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USER'S MANUAL

NXL FREQUENCY CONVERTERS

LOCAL REMOTE APPLICATION MANUAL

ALFIFF27

INDEX

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1. LOCAL/REMOTE CONTROL APPLICATION

1.1 Introduction

Utilising the NXL Local/Remote Control Application ALFIFF27 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.

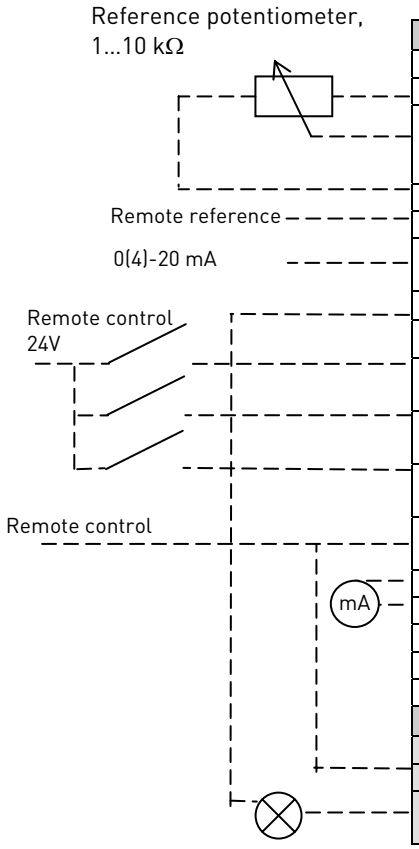
- All outputs are freely programmable.

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
- 3 prohibit frequency areas
- 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 2 of this manual. The explanations are arranged according to the individual ID number of the parameter.

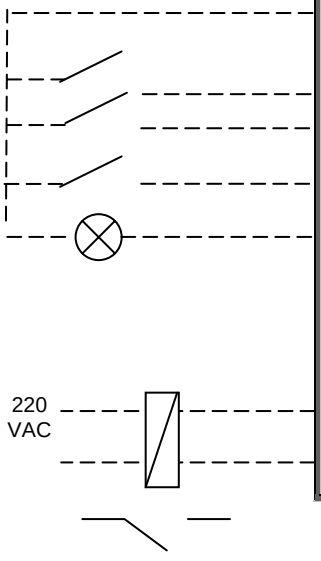
1.2 Control I/O



NXL internal I/O board			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
	AI1+	Analogue input, voltage range 0—10V DC.	Place B frequency reference Range 0-10 V DC
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, voltage range 0—10V DC, or current range 0/4—20mA	Place A frequency reference Range 0-20 mA
5	AI2-/GND		
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)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = No fault Contact closed = Fault
11	GND	I/O ground	Ground for reference and controls
18	AO1+	Output frequency Analogue output	Programmable. Range 0—20 mA/R_L, max. 500Ω
19	AO1-		
A	RS 485	Serial bus	Differential receiver/transmitter
B	RS 485	Serial bus	Differential receiver/transmitter
30	+24V	24V aux. input voltage	Control power supply backup
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		

Figure 1-1. Local/Remote application default I/O configuration.

I/O terminals on the option board OPT-AA



Terminal		Signal in application	Description
X3			
1	+24V	Control voltage output	Voltage for switches etc, max. 150 mA
2	GND	I/O ground	Ground for reference and controls
3	DIE1	Place B: start forward (programmable)	Contact closed = start forward
4	DIE2	Place B: start reverse (programmable)	Contact closed = start reverse
5	DIE3	Control place A/B selection	Contact open = Place A is active Contact closed = Place B is active
6	DO1	Exp. D01 READY	Open collector output, 50mA/48V, programmable
X5			
24	ROE1	Relay output 2, FAULT	Expander Relay output 1 (NO), function programmable Switching capacity: 24VDC/8A 250VAC/8A 125VDC/0,4A
25	ROE1		
26	ROE1		

Figure 1-2. I/O terminals of option board OPT-AA in Local/Remote application

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1.3 Control signal logic in Local/Remote Application

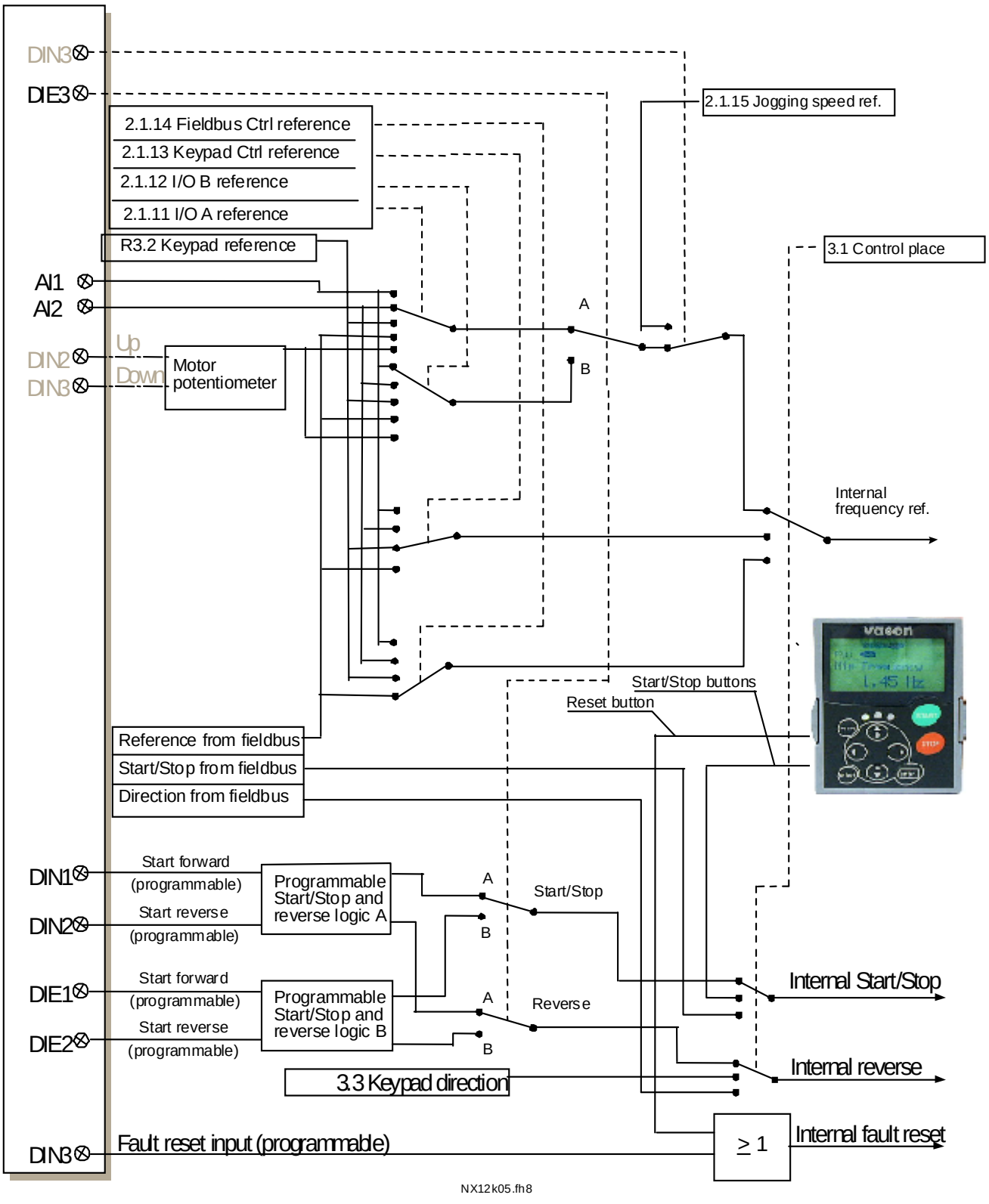

Figure 1-3. Control signal logic of the Local/Remote Control Application

1.4 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 16 to 55.

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.

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.

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	Output current ot motor
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	Output voltage to motor
V1.8	DC link voltage	V	7	DC Voltage at DC link
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Analogue input 1	V	13	AI1
V1.11	Analogue input 2	mA	14	AI2
V1.12	DIN1, DIN2, DIN3		15	Digital input statuses
V1.13	DIE1, DIE2, DIE3		16	Option board digital input statuses
V1.14	DO1, RO1, RO2		17	Digital and relay output statuses
V1.15	Analogue I_{out}	mA	26	AO1

Table 1-1. Monitoring values

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

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	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 x I_H	2 x I_H	A	I_L		107	NOTE: Formulas applies approximately up to MF3. For greater sizes, consult the factory
P2.1.6	Nominal voltage of the motor	180	690	V	NXL2: 230V NXL5: 400V		110	
P2.1.7	Nominal frequency of the motor	30,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	300	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	0,3 x I_L	1,5 x I_L	A	I_L		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 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	Par. 2.1.2	Hz	0,00		124	

Table 1-2. Basic parameters G2.1

1.4.3 Input signals (Control keypad: Menu M2 → G2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1	Place A Start/Stop logic selection	0	8		0		300	0 Start fwd / Start rvs 1 Start/Stop / Reverse 2 Start/Stop / RunEnable 3 Start pulse / Stop pulse 4 Start fwd / Mot.pot.UP 5 Fwd* / Rvs* 6 Start*/Stop / Rvs/Fwd 7 Start*/Stop / RunEnable 8 Start fwd* / Mot.pot.UP (DIN1 / DIN2)
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	21		10		377	**10**=AI1 (**1**=Local, **0**=input 1) **11**=AI2 (**1**=Local, **1**= input 2) **20**=Exp. AI1 (**2**=exp.board **0**=input 1) **21**=Exp AI2 (**2**=exp.board **1**=input 2)
P2.2.4	AI1 signal range	0	2		0		320	**0**=0...100%** **1**=20...100%** **2**=Custom setting range**
P2.2.5	AI1 custom setting minimum	0,00	100,00	%	0,00		321	Analogue input 1 scale minimum
P2.2.6	AI1 custom setting maximum	0,00	100,00	%	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	21		11		388	As par. 2.2.3
P2.2.10	AI2 signal range	0	2		1		325	**0**=0 – 20 mA** **1**=4 – 20 mA** **2**=custom setting range
P2.2.11	AI2 custom setting minimum	0,00	100,00	%	0,00		326	Analogue input 2 scale minimum
P2.2.12	AI2 custom setting maximum	0,00	100,00	%	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

