USER'S MANUAL

NX FREQUENCY CONVERTERS

WINDER APPLICATION

ASFIFF18

INDEX

Winder Application for NXS (ASFIFF18)

1. Introduction

Select the Winder Application in menu M6 on page *S6.2*. ASFIF18 is designed for NXS use. If you are using NXP use Winder Application for NXP (APFIFF26). Although ASFIFF18 can be download to NXP, application don't use NXP drive higher performance.

The Winder Application can be used for the control of winder or unwinder drives. The winder operation is possible in both open loop and closed loop control modes (using an encoder on the motor shaft). The unwinder operation requires the closed loop control mode. This application can control the tension of the material to an approximately constant value through the radius range, without the aid of tension feedback devices. The application also supports tension and speed feedback devices to get more accurate operation. The radius can be estimated by comparing the line speed reference with the actual drive speed or it can be measured.
The control system receives reference values for line speed and material tension. The conversion to motor speed and torque is based on the radius.

- The Winder application has to know the radius to be able to operate.
- The line speed reference is always needed regardless of operation mode
  - In line tension control, the line speed reference can be replaced by actual line speed.
  - In line speed control, the drive also needs information about the actual line speed.
- The Winder Application has the same I/O control logic as the Multipurpose Application.
- The Start command is always given through DIA1 and/or DIA2 and the motor rotation direction is determined in line speed control mode as direction of web and in tension control mode as direction of torque.

Additional functions:

- Torque compensation while accelerating or decelerating in tension control
- Static friction compensation
- Viscous friction compensation
- Web break monitoring
- Open loop torque linearization
- 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
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

2. Function / terminal programming methods

There are two methods for programming the input and output signals for the NX drives.
The first method is called FTT or Function To Terminal, the other method is called TTF or Terminal To Function.

In FTT the terminal appears as a parameter and the user defines what function he wants to be activated for the specific terminal. This is the traditional way of I/O programming. See. Figure 1

In the figure, the function "Run Enable" is connected to DIN3.

P2.2.2 DIN3 function:
0= Not Used
1= Ext.Fault (cc)
2= Ext.Fault (oc)
3= Run Enable
4= Acc/Dec....

Figure 1. The FTT method

In TTF, the different functions appear as parameters and the user defines the terminal he wants to connect the function to. This method allows a flexible use of additional I/O boards. See Figure 2

P2.2.2.1 Run Enable= *0.1*
P2.2.2.2 Reverse= 0.1
P2.2.2.3 Fault Reset= A.6
P2.2.2.4 Ext Fault Close= A.3

Figure 2. The TTF method

In the figure, the function "Run Enable" is connected to Slot A Terminal 3 = DIN3,
"External Fault" to DIN6,
"External Fault, inverted" to the virtual board with value TRUE, i.e. NOT active,
"Acc/Dec time sel" to the virtual board with value FALSE, i.e. NOT active.

The first letter describes the Slot (0 = virtual slot) and the number is the index number of the terminal.
Depending on the option board, there can be several (or no) inputs and/or outputs available.
If there are both inputs and outputs on the same board the first input is named A.1 but the first output is also named A.1.
NOTE!
With this method is it possible to have several signals connected to one hardware input, but only one signal can be controlling one hardware output.

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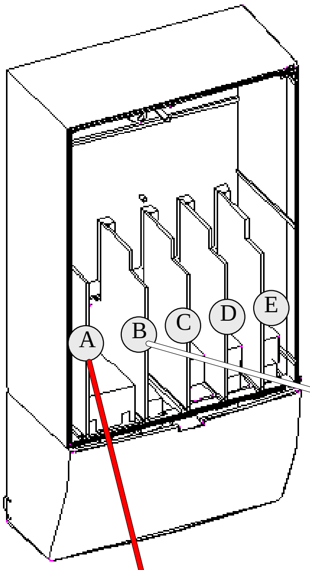


Virtual Board in slot 0:

Analog In	1	2	3	4	5	6	7	8	9	10
Digital In	1	2	3	4	5	6	7	8	9	10
Analog Out	1	2	3	4	5	6	7	8	9	10
Digital Out	1	2	3	4	5	6	7	8	9	10

	1	2	3-10
Analog In	0%	20%	100%
Digital In	FALSE	TRUE	TRUE

Using eg. for testing purpose!

NXOPTA2 in slot B:

Analog In	1	2	3	4	5	6	7	8	9	10
Digital In	1	2	3	4	5	6	7	8	9	10
Analog Out	1	2	3	4	5	6	7	8	9	10
Digital Out	1	2	3	4	5	6	7	8	9	10

NXOPTA1 in slot A:

Analog In	1	2	3	4	5	6	7	8	9	10
Digital In	1	2	3	4	5	6	7	8	9	10
Analog Out	1	2	3	4	5	6	7	8	9	10
Digital Out	1	2	3	4	5	6	7	8	9	10

Figure 3. Capacity of interface board

Each option card can have up to 10 inputs and /or outputs of each type, but all 10 are not necessary used on every board (the amount of terminals causes limitations).

The standard option cards are described in Figure 3. Capacity of interface board .

