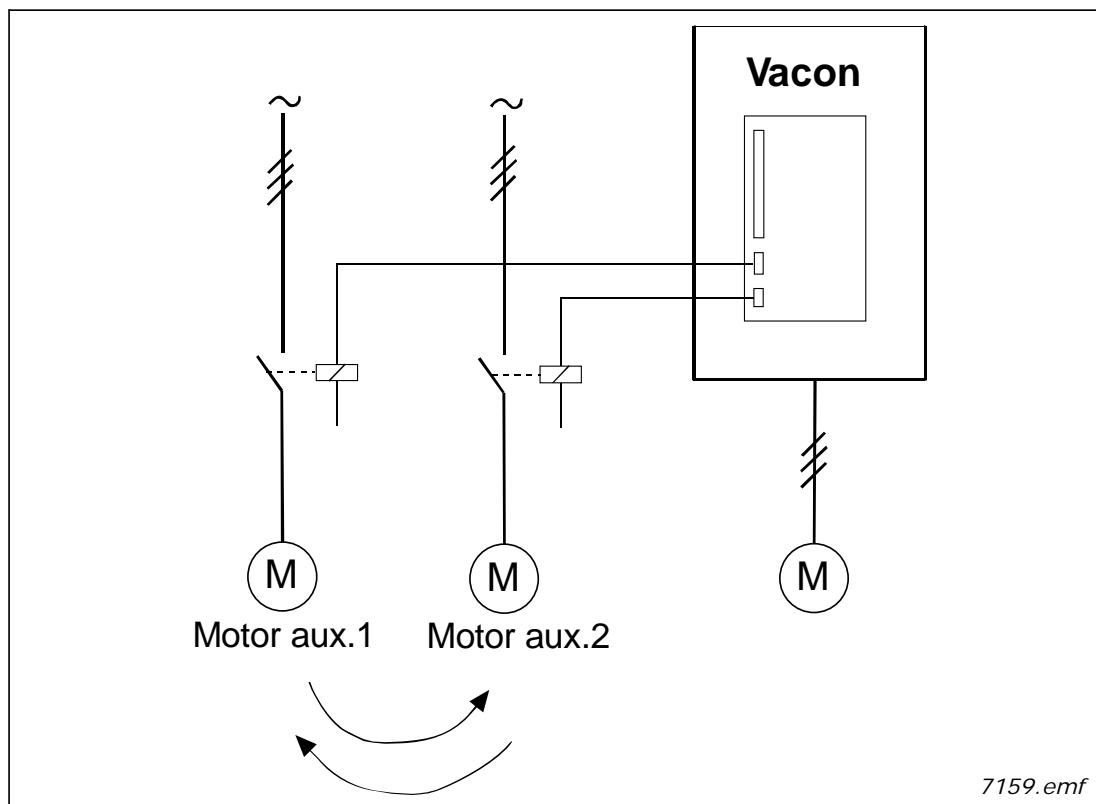
Figure 84. Autochange applied to auxiliary drives only.