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P2.2.15	Place B Start/Stop logic selection	0	6		0		363		DIE1	DIE2
								0	Start fwd	Start rvs
								1	Start/Stop	Rvs/Fwd
								2	Start/Stop	Run enable
								3	Start pulse	Stop pulse
								4	Fwd*	Rvs*
								5	Start*/Stop	Rvs/Fwd
								6	Start*/Stop	Run enable
P2.2.16	Place A Reference scaling minimum value	0,00	P2.2.17	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	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal 0,00 = No scaling >0 = scaled max. value		
P2.2.18	Place B Reference scaling minimum value	0,00	P2.2.19	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**=U_{in} (analogue volt. input **2**=I_{in} (analogue curr. input)		
P2.2.21	Free analogue input, function	0	4		0		362	**0**=No function **1**=Reduces current limit (par. 2.1.5) **2**=Reduces DC braking current **3**=Reduces accel. and decel. times **4**=Reduces torque supervision limit		
P2.2.22	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331			
P2.2.23	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down		
P2.2.24	Start pulse memory	0	1		0		498	**0**=Run state not copied **1**=Run state copied		

Table 1-3. Input signals, G2.2

1.4.4 Output signals (Control keypad: Menu M2 → G2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	AO1 signal selection	0	21		10		464	TTF programming method used.
P2.3.2	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**=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	Par. 2.1.2	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

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P2.3.13	Output frequency limit 2; Supervision value	0,00	Par. 2.1.2	Hz	0,00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	**0**=No **1**=Low limit **2**=High limit
P2.3.15	Torque limit supervision value	0,0	200,0	%	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 signal selection	0			0.1		471	TTF programming method used.
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	

Table 1-4. Output signals, G2.3

1.4.5 Drive control parameters (Control keypad: Menu M2 → 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	1		0		505	**0**=Ramp **1**=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	0,15x I_N	1,5x I_N	A	Varies		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	0,15x I_N	1,5x I_N	A	0,00		519	

Table 1-5. Drive control parameters, G2.4

1.4.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	P2.5.2	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	P2.5.4	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	P2.5.6	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	

Table 1-6. Prohibit frequency parameters, G2.5

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1.4.7 Motor control parameters (Control keypad: Menu M2 → 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% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. 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 = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	0,00		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies	6,0	601	
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

Table 1-7. Motor control parameters, G2.6

1.4.8 Protections (Control keypad: Menu M2 → 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	Par. 2.1.2	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	3		3		727	0=No response 1=Warning 2=Fault,stop acc. to 2.4.7 3=Fault,stop by coasting
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	45		707	
P2.7.12	Motor duty cycle	0	100	%	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	0,10	I_L	A	1,00		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	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

Table 1-8. Protections, G2.7

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1.4.9 Autorestart parameters (Control keypad: Menu M2 → 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 par. 2.4.6
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	

Table 1-9. Autorestart parameters, G2.8

1.4.10 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.

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	Par. 2.1.1	Par. 2.1.2	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

Table 1-10. Keypad control parameters, M3

1.4.11 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.

1.4.12 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 .

2. DESCRIPTION OF PARAMETERS

On the following pages you will find the parameter descriptions arranged according to the individual ID number of the parameter.

101 *Minimum frequency* *(2.1.1)*

102 *Maximum frequency* *(2.1.2)*

Defines the frequency limits of the frequency converter.
The maximum value for these parameters is 320 Hz.
The software will automatically check the values of parameters ID105, ID106 and ID728.

103 *Acceleration time 1* *(2.1.3)*

104 *Deceleration time 1* *(2.1.4)*

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

107 *Current limit* *(2.1.5)*

This parameter determines the maximum motor current from the frequency converter. The parameter value range differs from size to size. When this parameter is changed the stall current limit (ID710) is internally calculated to 90% of current limit.

108 *U/f ratio selection* *(2.6.3)*

Linear: 0	The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. Linear U/f ration should be used in constant torque applications. **This default setting should be used if there is no special need for another setting**.
Squared: 1	The voltage of the motor changes following a squared curve form with the frequency in the area from 0 Hz to the field weakening point where the nominal voltage is also supplied to the motor. The motor runs undermagnetised below the field weakening point and produces less torque and electromechanical noise. Squared U/f ratio can be used in applications where torque demand of the load is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

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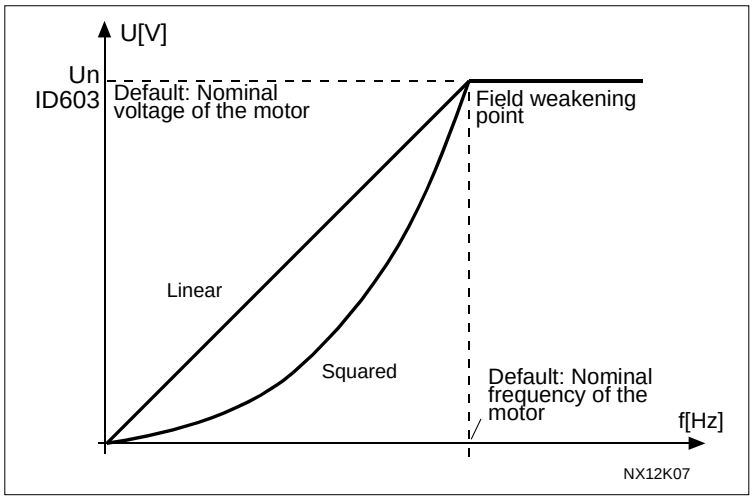

Figure 2-1. Linear and squared change of motor voltage

Programmable U/f curve:

2 The U/f curve can be programmed with three different points. Programmable U/f curve can be used if the other settings do not satisfy the needs of the application.

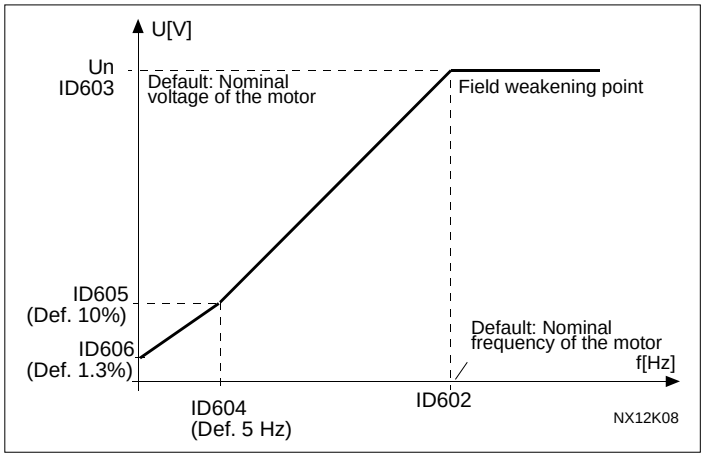

Figure 2-2. Programmable U/f curve

Linear with flux optimisation:

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

109 U/f optimisation (2.6.2)

Automatic torque boost The voltage to the motor changes automatically which makes the motor produce sufficient torque to start and run at low frequencies. The voltage increase depends on the motor type and power. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors.

EXAMPLE:
What changes are required to start with load from 0 Hz?

♦ First set the motor nominal values (Parameter group 2.1).

Option 1: Activate the Automatic torque boost.

Option 2: Programmable U/f curve
To get torque you need to set the zero point voltage and midpoint voltage/frequency (in parameter group 2.6) so that the motor takes enough current at low frequencies. First set par. ID108 to *Programmable U/f curve* (value 2). Increase zero point voltage (ID606) 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 (2.1.6)

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 (2.1.7)

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 (2.1.8)

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

113 Nominal current of the motor (2.1.9)

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

114 Stop button activated (3.4)

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.

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117 I/O A frequency reference selection (2.1.11)

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

Selection	
0	Analogue volt.ref. Terminals 2-3
1	Analogue curr.ref. Terminals 4-5
2	Keypad reference (Menu M3)
3	Fieldbus reference
4	Motor Potentiometer

Table 2-1. Selections for parameter ID117

120 Motor cos phi (2.1.10)

Find this value "cos phi" on the rating plate of the motor.

121 Keypad frequency reference selection (2.1.13)

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

Selection	
0	Analogue volt.ref. Terminals 2–3
1	Analogue curr.ref. Terminals 4–5
2	Keypad reference (Menu M3)
3	Fieldbus reference*

Table 2-2. Selections for parameter ID121

*FBSpeedReference

122 Fieldbus frequency reference selection (2.1.14)

Defines which frequency reference source is selected when controlled from the fieldbus. For selections in different applications, see ID121.

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.

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 (2.1.15)

Defines the jogging speed selected with the DIN3 digital input which can be programmed for Jogging speed. See parameter ID301.

Parameter value is automatically limited between minimum and maximum frequency (ID's 101 and 102).

131 *I/O frequency reference selection, place B* *(2.1.12)*

See the values of the parameter ID117 above

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300 Start/Stop logic selection (2.2.1)

0 DIN1: closed contact = start forward
DIN2: closed contact = start reverse

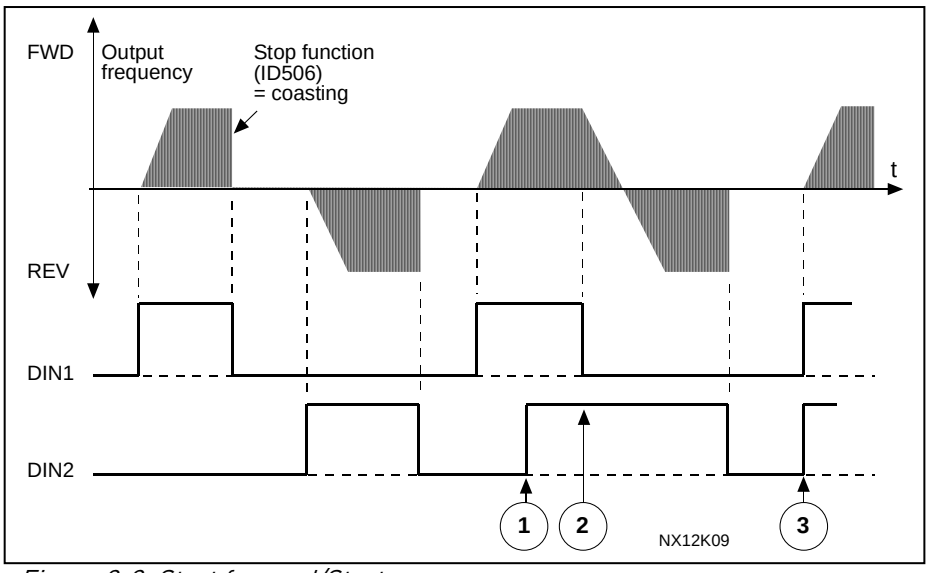

Figure 2-3. Start forward/Start reverse

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 = start open contact = stop
DIN2: closed contact = reverse open contact = forward
See below.