NXOPTA1 in slot A has:
2 analog inputs, referred to as A.1 and A.2 when programming.
6 digital inputs, referred to as A.1...A.6 when programming.
1 analog output, referred to as A.1 when programming.
1 digital output, referred to as A.1 when programming.

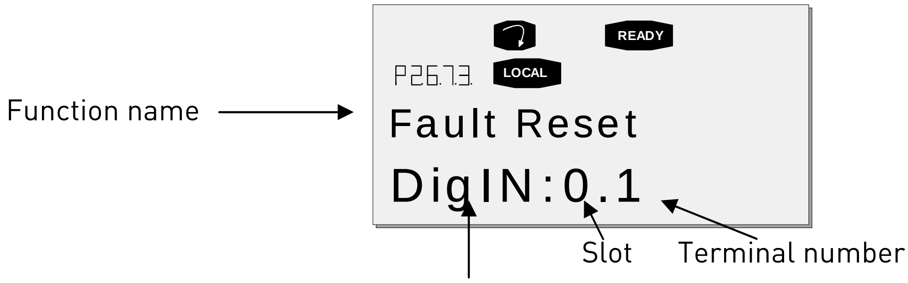
NXOPTA2 in slot B has:
2 digital outputs available, referred to as B.1 and B.2 when programming.

Some of the I/O's on the same board are referred to with the same letter-number combination (e.g. A.1). Note, however, that they represent different types of I/O's. Each type numbering starts from 1.

Functions that are not used are programmed to the "virtual board" in slot 0. Depending on the needed value or level, the number is set to 1, 2 or 3.

2.1 Defining an input for a certain function on keypad

Connecting a certain terminal (input/output) to a certain function is done by giving the parameter an appropriate value. The value is formed of the *Board slot* on the Vacon NX control board (see Vacon NX User's Manual, Chapter 6.2) and the *respective signal number*, see below.



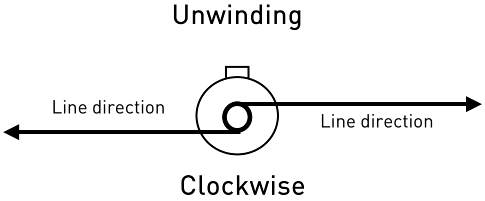
3. Winder application control basics

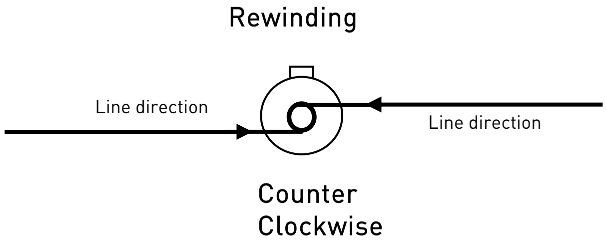
3.1 Starting direction

Select starting direction as shown below.

3.1.1 Speed control

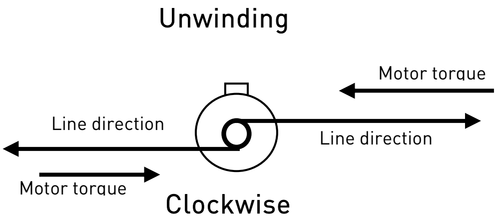
Motor starting direction is the same as the line direction seen from the shaft end.

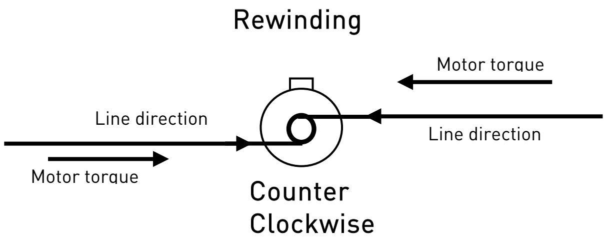




3.1.2 Tension control

Motor starting direction is defined as direction of torque. Regardless of the drive being an unwinder or a rewinder.





	Open Loop (NXS)	Closed Loop (NXP)	Supported Feedbacks		
			Radius	Tension	Act. Speed
Tension control					
Rewinder forward	*	*	*	*	*
Unwinder forward		*	*	*	*
Rewinder reverse	*	*	*	*	*
Unwinder forward		*	*	*	*
Speed control					
Rewinder forward	*	*	*		*
Unwinder forward		(Contact factory)	*		*
Rewinder reverse	*	*	*		*
Unwinder forward		(Contact factory)	*		*

3.1.3 *Generating side operations*

When the motor is in the generating side (unwinding or making fast ramping stop) the motor power is fed to the DC-link of the frequency converter. If that power aren't used anywhere the motor cannot produce the necessary tension torque or maintain the line speed. Therefore the drive must be equipped with a brake chopper and a brake resistor. The brake chopper is activated with parameter 2.4.5. The brake resistor parameters can be found in the system menu. The internal brake resistor is rarely sufficient for this kind of operation.

3.2 References and actual values

3.2.1 *Requirements for radius calculation*

The Winder application needs the radius value to be able to operate. The radius value can be given through an analogue input or a fielbus. In tension control mode, the radius can be calculated from the line speed reference and the actual motor speed. In speed control mode, the radius can be calculated from the line speed reference and the actual line speed.