1   All drives included in the autochange/interlockings sequence

The drive controlled by the frequency converter is included in the automatics and two contactors are needed for each drive to connect it to the mains or the frequency converter. See Figure 85.
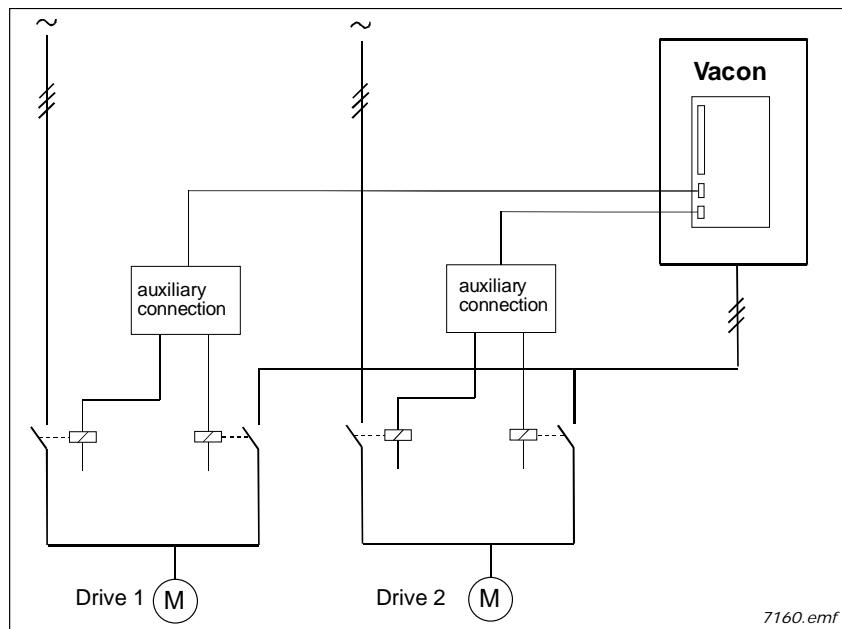
Figure 85. Autochange with all drives

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 ID1031 (*Autochange frequency limit*) and ID1030 (*Maximum number of auxiliary drives*). Should the capacity exceed the value of ID1031, the autochange will not take place before the capacity goes below this limit.

The time count is activated only if the Start/Stop request is active.

The time count is reset after the autochange has taken place.

See Figure 86.

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:

- 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.
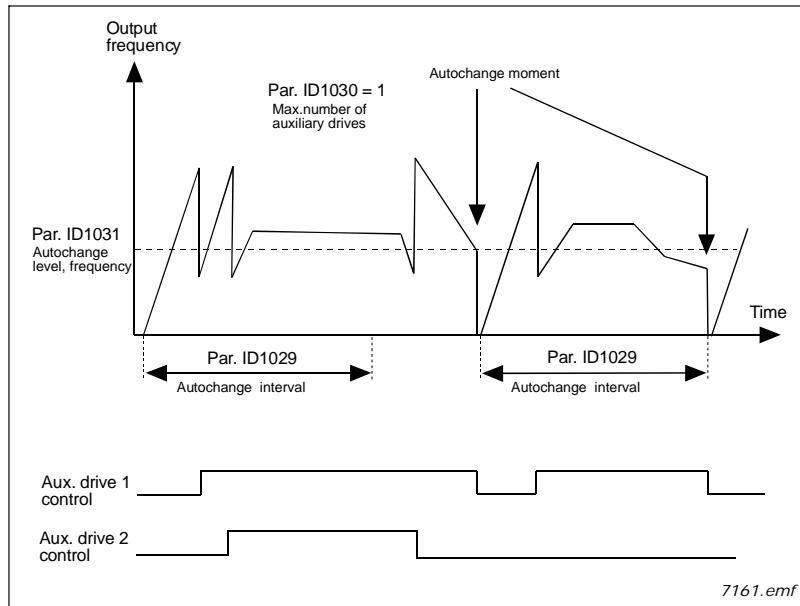
Figure 86. Autochange interval and limits

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 (frequency converter), directly to the mains or place them to off-state. The interlock feedback functions are connected to the digital inputs of the frequency converter. 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.

0   Interlock feedback not used

The frequency converter receives no interlock feedback from the drives

1   Update of autochange order in Stop

The frequency converter receives interlock feedback from the drives. In case one of the drives is, for some reason, disconnected from the system and eventually re-connected, it will be placed last in the autochange line without stopping the system. However, if the autochange order now becomes, for example, [P1 → P3 → P4 → P2], it will be updated in the next Stop (autochange, sleep, stop, etc.)