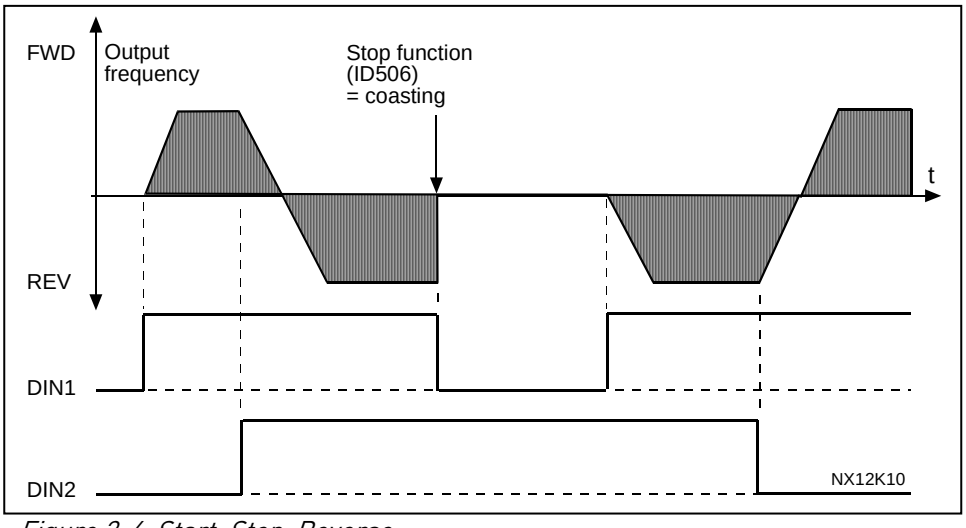

Figure 2-4. Start, Stop, Reverse

2 DIN1: closed contact = 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)

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 2-5.

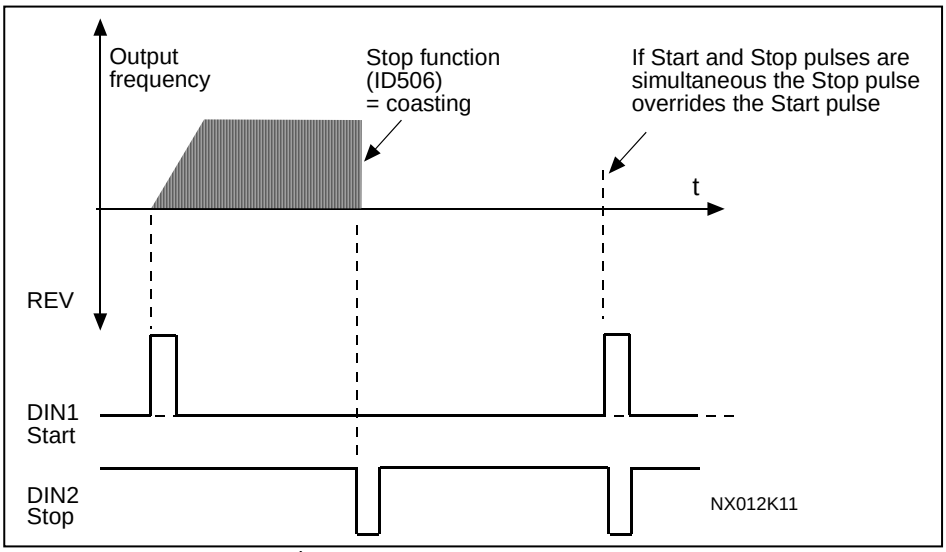

Figure 2-5. Start pulse/ Stop pulse.

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

4 DIN1: closed contact = start forward **(Rising edge required to start)**
DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if par. ID117 is set to 3 or 4).

5 DIN1: closed contact = start Forward **(Rising edge required to start)**
open contact = stop
DIN2: closed contact = Start Reverse
open contact = stop **(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

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

DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if par. ID117 is set to 3 or 4).

301 DIN3 function (2.2.2)

0 Not used
1 External fault, closing contact = Fault is shown and motor is stopped when the input is active.
2 External fault, opening contact = Fault is shown and motor is stopped when the input is not active.
3 Run enable, contact open = Motor start disabled and the motor is stopped
contact closed = Motor start enabled

4 Acc./Dec time select. contact open = Acceleration/deceleration time 1 selected
contact closed = Acceleration/deceleration time 2 selected

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

6 Closing contact: Force control place to keypad

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

8 Reverse contact open = Forward
contact closed = Reverse
Can be used for reversing if start signal 2 is used for other functions

9 Jogging sp. contact closed = Jogging speed selected for frequency reference
10 Fault reset contact closed = Resets all faults
11 Acc./dec. operation prohibited
contact closed = Stops acceleration or deceleration until the contact is opened
12 DC-braking command
contact closed = In Stop mode, the DC-braking operates until the contact is opened, see

Figure 2-6

13 Motor potentiometer down
contact closed = Reference decreases until the contact is opened

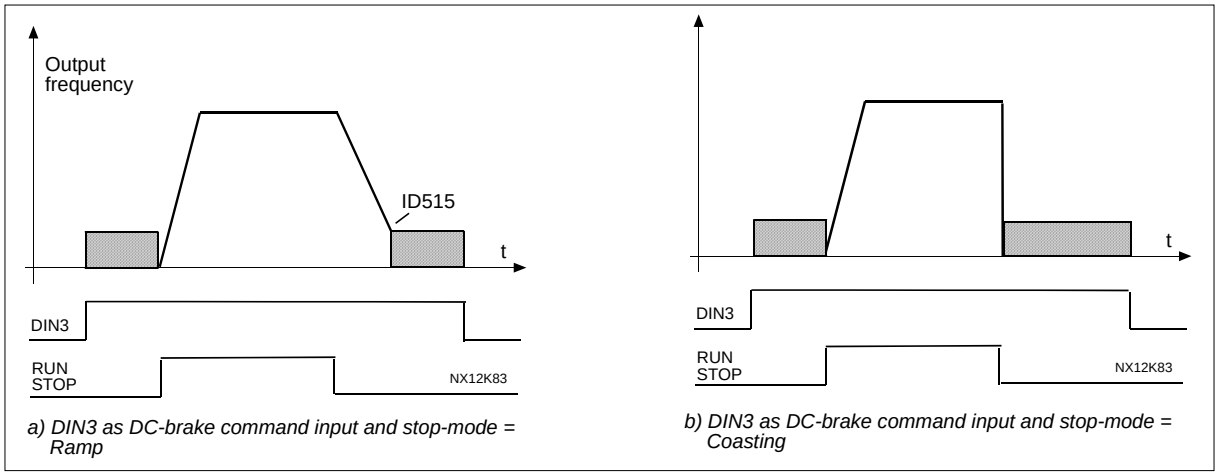

Figure 2-6. DIN3 as DC-brake command input: a) Stop mode = Ramp, b) Stop mode = coasting

303 ***Reference scaling, minimum value*** *(2.2.16)*

304 ***Reference scaling, maximum value*** *(2.2.17)*

Setting value limits: 0 ≤ par. ID303 ≤ par. ID304 ≤ par. ID102. If both parameter ID303 and parameter ID394 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.

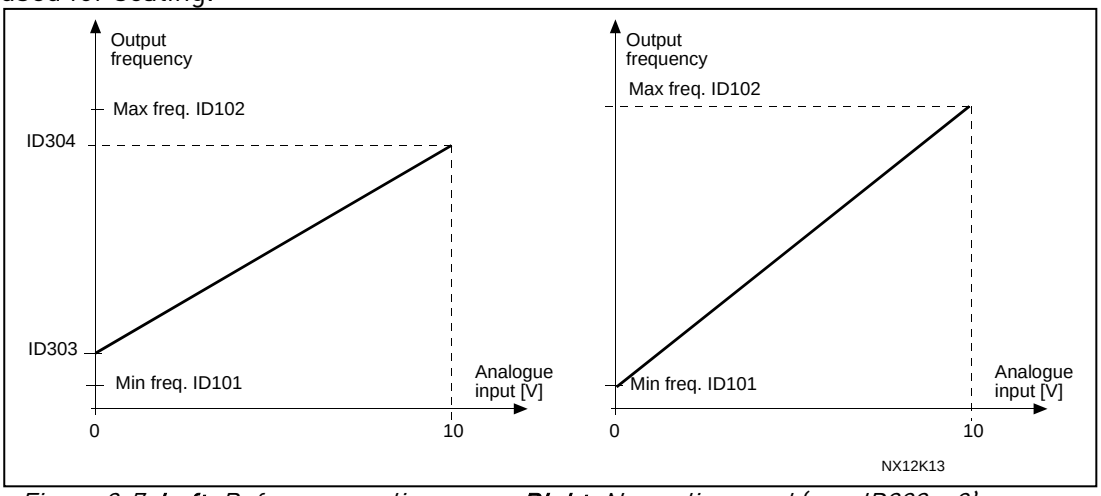

Figure 2-7. ***Left****: Reference scaling;* ***Right****: No scaling used (par. ID303 = 0).*

307 ***Analogue output function*** *(2.3.2)*

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

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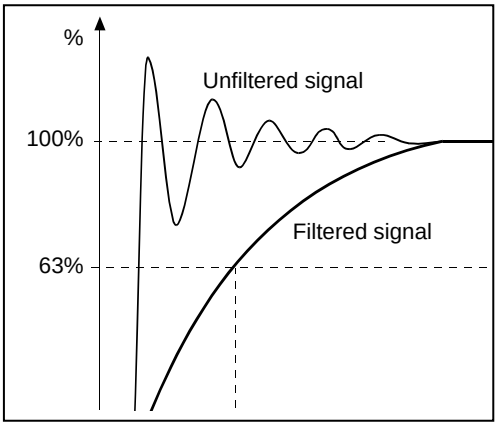
308 ***Analogue output filter time*** *(2.3.3)*

Defines the filtering time of the analogue output signal. Setting this parameter value



0 will deactivate filtering.