3.2.2 *Speed control*

When using the speed controlled mode, the drive needs the line speed references and the actual line speed or the actual radius.

3.2.3 *Slack recovery*

Slack recovery removes slack from line. When slack recovery function is active the drive is in speed control.

When the slack recovery parameters 2.9.4.4 and 2.9.4.5 are set to zero, the drive will immediately work under speed reference or torque reference.

The Winder application works under slack recovery, until the set time has expired and there is enough torque on the motor shaft. After the slack recovery, references are switched to correspond to calculated radius and line speed references or the line tension reference.

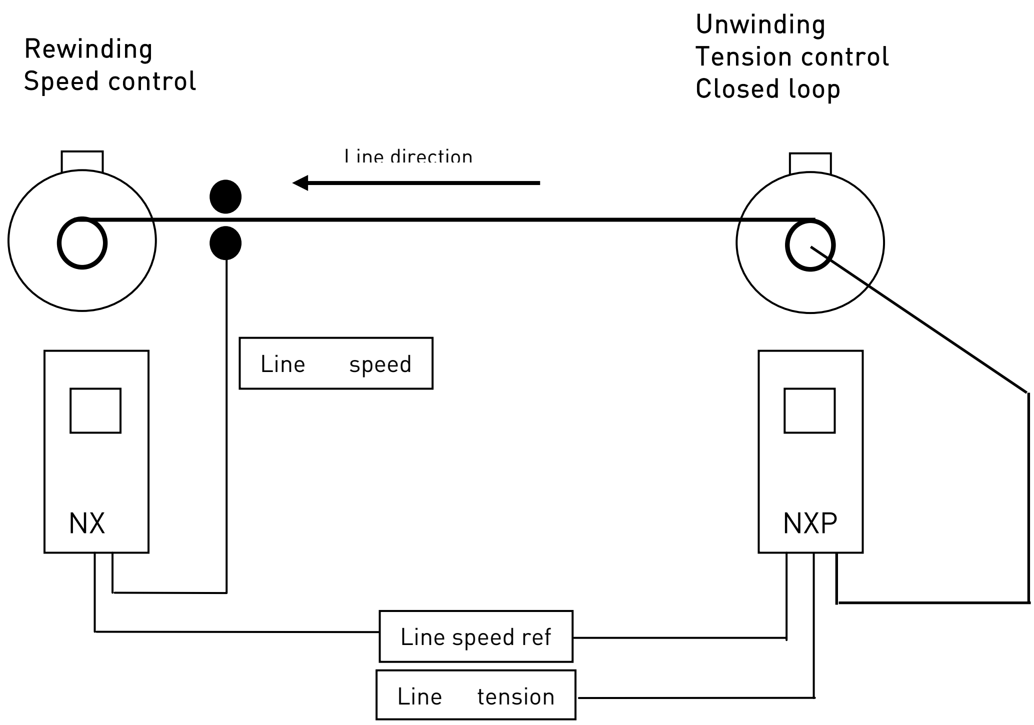
The unwinder tension control mode is always used in slack recovery. The drive gives torque according to tension and the speed is limited to slack recovery frequency.

3.2.4 *Tension control*

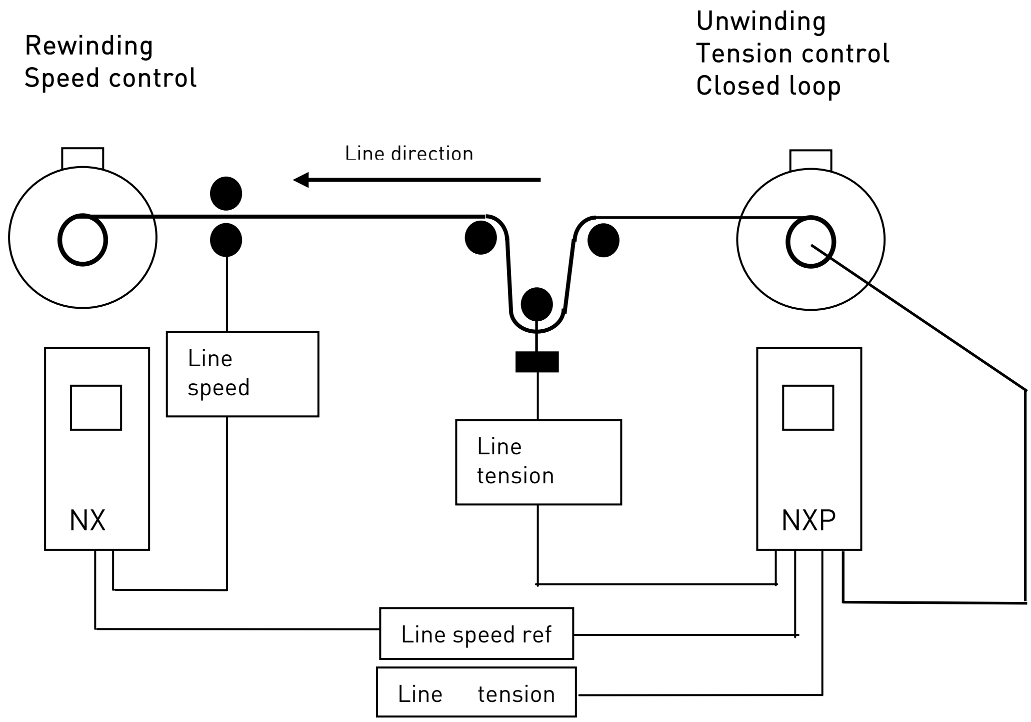
When using the tension control, it is recommended to use the line speed reference value, which is used by the line speed controller, since the actual line speed measurement delay may cause miscalculation of inertia torque. The line speed reference must be ramped externally slower than the line speed controller can achieve. Otherwise the drive receives a wrong value of line speed, which causes miscalculation of radius and/or inertia compensation.