Example:

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

2   Update of order immediately

The frequency converter receives interlock feedback from the drives. At re-connection 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)...20mA. 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 m^3/s. You then set a value for par. ID1033 to correspond to the minimum signal level (0/4 mA) and another value for par. ID1034 to correspond to the maximum signal level (20 mA). The number of decimals needed can be set with par. ID1035 and the unit (m^3/s) with par. 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 (par. ID1036):

Table 123. Selectable values for Actual Value Special Display

Value	Unit	On keypad	Value	Unit	On keypad
0	Not Used		15	m3 /h	m3/h
1	%	%	16	°F	°F
2	°C	°C	17	ft	ft
3	m	m	18	gal / s	GPS
4	bar	bar	19	gal / min	GPM
5	mbar	mbar	20	gal / h	GPH
6	Pa	Pa	21	ft3 / s	CFS
7	kPa	kPa	22	ft3 / min	CFM
8	PSI	PSI	23	ft3 / h	CFH
9	m / s	m/s	24	A	A
10	l / s	l/s	25	V	V
11	l / min	l/m	26	W	W
12	l / h	l/h	27	kW	kW
13	m3 /s	m3/s	28	Hp	Hp
14	m3 /min	m3/m			

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.
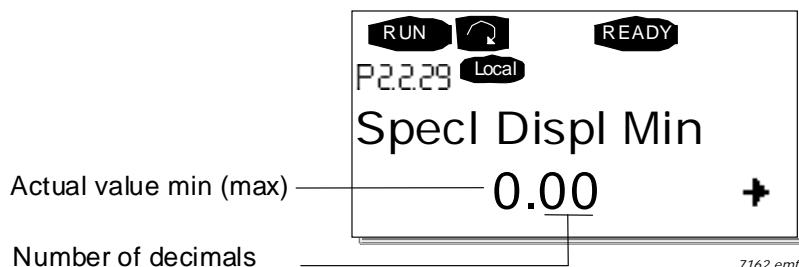
Figure 87.

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 124. Selections for parameter ID1081

Sel	Function	Sel	Function
0	Analogue input 1 (AI1). See ID377	10	Potentiometer reference; controlled with ID418 (TRUE=increase) and ID417 (TRUE=decrease)
1	Anlogue input 2 (AI2). See ID388	11	AI1 or AI2, whichever is lower
2	AI1+AI2	12	AI1 or AI2, whichever is greater
3	AI1–AI2	13	Max. frequency ID102 (recommended in torque control only)
4	AI2–AI1	14	AI1/AI2 selection, see ID422
5	AI1*AI2	15	Encoder 1 (AI input C.1)
6	AI1 joystick	16	Encoder 2 (With OPTA7 Speed Synchronization, NXP only AI input C.3)
7	AI2 joystick	17	Master Reference
8	Keypad reference (R3.2)	18	Master Ramp Out (default)
9	Fieldbus reference		

1082   *SYSTEMBUS COMMUNICATION FAULT RESPONSE   6   (2.7.30)*

Defines the action when SystemBus heartbeat is missing.

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.

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 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)*

If motor current falls below this value the brake is closed immediately.

This parameter is available for NXP drives only.

1087   **Scaling of generating torque limit**   *6*   *(2.2.6.6)*

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)*

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, par. ID1081, selection 18).

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 Page 76

The parameter is available for NXP drives only.

1092 **MASTER FOLLOWER MODE 2G** *(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.

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.

1210 **EXTERNAL BRAKE ACKNOWLEDGEMENT 6** *(2.2.7.24)*

Connect this input signal to the auxiliary contact of the mechanical brake. If the contact is not closed within given time the drive will generate a brake fault (F58). 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.

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 1G** *(2.4.15)*
1240 **INCHING REFERENCE 2G** *(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.

1244 **TORQUE REFERENCE FILTERING TIME 6** *(2.10.10)*

Defines 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)

This parameter defines the acceleration and deceleration times when inching 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.

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.

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 page.

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)*

Defines the maximum motoring side torque limit. The parameter is available for NXP drives only.

1288   *Generator torque limit   6   (2.6.21)*

Defines the maximum generating side torque limit. The parameter is available for NXP drives only.

1289   *Motoring power limit   6   (2.6.23.20)*

Defines the maximum motoring side power limit. For Closed Loop control mode only.

1290   *Generator power limit   6   (2.6.23.19)*

Defines the maximum generating side power limit. For Closed Loop control mode only.