Figure 2-8. Analogue output filtering

309 ***Analogue output inversion*** *(2.3.4)*

Inverts the analogue output signal:

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

See parameter ID311 below.

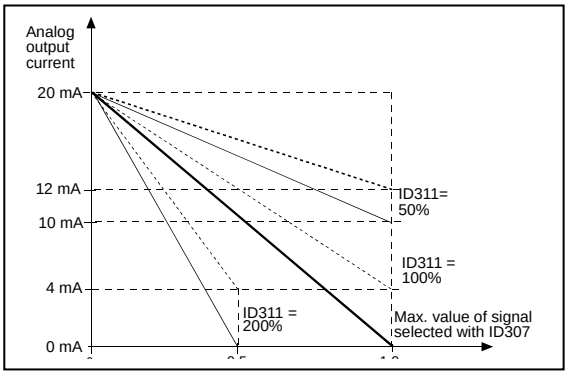


Figure 2-9. Analogue output invert

310 ***Analogue output minimum*** *(2.3.5)*

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

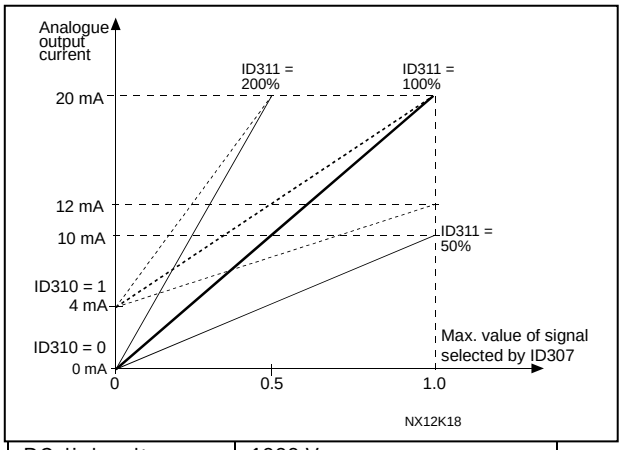
Figure 2-10).

0 Set minimum value to 0 mA
1 Set minimum value to 4 mA

311 ***Analogue output scale*** *(2.3.6)*

Scaling factor for analogue output.

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



DC-link voltage	1000 V
PI-ref. value	100% x ref. value max.
PI act. value 1	100% x actual value max.
PI act. value 2	100% x actual value max.
PI error value	100% x error value max.
PI output	100% x output max.

Table 2-3. Analogue output scaling

Figure 2-10. Analogue output scaling

312 ***Digital output function*** *(2.3.7)*
313 ***Relay output 1 function*** *(2.3.8)*
314 ***Relay output 2 function*** *(2.3.9)*

Setting value	Signal content
0 = Not used	Out of operation
	Digital output DO1 sinks the current and programmable relay (RO1, RO2) is activated when:
1 = Ready	The frequency converter is ready to operate
2 = Run	The frequency converter operates (motor is running)

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3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip not occurred
5 = Vacon 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 = Jogging speed	The jogging speed has been selected with digital input
11 = At speed	The output frequency has reached the set reference
12 = Motor regulator activated	Overvoltage or overcurrent regulator was activated
13 = Output frequency limit supervision	The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 315 and 316 below)
14 = Output freq.limit 2 supervision	The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 346 and 347 below)
15 = Torque limit supervision	The motor torque goes beyond the set supervision low limit/high limit (par. ID348 and ID349).
16 = Reference limit supervision	Active reference goes beyond the set supervision low limit/high limit (par. ID350 and ID351)
17 = External brake control	External brake ON/OFF control with programmable delay (par. ID352 and ID353)
18 = Control from I/O terminals	External control mode (Menu **M3**; ID125)
19 = Frequency converter temperature limit supervision	Frequency converter heatsink temperature goes beyond the set supervision limits (par. ID354 and ID355).
20 = Unrequested rotation direction	Rotation direction is different from the requested one.
21 = External brake control inverted	External brake ON/OFF control (par. ID352 and ID353); Output active when brake control is OFF
22 = Thermistor fault or warning	The thermistor input of option board indicates overtemperature. Fault or warning depending on parameter ID732.

Table 2-4. Output signals via DO1 and output relays RO1 and RO2.

315 ***Output frequency limit supervision function*** *(2.3.10)*

0 No supervision
1 Low limit supervision
2 High limit supervision

If the output frequency goes under/over the set limit (ID316) this function generates a warning message via the digital output DO1 or via the relay output RO1 or RO2 depending on the settings of parameters ID312...ID314.

316 ***Output frequency limit supervision value*** *(2.3.11)*

Selects the frequency value supervised by parameter ID315.

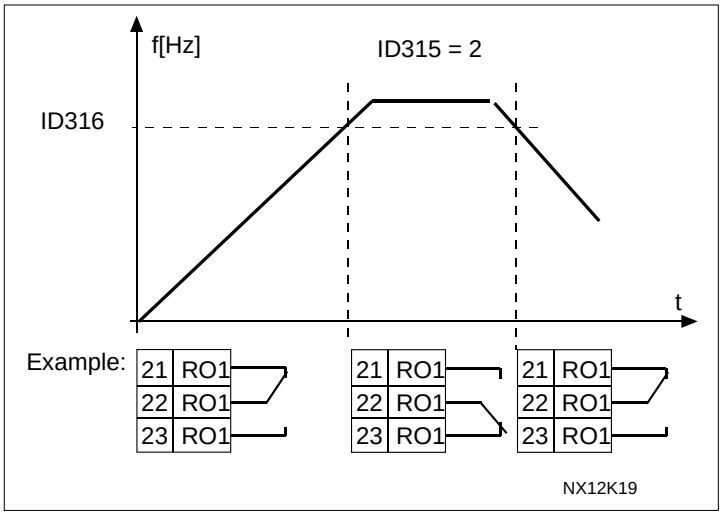


Figure 2-11. Output frequency supervision

320 ***AI1 signal range*** *(2.2.4)*

Applic. Sel.	3,4,5
0	0...100%
1	20...100%
2	Customised
3	

Table 2-5. Selections for parameter ID320

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

321 ***AI1 custom setting minimum*** *(2.2.5)*
322 ***AI1 custom setting maximum*** *(2.2.6)*

These parameters set the analogue input signal for any input signal span within 0—160%.

323 ***AI1 signal inversion*** *(2.2.7)*

If this parameter = **0**, no inversion of analogue U_{in} signal takes place.

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

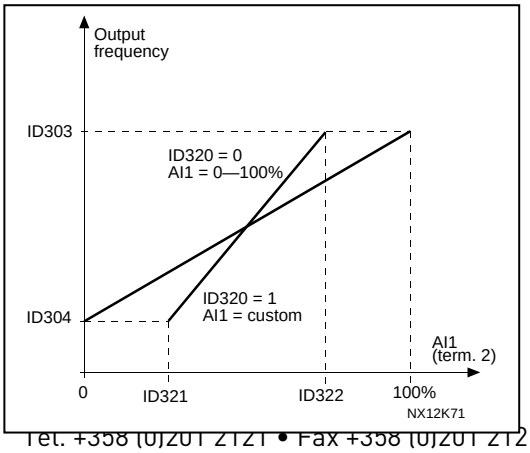


Figure 2-12. AI1 no signal inversion

If this parameter = 1 inversion of analogue signal takes place.
max. AI1 signal = minimum set speed
min. AI1 signal = maximum set speed

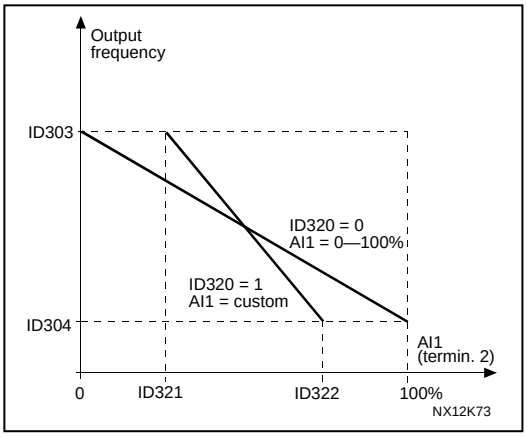


Figure 2-13. AI1 signal inversion

324 AI1 signal filter time *(2.2.8)*

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.

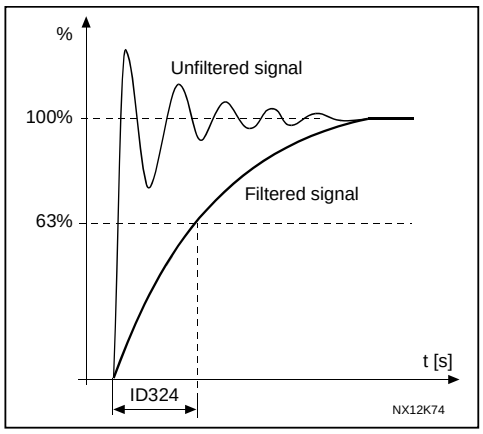


Figure 2-14. AI1 signal filtering

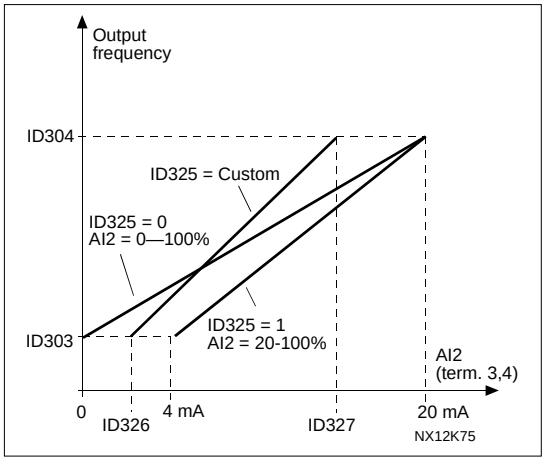
325 Analogue input AI2 signal range *(2.2.10)*

Applic. Sel.	3, 4
0	0...20mA
1	4...20mA
2	Customised
3	

Table 2-6. Selections for parameter ID325

326 *Analogue input AI2 custom setting min.* *(2.2.11)*

327 *Analogue input AI2 custom setting max.* *(2.2.12)*



These parameters set AI2 for any input signal span within 0...160%.