3.2.5 *Requirements for inertia compensation*

Inertia compensation needs the correct radius value and an accurate speed value. Because the actual line speed value is often unstable or there is delay in measurement it is recommended to use the line speed reference.

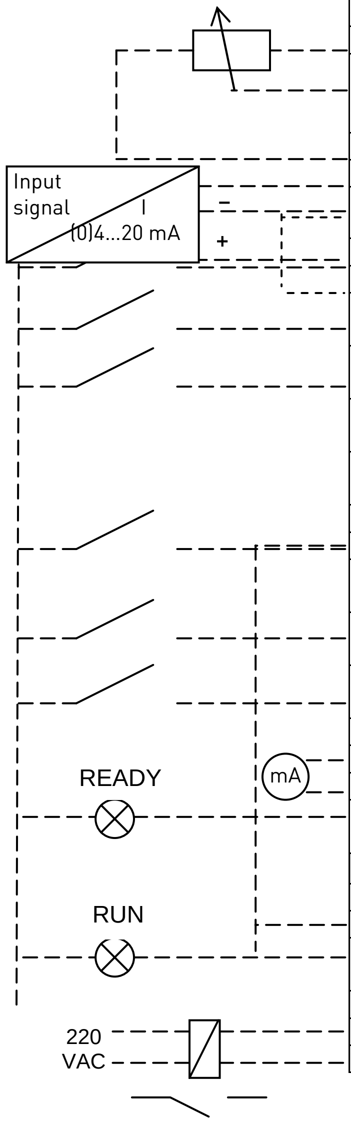


Direct roll to roll winding



Direct roll to roll winding with tension feedback

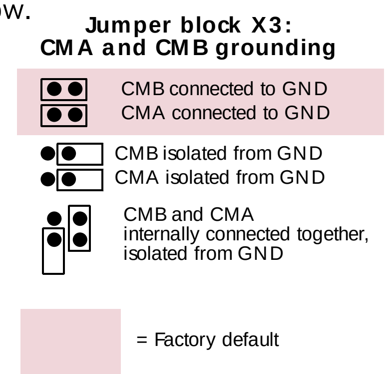
4. Control I/O



NXOPTA1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input for line reference or actual Programmable
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Current input line reference or actual Programmable
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)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for 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	(programmable)	
15	DIN5	(programmable)	
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
NXOPTA2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Table 4-1. Winder application default I/O configuration.

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



5. Winder 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 29 to 75.

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 (used with PC tools)
(grey) = In parameter row: Use TTF method to program these parameters.
(cyan) = On parameter code: Parameter value can only be changed after the frequency converter has been stopped.

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.

Code	Parameter	Unit	ID	Description
V1.1.1	Output frequency	Hz	1	Output frequency to motor
V1.1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.1.3	Motor speed	rpm	2	Motor speed in rpm
V1.1.4	Motor current	A	3	
V1.1.5	Motor torque	%	4	In % of the nominal motor torque
V1.1.6	Motor power	%	5	Motor shaft power
V1.1.7	Motor voltage	V	6	
V1.1.8	DC link voltage	V	7	
V1.1.9	Unit temperature	°C	8	Heatsink temperature
V1.1.10	Motor temperature	%	9	Calculated motor temperature
V1.1.11	Voltage input	V	13	AI1
V1.1.12	Current input	mA	14	AI2
V1.1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.1.15	Analogue I_{out}	mA	26	AO1

Table 5-1. Monitoring values

5.1.1 Winder monitoring values

Code	Parameter	Unit	ID	Description
V1.2.1	Winder radius	%	1600	
V1.2.2	Line speed reference	%	1556	
V1.2.3	Line speed actual	%	1557	
V1.2.4	Torque reference	%	18	
V1.2.5	Speed Reference	Hz	1504	
V1.2.6	Speed reference limit	Hz	1508	
V1.2.7	Radius Old	%	1509	
V1.2.8	Positive frequency limit	Hz	1552	
V1.2.9	Negative frequency limit	Hz	1553	
V1.2.10	Line speed derivate		1554	
V1.2.11	Roll inertia	%	1513	
V1.2.9	Inertia torque	%	1555	
V1.2.13	Tension torque	%	1515	
V1.2.14	Viscous torque	%	1516	
V1.2.15	Static torque	%	1517	
V1.2.16	Tension Actual	&	1506	
V1.2.17	PIC torque	%	1518	
V1.2.18	Motoring torque limit	%	1550	
V1.2.19	Release torque limit	%	1551	
V1.2.20	Tension reference	%	1558	
V1.2.21	Taper reference	%	1559	
V1.2.22	Open loop torque compensation	%	1560	
V1.2.23	Base Inertia	Kgm^2	1601	

Table 5-2. Winder monitoring values

V1.2.1 Winder radius

Radius on keypad has not been limited via minimum radius or maximum radius (100%) to confirm the correct actual and/or reference values scaling. Internally used radius is limited from minimum radius to 100,00 %.