1316   *Brake fault response   6   (2.7.28)*

Defines the action when a brake fault is detected.

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 par. 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.

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.

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.

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 stabilator gain**   6   (2.6.26.1)

Additional gain for the torque stabilator 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.

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** **(2.6.26.10)**

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.

1720 **Torque Stabilator Limit Ratio** **6** **(2.6.26.4)**

Limit of torque stabilator output.

ID111 * ID1720 = Torque Stabilator Limit

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)**

8.1   Speed control parameters (application 6 only)
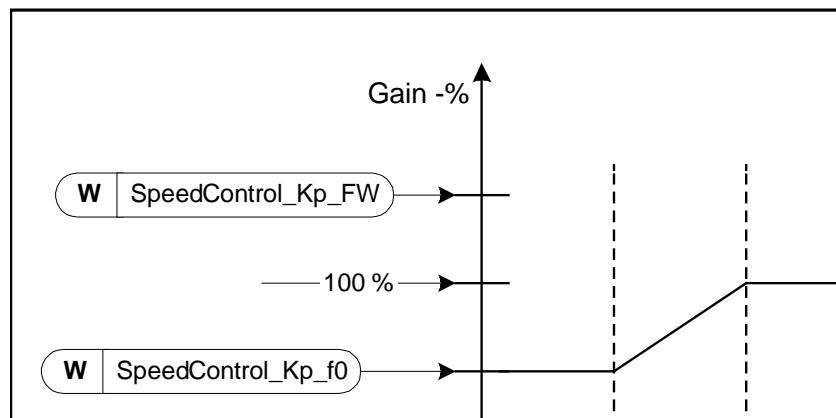

Figure 88. Speed Controller adaptive gain

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 par. 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 par. 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 par. ID613.

1299   **Speed controller gain f0   6   (2.6.23.27)**

The relative gain of the speed controller as a percentage of par. 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 par. 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 par. ID613. From the speed defined by par. ID1300 to speed defined by par. ID1301, the speed controller gain changes linearly from par. 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.

8.2   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's 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).

0 = PC Control, Activeted by NCDrive

1 = I/O terminal

2 = Keypad

3 = Fieldbus

123   Keypad Direction   (3.3)

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's 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's manual.

167   PID reference   157   (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   257   (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%.

9.   APPENDICES

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

- *Parameters of External brake control with additional limits (Chapter9.1)*
- *Closed Loop parameters (Chapter 9.2)*
- *Parameters of Motor thermal protection (Chapter 9.3)*
- *Parameters of Stall protection (Chapter 9.4)*
- *Parameters of Underload protection (Chapter 9.5)*
- *Fieldbus control parameters (Chapter 9.6)*

9.1   EXTERNAL BRAKE CONTROL WITH ADDITIONAL LIMITS (ID'S 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. See Figure 89.

NOTE: During Identification Run (see par. ID631), brake control is disabled.
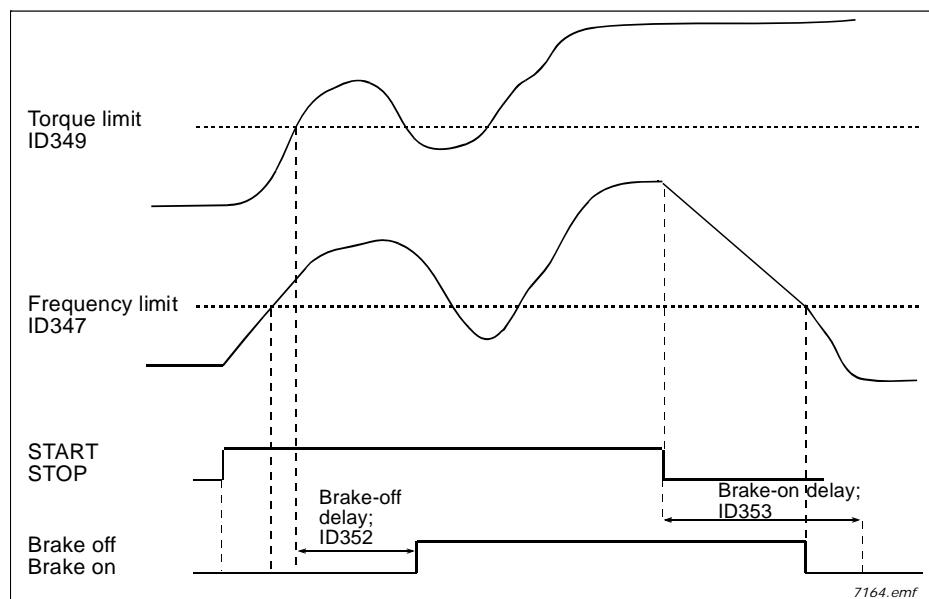