Figure 2-15. Analogue input AI2 scaling.

328 *Analogue input AI2 inversion* *(2.2.13)*

See ID323.

Note: AI2 is the place A frequency reference, if parameter ID117 = 1 (default)

329 *Analogue input AI2 (I_{in}) filter time* *(2.2.14)*

See ID324

346 *Output freq. limit 2 supervision function* *(2.3.12)*

0 No supervision
1 Low limit supervision
2 High limit supervision

347 *Output frequency limit 2 supervision value* *(2.3.13)*

Selects the frequency value supervised by parameter ID346.

348 *Torque limit, supervision function* *(2.3.14)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision

349 *Torque limit, supervision value* *(2.3.15)*

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

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

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350 ***Reference limit, supervision function*** *(2.3.16)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision
If the reference value falls below or exceeds the set limit (ID351), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2
Depending on the settings of parameters ID312 to ID314

The supervised reference is the current active reference. It can be place A or B reference depending on DIN6 input, or panel reference if the panel is the active control place.

351 ***Reference limit, supervision value*** *(2.3.17)*

The frequency value to be supervised with the parameter ID350.

352 ***External brake-off delay*** *(2.3.18)*

353 ***External brake-on delay*** *(2.3.19)*

The function of the external brake can be timed to the start and stop control signals with these parameters. See Figure 2-16.
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

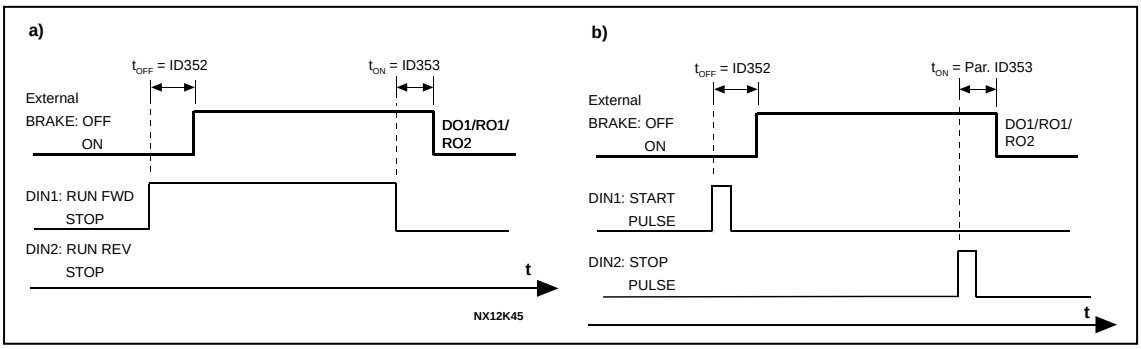

Figure 2-16. External brake control:
a) Start/Stop logic selection, ID300 = 0, 1 or 2
b) Start/Stop logic selection, ID300= 3

354 ***Frequency converter temperature limit supervision*** *(2.3.20)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision

If the temperature of the frequency converter unit falls below or exceeds the set limit (ID355), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2
Depending on the settings of parameters ID312 to ID314

355 ***Frequency converter temperature limit value*** *(2.3.21)*

This temperature value is supervised by parameter ID354.

361 ***Free analogue input, signal selection*** *(2.2.20)*

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

0 = Not in use
1 = Voltage signal U_{in}
2 = Current signal I_{in}

362 ***Free analogue input, function*** *(2.2.21)*

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)

This signal will adjust the maximum motor current between 0 and max. limit set with ID107.

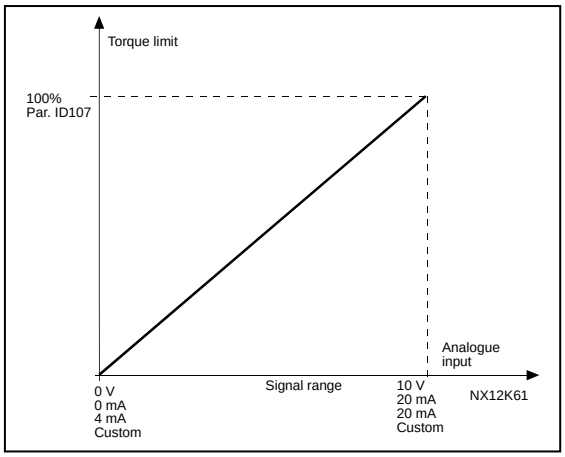

Figure 2-17. Scaling of max. motor current

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.

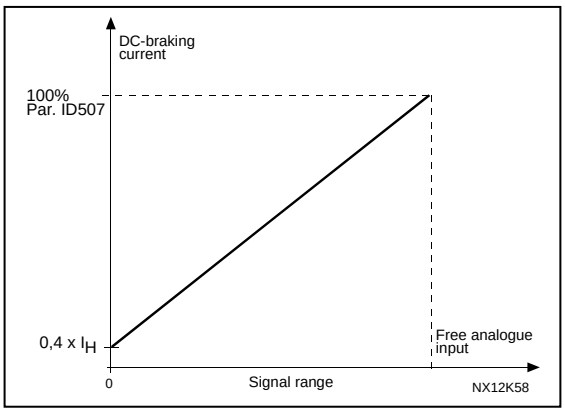

Figure 2-18. Reduction of DC braking current

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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.

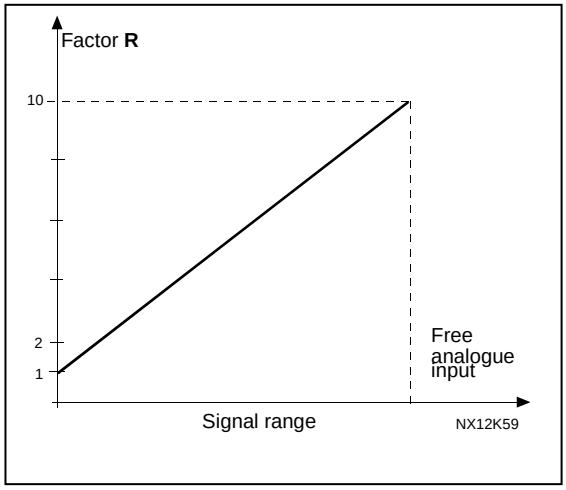

Figure 2-19. Reduction of acceleration and deceleration times

4 = Reduces torque supervision limit

Set supervision limit can be reduced with the free analogue input signal between 0 and set supervision limit (ID349).

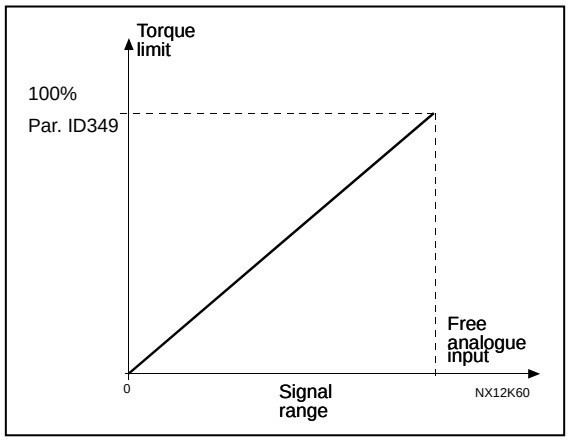

Figure 2-20. Reduction of torque supervision limit

363 Start/Stop logic selection, place B (2.2.15)

0 DIE1: closed contact = start forward
DIE2: closed contact = start reverse

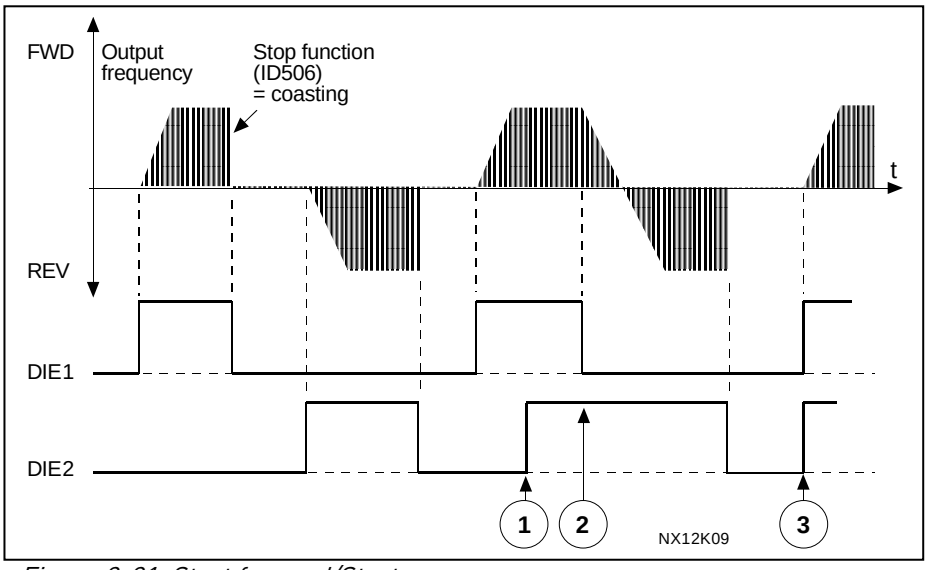

Figure 2-21. Start forward/Start reverse

① The first selected direction has the highest priority.

② When the DIE1 contact opens the direction of rotation starts the change.