V1.2.2 Line speed reference

Used line speed reference value.

V1.2.3 Line speed actual

Actual line speed if measurement in use.

V1.2.4 Torque Reference

Includes friction and inertia compensations. In testing mode, the torque reference also includes friction compensations and inertia compensation.

V1.2.5 Speed Reference

Pure speed reference from radius and line speed reference.

V1.2.6 Speed Reference limit

Speed reference limit, which is calculated from old radius and line speed reference

V1.2.7 *Radius old*

Radius value, which is used for calculating speed reference limit.

V1.2.8 *Positive frequency limit*

Positive speed limit given from application

V1.2.9 *Negative frequency limit*

Negative speed limit given from application

V1.2.10 *Line speed derivate*

Derivate from line speed reference

V1.2.11 *Roll inertia*

Roll inertia value, which is used to calculate acceleration compensation.

V1.2.9 *Inertia torque*

Actual torque, which is used for acceleration compensation. Part of torque reference.

V1.2.13 *Tension torque*

Actual torque, which is used for tension. Part of torque reference.

V1.2.14 *Viscous torque*

Amount of torque, which is used for viscous friction compensation. Part of torque reference.

V1.2.15 *Static torque*

Amount of torque, which is used fro static friction compensation. Part if torque reference.

V1.2.16 *Actual Tension*

Measured tension.

V1.2.17 *PIC torque*

When using tension feedback devices this value shown amount of used to correct tension.

V1.2.18 *Motor torque limit*

While in rewinding this value show actually used motoring torque limit. While in unwinding this value is used also for generating torque limit.

V1.2.19 *Release torque limit*

Torque what most be reached until operation mode changes to normal winding, if slack recovery is in use.

V1.2.20 *Tension reference*

Tension reference, equals full scale torque (P2.9.2.3) at 100.0 % radius.

V1.2.21 Taper reference

Taper tension reference, which is added to tension reference.

V1.2.22 Open loop torque compensation

Torque which is added in zero frequency t motoring torque limit and final torque reference.

V1.2.23 Base Inertia

Internally calculated inertia value from the motor nominal power. Reference point for empty and full winder inertia to calculate percentage values.

5.2 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_L	2,5 x I_L	A	1,5 x I_L		107	NOTE: This applies for frequency converters up to FR7. For greater sizes, consult the factory.
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	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	1 x I_L	2,5 x I_L	A	I_L		113	Check the rating plate of the motor
2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
2.1.11	I/O reference	0	3		0		117	0=AI1 1=AI2 2=Keypad 3=Fieldbus
2.1.12	Nominal Power	0	3200,0	kW	0,0		1610	Used to calculate base inertia V1.18
2.1.13	Line Speed Reference Source	0	3		0		1611	0=Not Used 1=I/O Terminal 2=Keypad 3=Fieldbus
2.1.14	Line Tension Reference Source	0	3		0		1612	0=Not Used 1=I/O Terminal 2=Keypad 3=Fieldbus
2.1.15	Line Speed Actual Source	0	2		0		1613	0=Not Used 1=I/O Terminal 2=Fieldbus
2.1.16	Radius Actual Source	0	2		0		1614	0=Not Used 1=I/O Terminal 2=Fieldbus
2.1.17	Line Tension Actual Source	0	2		0		1615	0=Not Used 1=I/O Terminal 2=Fieldbus
2.1.18	Preset Radius Value Source	0	2		0		1616	0=Not Used 1=I/O Terminal 2=Keypad 3=Fieldbus
Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note

2.1.19	Taper function source	0	2		0		1617	0=Not Used 1=I/O Terminal 2=Keypad 3=Fieldbus
2.1.20	Jogging speed reference	- Par. 2.1.2	Par. 2.1.2	Hz	0.00		124	
2.1.21	Jogging Speed Reference Input	0	1		0		1504	0 = Parameter 1 = CalcSpeedRef

Table 5-3. Basic parameters G2.1

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

5.3.1 Basic Settings (Control keypad: Menu M2 → G2.2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.1.1	Start/Stop logic	0	6		0		300	DIN1 / DIN2 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
2.2.1.2	Reference scaling minimum value	0,00	par. 2.2.5	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal 0,00 = No scaling
P2.2.1.3	Reference scaling maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the min. reference signal 0,00 = No scaling
P2.2.1.4	Reference inversion	0	1		0			0=Not inverted 1=Inverted
P2.2.1.5	Reference filter time	0,00	10,00	s	0,10		306	0 = No filtering