Figure 89. Brake control with additional limits

In 21 above, the brake control is set to react to both the torque supervision limit (par. 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.

See Figure 90.

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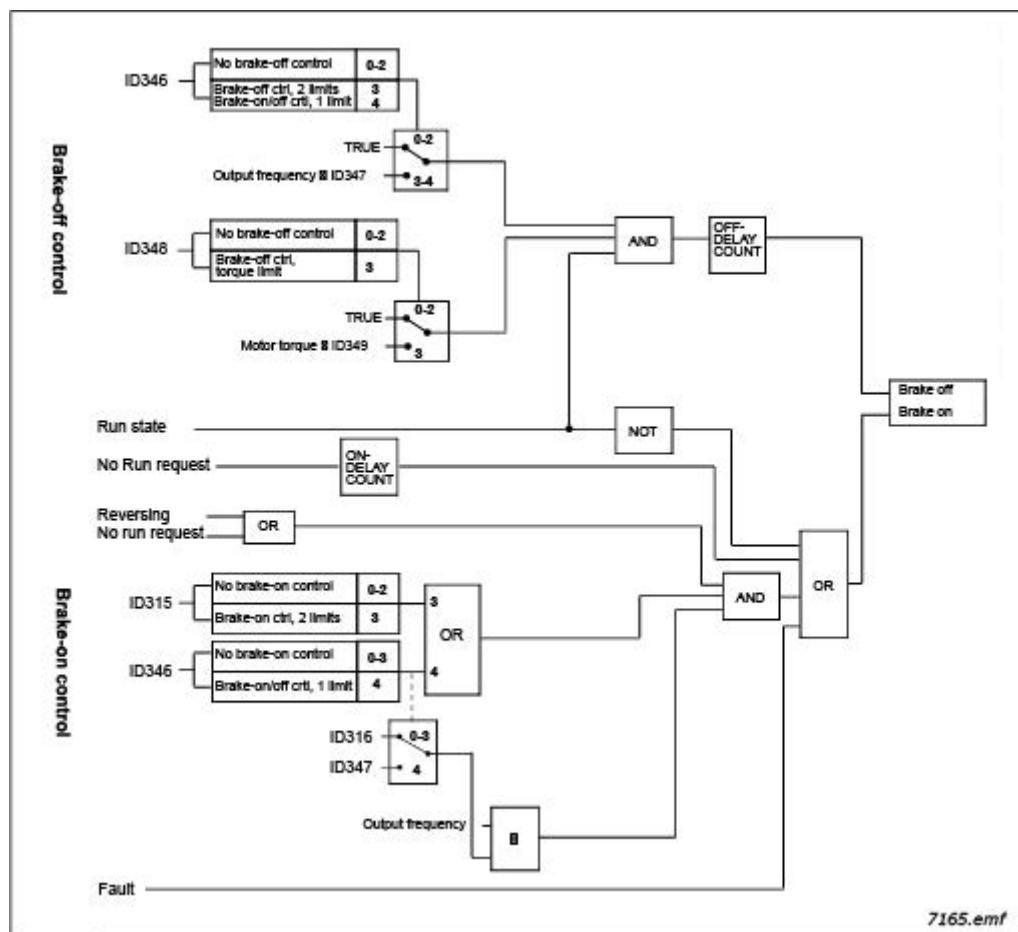

Figure 90. Brake control logic

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.