③ If Start forward (DIE1) and Start reverse (DIE2) signals are active simultaneously the Start forward signal (DIE1) has priority.

1 DIE1: closed contact = start open contact = stop
DIE2: closed contact = reverse open contact = forward

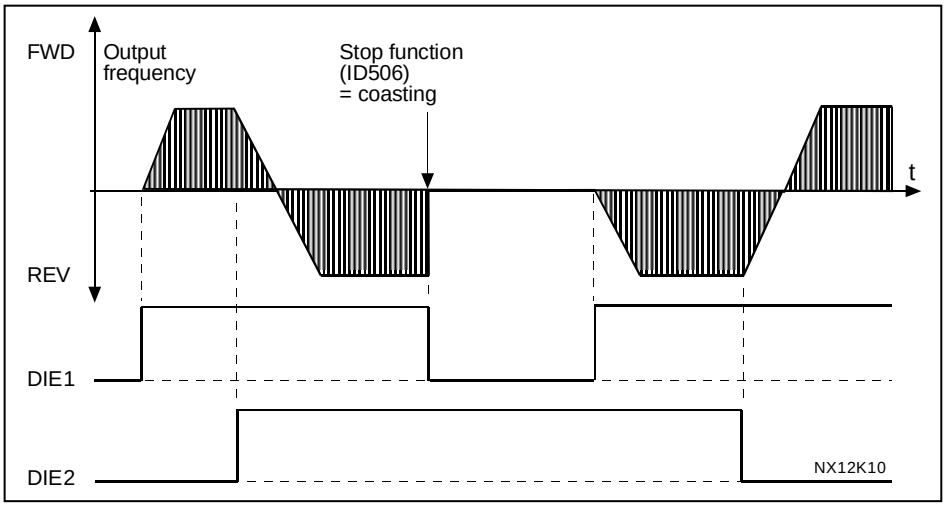

Figure 2-22. Start, Stop, Reverse

2 DIE1: closed contact = start open contact = stop
DIE2: closed contact = start enabled open contact = start disabled and drive stopped if running

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3 3-wire connection (pulse control):
DIE1: closed contact = start pulse
DIE2: open contact = stop pulse
(DIN3 can be programmed for reverse command)

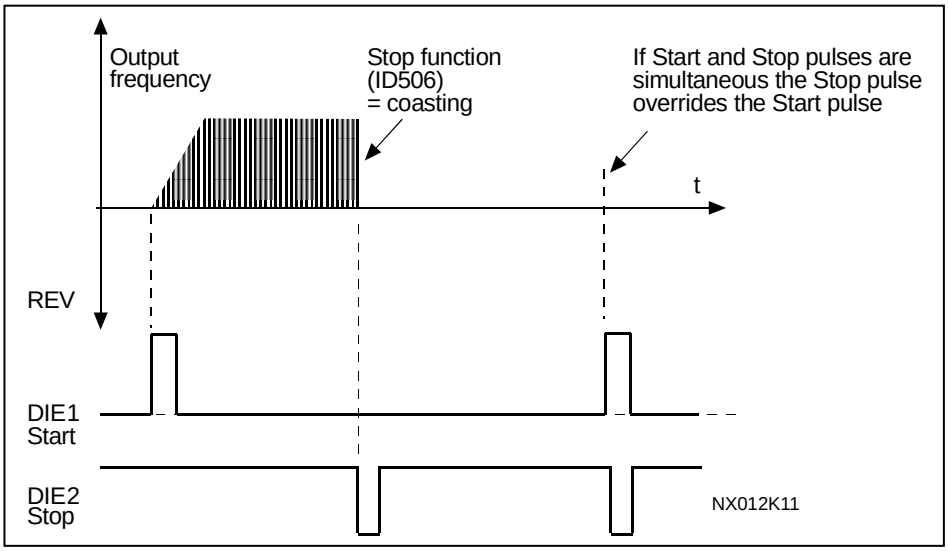


Figure 2-23. Start pulse/ Stop pulse.

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 DIE1: closed contact = start forward **(Rising edge required to start)**
DIE2: closed contact = start reverse **(Rising edge required to start)**

5 DIE1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIE2: closed contact = reverse
open contact = forward

6 DIE1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIE2: closed contact = start enabled
open contact = start disabled and drive stopped if running

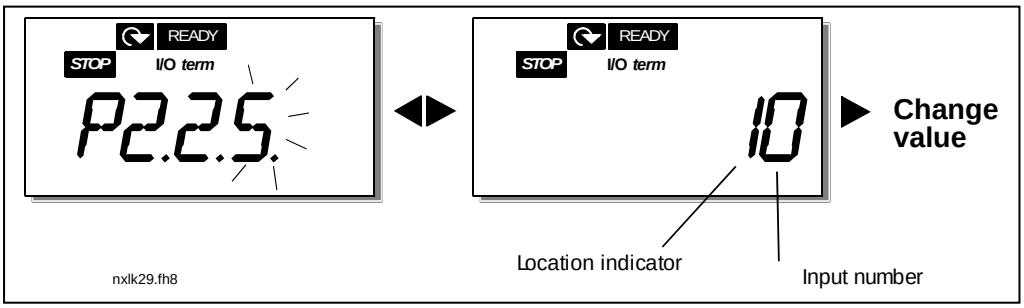
364 Reference scaling, minimum value, place B *(2.2.18)*
365 Reference scaling, maximum value, place B *(2.2.19)*

See parameters ID303 and ID304 above.

331 Motor potentiometer ramp time *(2.2.22)*

Defines the speed of change of the motor potentiometer value (Hz/s).

377 *AI1 signal selection* *(2.2.3)*



Connect the AI1 signal to the analogue input of your choice with this parameter.
Figure 1- 1. AI1 signal selection

The value of this parameter is formed of the *board indicator* and the *respective input terminal number*. See Figure 1- 2 above.

Board indicator **1**	= Local inputs
Board indicator **2**	= Expander board inputs
Input number **0**	= Input 1
Input number **1**	= Input 2
Input number **2**	= Input 3
⋮	
Input number **9**	= Input 10

Example:
If you set the value of this parameter to **10**, you have selected the local input **1** for the AI1 signal. Again, if the value is set to **21**, the expander board input **2** has been selected for the AI1 signal.
If you want to use the values of analogue input signal for e.g. testing purposes only, you can set the parameter value to **0** - **9**. In this case, value **0** corresponds to **0%**, value **1** corresponds to **20%** and any value between **2** and **9** corresponds to **100%**.

NOTE: It is possible to use the TTF method with Ncdrive (A.1 = 10, A.2 = 11...)

367 *Motor potentiometer memory reset (Frequency reference)* *(2.2.23)*

0 No reset
1 Memory reset in stop and powerdown
2 Memory reset in powerdown

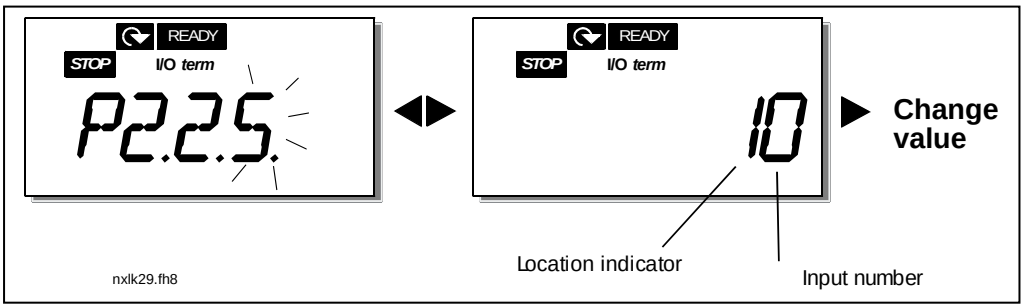
498 *Start pulse memory* *(2.2.24)*

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.

464 *Analogue output 1 signal selection* *(2.3.1)*



Connect the AO1 signal to the analogue output of your choice with this parameter.
Figure 1- 2. AO1 signal selection

The value of this parameter is formed of the *board indicator* and the *respective output terminal number*. See Figure 1- 1 above.

Board indicator **1**	= Local output
Board indicator **2**	= Expander board output
Input number **0**	= Output 1
Input number **1**	= Output 2
Input number **2**	= Output 3
⋮	
Input number **9**	= Output 10

Example:
If you set the value of this parameter to **10**, you have selected the local analogue output **1** for the AO1 signal. Again, if the value is set to **21**, the expander board analogue output **2** has been selected for the AO1 signal. (Not available on the OPTAA board)

NOTE: It is possible to use the TTF method with NCdrive (A.1 = 10, A.2 = 11…)

471 *Analogue output 2 signal selection* *(2.3.22)*

See description for ID464 above

472 *Analogue output 2 function* *(2.3.23)*
473 *Analogue output 2 filter time* *(2.3.24)*
474 *Analogue output 2 inversion* *(2.3.25)*
475 *Analogue output 2 minimum* *(2.3.26)*
476 *Analogue output 2 scaling* *(2.3.27)*

For more information on these five parameters, see the corresponding parameters for the analogue output 1.

500 *Acceleration/Deceleration ramp 1 shape* *(2.4.1)*

501 ***Acceleration/Deceleration ramp 2 shape*** *(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).

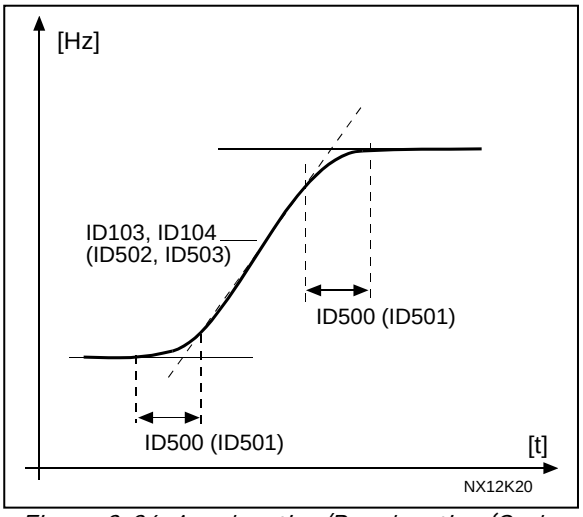


Figure 2-24. Acceleration/Deceleration (S-shaped)

502 ***Acceleration time 2*** *(2.4.3)*
503 ***Deceleration time 2*** *(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*** *(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). 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).