Table 5-4. Input signals, G2.2.1

* = Rising edge required to start

5.3.2 Digital Inputs (Control keypad: Menu M2 → G2.2.2)

Code	Parameter	Min	Default	Cust	ID	Note
2.2.2.1	Run enabled	0	0.1		407	
2.2.2.2	Reverse	0	0.1		412	
2.2.2.3	Fault reset	0	A.6		414	
2.2.2.4	External fault (close)	0	A.3		405	
2.2.2.5	External fault (open)	0	0.2		405	
2.2.2.6	Acc/Dec time selection	0	0.1		408	
2.2.2.7	Jogging speed	0	0.1		413	
2.2.2.8	Control from I/O terminal	0	0.1		409	
2.2.2.9	Control from keypad	0	0.1		410	
2.2.2.10	Control from fieldbus	0	0.1		411	
2.2.2.11	Winder mode	0	0.1		1680	
2.2.2.12	Control mode	0	0.1		1681	
2.2.2.13	Enable web break detection	0	0.2		1682	
2.2.2.14	Speed release	0	0.2		1683	
Code	Parameter	Min	Default	Cust	ID	Note
2.2.2.15	Reset radius	0	0.1		1684	
2.2.2.16	Web break	0	0.1		1685	
2.2.2.17	DC brake in stop	0	0.1		1686	
2.2.2.18	Enable PI	0	0.2		1639	

Table 5-5. Digital inputs, G2.2.2

5.3.3 Line Speed Reference (Control keypad: Menu M2 → G2.2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.3.1	Line Speed Reference signal selection	0			0.1		1620	
2.2.3.2	Line Speed Reference filter time	0.00	10.00	s	0.01		1621	
2.2.3.3	Line Speed Reference signal range	0	2		0		1622	0=0—20 mA 1=4—20 mA 2=Customised
2.2.3.4	Line Speed Reference input minimum scaling	-320.00	320.00	%	0.00		1623	
2.2.3.5	Line Speed Reference input maximum scaling	-320.00	320.00	%	100.00		1624	
2.2.3.6	Line Speed Reference signal inversion	0	1		0		1625	0=Not inverted 1=Inverted
2.2.3.7	Line Speed Reference Ramp Rate	0	100	Hz/s	0	1		0=Not in use Stabilizes inertia compensation

Table 5-6. Line speed reference, G2.2.2

5.3.4 Line Tension Reference (Control keypad: Menu M2 → G2.2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.4.1	Line Tension Reference signal selection	0			0.1		1630	
2.2.4.2	Line Tension Reference filter time	0.00		s	0.01		1631	
2.2.4.3	Line Tension Reference signal range	0	2		0		1632	0=0—20 mA 1=4—20 mA 2=Customised
2.2.4.4	Line Tension Reference input minimum scaling	-320.00	320.00	%	0.00		1633	
2.2.4.5	Line Tension Reference input maximum scaling	-320.00	320.00	%	100.00		1634	
2.2.4.6	Line Tension Reference signal inversion	0	1		0		1635	0=Not inverted 1=Inverted

Table 5-7. Tension reference, G2.2.4

5.3.5 Line Speed Actual (Control keypad: Menu M2 → G2.2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.5.1	Line Speed Actual signal selection	0			0.1		1640	
2.2.5.2	Line Speed Actual filter time	0.00		s	0.01		1641	
2.2.5.3	Line Speed Actual signal range	0	2		0		1642	0=0—20 mA 1=4—20 mA 2=Customised
2.2.5.4	Line Speed Actual input minimum scaling	-320.00	320.00	%	0.00		1643	
2.2.5.5	Line Speed Actual input maximum scaling	-320.00	320.00	%	100.00		1644	
2.2.5.6	Line Speed Actual signal inversion	0	1		0		1645	0=Not inverted 1=Inverted

Table 5-8. Speed actual, G2.2.5

5.3.6 Radius Actual (Control keypad: Menu M2 → G2.2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.6.1	Radius Actual signal selection	0			0.1		1650	
2.2.6.2	Radius Actual filter time	0.00		s	0.01		1651	
2.2.6.3	Radius Actual signal range	0	2		0		1652	0=0—20 mA 1=4—20 mA 2=Customised
2.2.6.4	Radius Actual input minimum scaling	-320.00	320.00	%	0.00		1653	
2.2.6.5	Radius Aactual input maximum scaling	-320.00	320.00	%	100.00		1654	
2.2.6.6	Radius Aactual signal inversion	0	1		0		1655	0=Not inverted 1=Inverted

Table 5-9. Radius actual, G2.2.6

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5.3.7 Line Tension Actual (Control keypad: Menu M2 → G2.2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.7.1	Tension Actual signal selection	0			0.1		1660	
2.2.7.2	Tension Actual filter time	0.00		s	0.01		1661	
2.2.7.3	Tension Actual signal range	0	2		0		1662	0=0—20 mA 1=4—20 mA 2=Customised
2.2.7.4	Tension Actual input minimum scaling	-320.00	320.00	%	0.00		1663	
2.2.7.5	Tension Actual input maximum scaling	-320.00	320.00	%	100.00		1664	
2.2.7.6	Tension Aactual signal inversion	0	1		0		1665	0=Not inverted 1=Inverted