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9.2   Closed loop parameters (ID's 612 to 621)

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

Closed loop control mode (see page 190) 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.

9.3   Parameters of motor thermal protection (ID's 704 to 708):

General

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

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

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

The thermal stage of the motor can be monitored on the control keypad display. See the product's user's manual.

⚠	**NOTE!**	If you use long motor cables (max. 100m) together with small drives (≤1.5 kW) the motor current measured by the drive can be much higher than the actual motor current due to capacitive currents in the motor cable. Consider this when setting up the motor thermal protection functions.
	CAUTION!	The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill. The model starts from zero if the control board is powered off.

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9.4   Parameters of Stall protection (ID's 709 to 712):

General

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

⚠	**NOTE!** If you use long motor cables (max. 100m) together with small drives (≤1.5 kW) the motor current measured by the dr```ive can be much higher than the actual motor current due to capacitive currents in the motor cable. Consider this when setting up the motor stall protection functions.

9.5   Parameters of Underload protection (ID's 713 to 716)

General

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

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

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

⚠	**NOTE!** If you use long motor cables (max. 100m) together with small drives (≤1.5 kW) the motor current measured by the drive can be much higher than the actual motor current due to capacitive currents in the motor cable. Consider this when setting up the motor stall protection functions.

9.6   Fieldbus control parameters (ID's 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.

9.6.1   Process Data OUT (Slave → Master)

The fieldbus master can read the frequency converter'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 125.

Data	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.

9.6.2   Current scaling in different size of units

NOTE: Monitoring value ID45 (usually in Process data OUT3) is given with one decimal only.

Table 126.

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
525 – 690 Vac	NX_6 0018 –	10 – 0,1A

9.6.3   Process Data IN (Master -> Slave)

ControlWord, Reference and Process Data are used in All in One applications as follows:

Basic, Standard, Local/Remote, Multi-Step applications

Table 127.

Data	Value	Unit	Scale
Reference	Speed reference	%	0.01%
ControlWord	Start/Stop command Fault reset command	-	-
PD1 – PD8	Not used	-	-

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Multipurpose control application

(**NOTE**: Settings in the table are factory defaults. See also parameter group G2.9)

Table 128.

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	-	-

PID control and Pump and fan control applications

Table 129.

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	-	-

10.   FAULT TRACING

The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults (warnings) only. The items written in white on black background present faults for which you can program different responses in the application. See parameter group Protections.

NOTE: When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display.

Table 130. Fault codes

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current ($>4*I_H$) in the motor cable: - sudden heavy load increase - short circuit in motor cables - unsuitable motor Subcode in T.14: S1 = Hardware trip S2 = Reserved S3 = Current controller supervision	Check loading. Check motor. Check cables. Make identification run.
2	Overvoltage	The DC-link voltage has exceeded the limits defined. - too short a deceleration time - high overvoltage spikes in supply Subcode in T.14: S1 = Hardware trip S2 = Overvoltage control supervision	Make deceleration time longer. Use brake chopper or brake resistor (available as options) Activate overvoltage controller. Check input voltage.
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. - insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. - faulty operation - component failure	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you.
6	Emergency stop	Stop signal has been given from the option board.	Check emergency stop circuit.
7	Saturation trip	Various causes: - defective component - brake resistor short-circuit or overload	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor