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Flying start:

1 The frequency converter is able to start into a running motor by applying a small torque to motor and searching for the frequency corresponding to the speed the motor is running at. Searching starts from the maximum frequency towards the actual frequency until the correct value is detected. Thereafter, the output frequency will be increased/decreased to the set reference value according to the set acceleration/deceleration parameters.

Use this mode if the motor is coasting when the start command is given. With the flying start it is possible to ride through short mains voltage interruptions.

506 Stop function (2.4.7)

Coasting:

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

Ramp:

1 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters.
If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

Normal stop: Ramp/ Run Enable stop: coasting

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

Normal stop: Coasting/ Run Enable stop: ramping

3 The motor coasts to a halt without any control from the frequency converter. However, when Run Enable signal is selected, the speed of the motor is decelerated according to the set deceleration parameters. If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

507 DC-braking current (2.4.8)

Defines the current injected into the motor during DC-braking.

508 DC-braking time at stop (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.

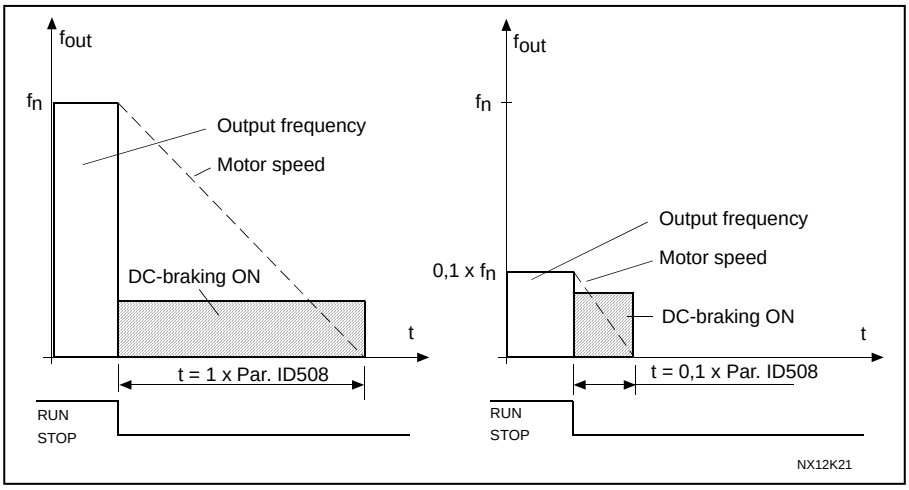

Figure 2-25. DC-braking time when Stop mode = Coasting.

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.

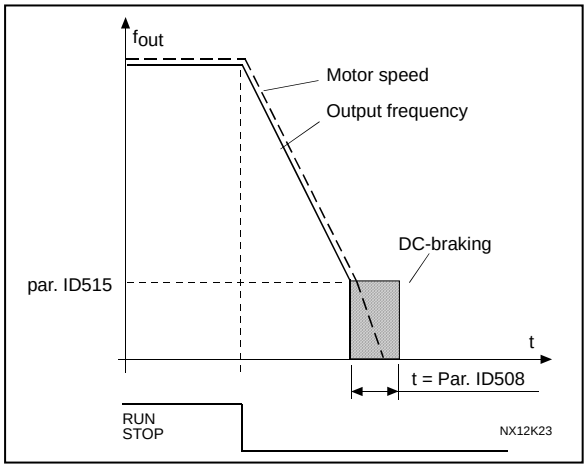

Figure 2-26. DC-braking time when Stop mode = Ramp

515 DC-braking frequency at stop (2.4.10)

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

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

DC-brake is activated when the start command is given. This parameter defines the time before the brake is released. After the brake is released, the output frequency increases according to the set start function by parameter ID505

519 ***Flux braking current*** *(2.4.13)*

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

520 ***Flux brake*** *(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.

509 ***Prohibit frequency area 1; Low limit*** *(2.5.1)*
510 ***Prohibit frequency area 1; High limit*** *(2.5.2)*
511 ***Prohibit frequency area 2; Low limit*** *(2.5.3)*
512 ***Prohibit frequency area 2; High limit*** *(2.5.4)*
513 ***Prohibit frequency area 3; Low limit*** *(2.5.5)*
514 ***Prohibit frequency area 3; High limit*** *(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.

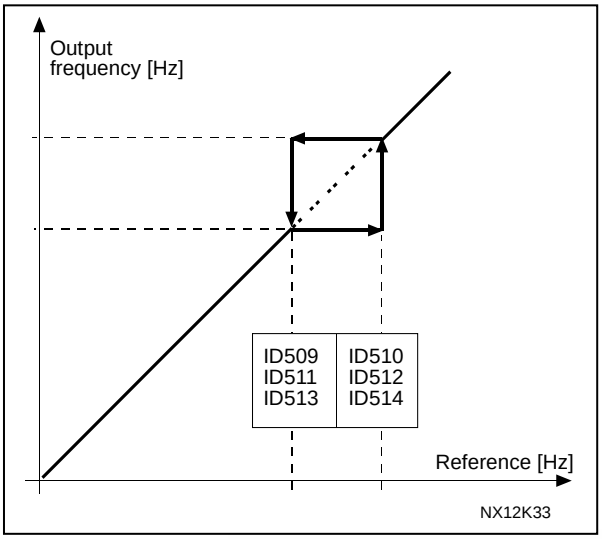

Figure 2-27. Example of prohibit frequency area setting.

518 ***Acceleration/deceleration ramp speed scaling ratio between prohibit frequency limits*** *(2.5.7)*

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits (parameters ID509 and ID510). The ramping speed (selected acceleration/ deceleration time 1 or 2) is multiplied with this factor. E.g. value 0.1 makes the acceleration time 10 times shorter than outside the prohibit frequency range limits.

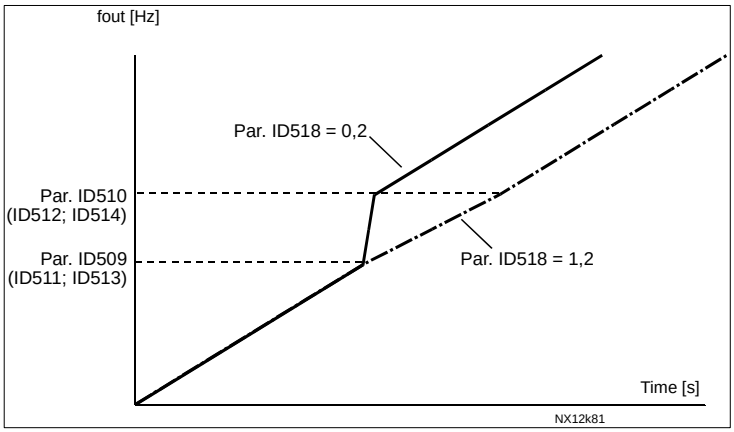

Figure 2-28. Ramp speed scaling between prohibit frequencies

600 ***Motor control mode***

0	Frequency control:	The I/O terminal and keypad references are frequency references and the frequency converter controls the output frequency (output frequency resolution = 0.01 Hz)
1	Speed control:	The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed compensating the motor slip (accuracy ± 0,5%).

601 ***Switching frequency*** *(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.
The range of this parameter depends on the size of the frequency converter:

Type	Min. [kHz]	Max. [kHz]	Default [kHz]
0003—0061 NX_5 0003—0061 NX_2	1.0	16,0	10.0
0072—0520 NX_5	1.0	10.0	3.6
0041—0062 NX_6 0144—0208 NX_6	1.0	6.0	1.5

Table 2-7. Size-dependent switching frequencies

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

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other output filters with a low resonance frequency.

602 *Field weakening point* *(2.6.4)*

The field weakening point is the output frequency at which the output voltage reaches the set (ID603) maximum value.

603 *Voltage at field weakening point* *(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* *(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.

605 *U/f curve, middle point voltage* *(2.6.7)*

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

606 *Output voltage at zero frequency* *(2.6.8)*

If the programmable U/f curve has been selected with the parameter ID108 this parameter defines the zero frequency voltage of the curve. NOTE: If the value of parameter ID108 is changed this parameter is set to zero.

607 *Overvoltage controller* *(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.

608 *Undervoltage controller* *(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 OP frequency are made
2 Controller switched on (with ramping) = Controller adjusts OP freq. up to zero speed

700 *Response to the 4mA reference fault* *(2.7.1)*

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset 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 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2.

701 *Response to external fault* *(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. The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

702 *Output phase supervision* *(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* *(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* *(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

If tripping is selected the drive will stop and activate the fault stage.
Deactivating the protection, i.e. setting parameter to 0, will reset the thermal stage of the motor to 0%..

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705 ***Motor thermal protection: Motor ambient temp. factor*** *(2.7.9)*

The factor can be set between -100.0%—100.0%.

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

The current can be set between 0—150.0% x I_{nMotor}. This parameter sets the value for thermal current at zero frequency.

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).

Note: The value is set as a percentage of the motor name plate data, par. ID113 (Nominal current of motor), not the drive's nominal output current. The motor's nominal current is the current that the motor can withstand in direct on-line use without being overheated.

If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value.
Setting this parameter does not affect the maximum output current of the drive which is determined by parameter ID107 alone.

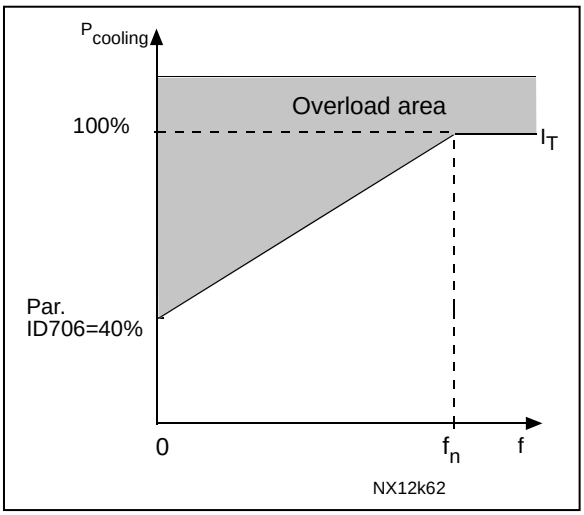

Figure 2-29. Motor thermal current I_T curve

707 ***Motor thermal protection: Time constant*** *(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.