Table 5-10. Tension actual, G2.2.7

5.3.8 Preset Radius (Control keypad: Menu M2 → G2.2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.8.1	Preset Radius signal selection	0			0.1		1670	
2.2.8.2	Preset Radius signal range	0	2		0		1671	0=0—20 mA 1=4—20 mA 2=Customised
2.2.8.3	Preset Radius input minimum scaling	-320.00	320.00	%	0.00		1672	
2.2.8.4	Preset Radius input maximum scaling	-320.00	320.00	%	100.00		1673	
2.2.8.5	Preset Radius signal inversion	0	1		0		1674	0=Not inverted 1=Inverted

Table 5-11. Preset radius, G2.2.8

5.3.9 Taper functions (Control keypad: Menu M2 → G2.2.9)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.2.9.1	Taper signal selection	0			0.1		1590	
2.2.9.2	Taper signal range	0	2		0		1591	0=0—20 mA 1=4—20 mA 2=Customised
2.2.9.3	Taper input minimum scaling	-320.00	320,00	%			1592	
2.2.9.4	Taper input maximum scaling	-320.00	320,00	%			1593	
2.2.9.5	Taper signal inversion	0	1				1594	0=Not inverted 1=Inverted
2.2.9.6	Taper minimum reference	-320.00	320,00	%			1595	
2.2.9.7	Taper maximum reference	-320.00	320,00	%			1596	

Table 5-12. Taper functions, G2.2.9

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

5.4.1 Digital outputs (Control keypad: Menu M2 → G2.3.1)

Code	Parameter	Min	Default	Cust	ID	Note
2.3.1.1	Ready	0	A.1		432	
2.3.1.2	Run	0	B.1		433	
2.3.1.3	Fault	0	B.2		434	
2.3.1.4	Fault, inverted	0	0.1		435	
2.3.1.5	Over Temperature Warn	0	0.1		439	
2.3.1.6	External Fault	0	0.1		437	
2.3.1.7	Reference fault/Warning	0	0.1		438	
2.3.1.8.	Warning	0	0.1		436	
2.3.1.9	Reverse	0	0.1		440	
2.3.1.10	Jogging	0	0.1		443	
2.3.1.11	At reference speed	0	0.1		442	
2.3.1.12	Motor regulator active	0	0.1		454	
2.3.1.13	Frequency output supervision limit	0	0.1		447	See G 2.3.4
2.3.1.14	External control place	0	0.1		444	
2.3.1.15	Motor thermal protection	0	0.1		452	
2.3.1.16	FB Digital input 1	0	0.1		455	
2.3.1.17	Slack recovery ON	0	0.1		1690	
2.3.1.18	Slack recovery OFF	0	0.1		1691	
2.3.1.19	Web Break fault or warning	0	0.1		1692	
2.3.1.20	Brake control	0	0.1		1693	

Table 5-13. Digital outputs, G2.3.1

5.4.2 Analogue output 1 (Control keypad: Menu M2 → G2.3.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.2.1	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) 9=Line speed
P2.3.2.2	Analogue output filter time	0,00	10,00	s	1,00		308	
P2.3.2.3	Analogue output inversion	0	1		0		309	0 = Not inverted 1 = Inverted
P2.3.2.4	Analogue output minimum	0	1		0		310	0 = 0 mA 1 = 4 mA
P2.3.2.5	Analogue output scale	10	1000	%	100		311	

Table 5-14. Analogue output 1, G2.3.2

5.4.3 Analogue output 2 (Control keypad: Menu M2 → G2.3.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.3.1	Analogue output 2 signal selection	0			0.1		471	TTF programming method used. See PFC application.
P2.3.3.2	Analogue output 2 function	0	8		4		472	As parameter 2.3.2.1
P2.3.3.3	Analogue output 2 filter time	0,00	10,00	s	1,00		473	
P2.3.3.4	Analogue output 2 inversion	0	1		0		474	0=Not inverted 1=Inverted
P2.3.3.5	Analogue output 2 minimum	0	1		0		475	0=0 mA 1=4 mA
P2.3.3.6	Analogue output 2 scaling	10	1000	%	1000		476	

Table 5-15. Analogue output 2, G2.3.3

5.4.4 Limit settings (Control keypad: Menu M2 → G2.3.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.4.1	Output frequency limit 1 supervision	0	1		0		475	0=No limit 1=Low limit 2=High limit
P2.3.4.2	Output frequency limit 1; supervision value	10	1000	%	1000		476	

Table 5-16. Limits, G2.3.4

5.5 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	0,0		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	3		0		504	0=Disabled 1=Used and tested in Run state 2=External brake chopper 3=Used and tested in Ready state
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	0,15 x I_n	1,5 x 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	0,00		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	0,0	Varies	A	0,0		519	
P2.4.14	Zero speed level	0,0	320.00	Hz	1,00		1500	

Table 5-17. Drive control parameters, G2.4

5.6 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	par. 2.5.2	Hz	0,00		509	
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,0		510	
P2.5.3	Prohibit acc./dec. ramp	0,1	10,0		1,0		518	