Table 130. Fault codes

Fault code	Fault	Possible cause	Correcting measures
8	System fault	- component failure - faulty operation Note exceptional fault data record. S1 = Reserved 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)	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you.
9	Undervoltage	DC-link voltage is under the voltage limits defined. - most probable cause: too low a suply voltage - frequency converter internal fault - defect input fuse - external charge switch not closed Subcode in T.14: S1 = DC-link too low during run S2 = No data from power unit S3 = Undervoltage control supervision	In case of temporary supply voltage break reset the fault and restart the frequency converter. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact the distributor near to you.
10	Input line supervision	Input line phase is missing.	Check supply voltage, fuses and cable.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	- no brake resistor installed - brake resistor is broken - brake chopper failure	Check brake resistor and cabling. If the these are ok, the chopper is faulty. Contact the distributor near to you.
13	Frequency converter undertemperature	Heatsink temperature is under –10°C	
14	Frequency converter overtemperature	Heatsink temperature is over 90°C (or 77ºC, NX_6, FR6). Overtemperature warning is issued when the heatsink temperature exceeds 85°C (72ºC).	Check the correct amount and flow of cooling air. Check the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.
15	Motor stalled	Motor stall protection has tripped.	Check motor and load.
16	Motor overtemperature	Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.	Decrease motor load. If no motor overload exists, check the temperature model parameters.
17	Motor underload	Motor underload protection has tripped.	Check load.

Table 130. Fault codes

Fault code	Fault	Possible cause	Correcting measures
18	Unbalance	Unbalance between power modules in parallelled units. Subcode in T.14: S1 = Current unbalance S2 = DC voltage unbalance	Should the fault re-occur, contact the distributor near to you.
22	EEPROM check-sum fault	Parameter save fault - faulty operation - component failure	Should the fault re-occur, contact the distributor near to you.
24	Counter fault	Values displayed on counters are incorrect	
25	Microprocessor watchdog fault	- faulty operation - component failure	Reset the fault and restart. Should the fault re-occur, contact 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 loaded 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	Check motor cooling and loading Check 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	Check loading. Check motor size. Make identification run.
32	Fan cooling	Cooling fan of the frequency converter does not start, when ON command is given	Contact the distributor near to you.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
35	Application	Problem in application software.	Contact your distributor. If you are application programmer check the application program.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit
37	Device changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset. Device is ready for use. Old parameter settings will be used.
38	Device added (same type)	Option board or drive added.	Reset. Device is ready for use. Old board settings will be used.
39	Device removed	Option board removed.	Reset. Device no longer available.
40	Device unknown	Unknown option board or drive. Subcode in T.14: S1 = Unknown device S2 = Power1not same type as Power2	Contact the distributor near to you.

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Table 130. Fault codes

| Fault code	Fault	Possible cause	Correcting measures
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size. Make identification run.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Problem detected in encoder signals. Subcode in T.14: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed 5 = Encoder board missing	Check encoder channel connections. Check the encoder board. Check encoder frequency in open loop.
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 option board parameters again.
49	Division by zero in application	Division by zero has occurred in application program.	Contact your distributor if the fault re-occurs while the converter is in run state. If you are application programmer check the application program.
50	Analogue input I_{in} < 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.	Check 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 keypad (or NCDrive) and the frequency converter is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken	Check installation. If installation is correct contact the nearest Vacon distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest Vacon distributor.
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded. More inputs are selected than actually connected. PT100 cable is broken.	Find the cause of temperature rise.
57	Identification	Identification run has failed.	Run command was removed before completion of identification run. Motor is not connected to frequency converter. There is load on motor shaft.

Table 130. Fault codes

Fault code	Fault	Possible cause	Correcting measures
58	Brake	Actual status of the brake is different from the control signal.	Check mechanical brake state and connections.
59	Follower commu-nication	SystemBus or CAN communication is broken between Master and Follower	Check option board parameters. Check optical fibre cable or CAN cable.
60	Cooling	Coolant circulation on liquid-cooled drive has failed.	Check reason for the failure on external system.
61	Speed error	Motor speed is unequal to reference	Check encoder connection. PMS motor has exceeded the pull out torque.
62	Run disable	Run enable signal is low	Check reason for 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	Check the main power switch of the drive.
65	PT100 board 2 temp fault	Temperature limit values set for the PT100 board parameters have been exceeded. More inputs are selected than actually connected. PT100 cable is broken.	Find the cause of temperature rise.
74	Follower fault	When using normal Master Follower function this fault code is given if one or more follower drives trip to fault.	

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