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.

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

Defines how much of the nominal motor load is applied.
The value can be set to 0%...100%..

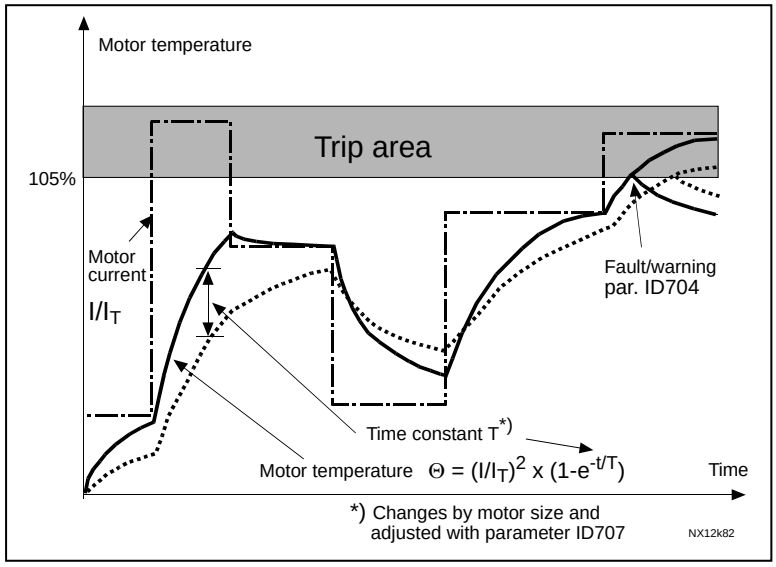

Figure 2-30. Motor temperature calculation

709 *Stall protection* *(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.

710 *Stall current limit* *(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 2-31. The software does not allow entering a greater value than 2*I_H. If parameter ID107 Nominal current limit of motor is changed, this parameter is automatically calculated to 90% of the current limit.

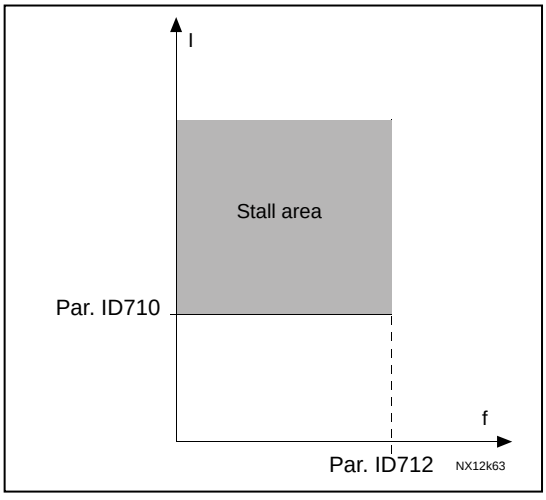

Figure 2-31. Stall characteristics settings

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711 ***Stall time*** *(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).

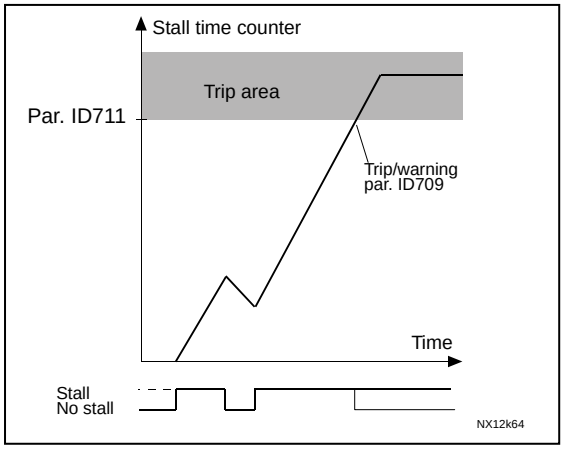

Figure 2-32. Stall time count

712 ***Stall frequency limit*** *(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.

713 ***Underload protection*** *(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

If tripping is set active the drive will stop and activate the fault stage.
Deactivating the protection by setting the parameter to 0 will reset the underload time counter to zero.

714 ***Underload protection, field weakening area load*** *(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.

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

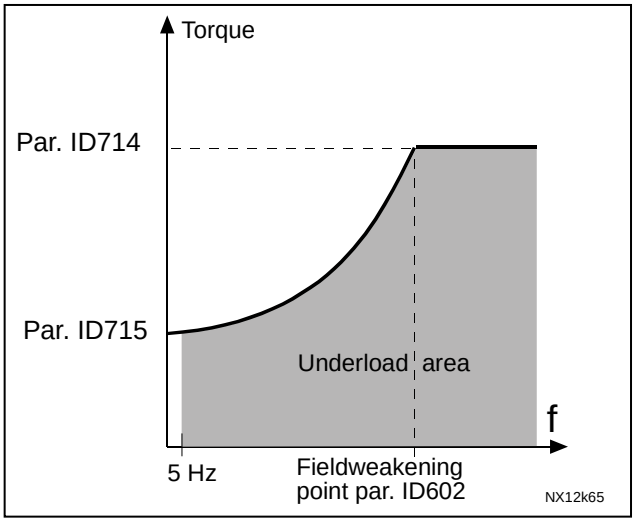

Figure 2-33. Setting of minimum load

715 ***Underload protection, zero frequency load*** *(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.

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

716 ***Underload time*** *(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.

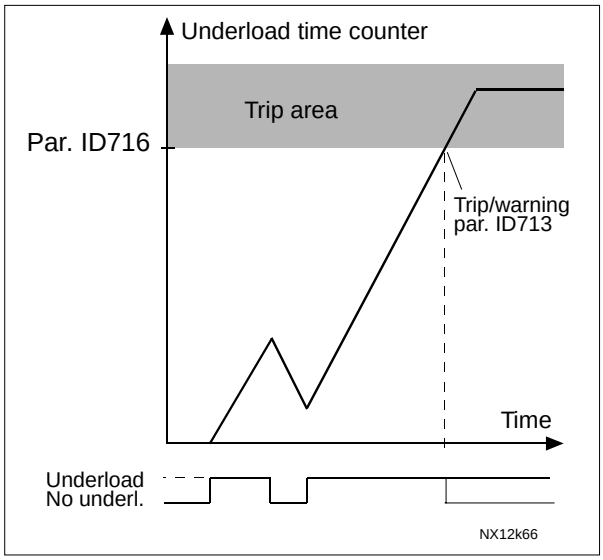

Figure 2-34. Underload time counter function

717 ***Automatic restart: Wait time*** *(2.8.1)*

Defines the time before the frequency converter tries to automatically restart the motor after the fault has disappeared.

718 ***Automatic restart: Trial time*** *(2.8.2)*

The Automatic restart function restarts the frequency converter when the faults selected with parameters ID720 to ID725 have disappeared and the waiting time has elapsed.

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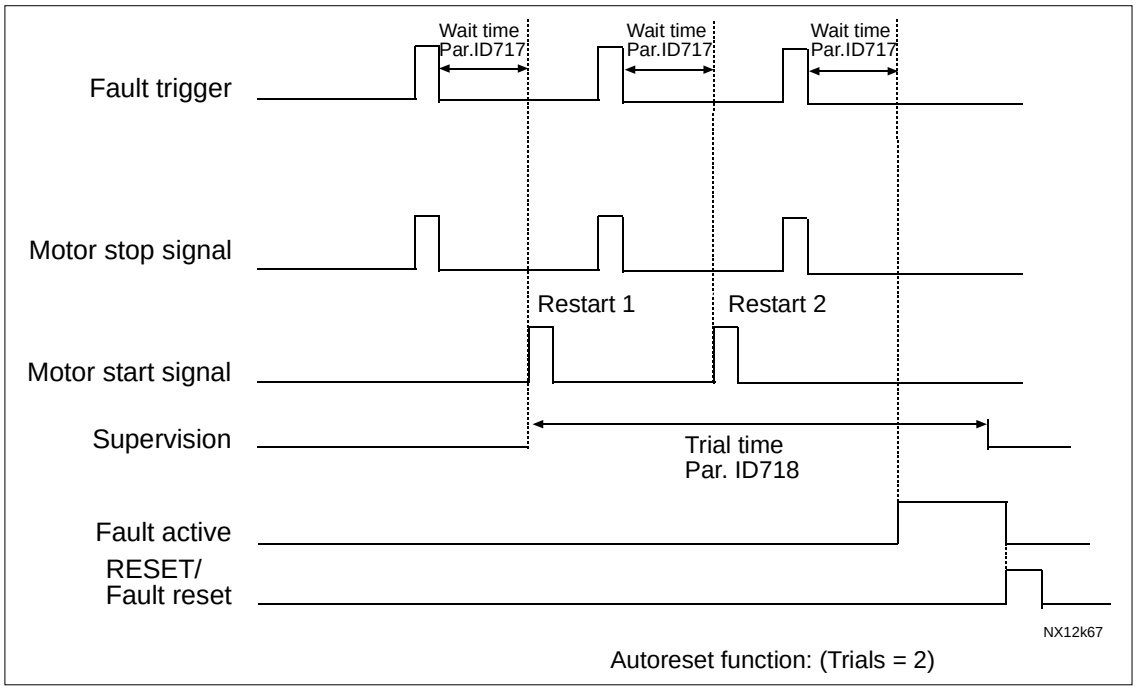

Figure 2-35. Example of Automatic restarts with two restarts

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 autorestart. 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 *[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 *[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*** *[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*** *[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*** *[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 (≥4mA)

725 ***Automatic restart: Number of tries after external fault trip*** *[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*** *[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

732 ***Response to thermistor fault*** *[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*** *[2.7.22]*

Set here the response mode for the fieldbus fault if a fieldbus board is used. For more information, see the respective Fieldbus Board Manual.

See parameter ID732.

734 ***Response to slot fault*** *[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

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