Table 5-18. Prohibit frequency parameters, G2.5

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5.7 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	NXS = 0 NXP = 1		0		600	0=Open loop 1=Closed loop
P2.6.2	U/f optimisation	0	1		0		109	0=Not used 1=Autom. 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	30,00	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	16,0	kHz	Varies		601	Depends on kW
P2.6.10	Overvoltage controller	0	2		0		607	0=Not used 1=Yes: No Ramping 2=Yes: Ramping
P2.6.11	Undervoltage controller	0	2		0		608	0=Not used 1=Used 2 =Ramping down
P2.6.12	Measured Rs voltage drop	0	32000		77		662	
P2.6.13	Load drooping	0.00	100.00	%	0.00		620	
P2.6.14	Identification	0	1		0		631	See P2.9.18
Closed Loop parameter group 2.6.15 (NXP only)								
P2.6.15.1	Magnetizing current	0.00	100.00	A	0.00		612	
P2.6.15.2	Speed control Kp	0	1000		30		613	
P2.6.15.3	Speed control Ti	0.0	500.0	ms	30.0		614	
P2.6.15.4	Acceleration Compensation	0.00	300.00	S	0.00		626	
P2.6.15.5	Slip adjust	0	500	%	100		619	
P2.6.15.6	Start magnetizing current	0	Varies	s	Varies		627	Use motor nominal current
P2.6.15.7	Start magnetizing time	0	32.000		0		628	
P2.6.15.8	Start 0 speed time	0	32000	ms	100		615	
P2.6.15.9	Stop 0 speed time	0	32000	ms	100		616	
P2.6.15.10	Start up Torque reference select	0	1		0		621	0=Not used 1=Torque memory 2=Torque reference 3=StartUp Torque fwd/rev
P2.6.15.11	Start up torque fwd	-300.0	300.0	%	0.0		633	
P2.6.15.12	Star up torque rev	-300.0	300.0	%	0.0		634	
P2.6.15.13	Encoder 1 faltering time	0	1000	ms	0		618	
P2.6.15.14	Current control Kp	0.00	100.00	%	40.00		617	

Table 5-19. Motor control parameters, G2.6

5.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Monitored signal	0	E.10		0.1		1702	Select desired signal to be monitored for 4 mA fault.
P2.7.2	Response to reference fault	0	5		0		700	0=No response 1=Warning 2=Warning+Old Freq. 3=Wrng+PresetFreq 2.7.2 4=Fault,stop acc. to 2.4.7 5=Fault,stop by coasting
P2.7.3	Reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.4	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
P2.7.5	Input phase supervision	0	3		0		730	
P2.7.6	Response to undervoltage fault	1	3		2		727	
P2.7.7	Output phase supervision	0	3		2		702	
P2.7.8	Earth fault protection	0	3		2		703	
P2.7.9	Thermal protection of the motor	0	3		2		704	
P2.7.10	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.11	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.12	Motor thermal time constant	1	200	min	10		707	
P2.7.13	Motor duty cycle	0	100	%	100		708	
P2.7.14	Stall protection	0	3		0		709	See P2.7.4
P2.7.15	Stall current	0,1	6000,0	A	10,0		710	
P2.7.16	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.17	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.18	Underload protection	0	3		0		713	See P2.7.4
P2.7.19	Underload curve at nominal frequency	10	150	%	50		714	
P2.7.20	Underload curve at zero frequency	5,0	150,0	%	10,0		715	
P2.7.21	Underload protection time limit	2	600	s	20		716	
P2.7.22	Response to thermistor fault	0	3		0		732	See P2.7.4
P2.7.23	Response to fieldbus fault	0	3		0		733	See P2.7.4
P2.7.24	Response to slot fault	0	3		0		734	See P2.7.4
P2.7.25	Brake in Fault	0	1		0		1503	

Table 5-20. Protections, G2.7

5.9 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 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	

Table 5-21. Autorestart parameters, G2.8

5.10 Winder Parameters (Control keypad: Menu M2 → G2.9)

5.10.1 Basic settings (Control keypad: Menu M2 → G2.9.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.1.1	Minimum radius	0.00	100.00	%	25.00		1700	
2.9.1.2	Winder mode	0	1		0		1701	0 = Rewinder 1 = Unwinder
2.9.1.3	Control Mode	0	1		0		1702	0 = Seed control 1 = Tension control
2.9.1.4	Radius filtering time	0.00	320.00	S	0.03		1707	Filtering time for calculated radius
2.9.1.5	Radius ramping rate	0	10	%/s	1		1703	
2.9.1.6	Radius holding frequency	0.00	20.00	Hz	3.00		1704	
2.9.1.7	Radius resetting mode	0	3		1		1705	0 = On command 1 = On Start 2 = Command, preset 3 = Start, preset
2.9.1.8	Motoring torque limit	0.0	300.0	%	100		1706	Work as tension limit if P2.9.2.3 is greater than zero
2.9.1.9	Torque limit down ramp	0.0	320	%/s	30			Speed control acceleration torque
2.9.1.10	Calculate radius from actual line speed	0	1		0		1709	0 = Tension control uses line speed reference channel to calculate radius 1 = Tension uses line speed actual channel to calculate radius
2.9.1.11	Preset radius	0.00	100.00	%	50.00		1710	
2.9.1.12	Frequency limit addition	0.00	10.00	Hz	3.00		1711	
2.9.1.13	Speed limited by radius	0	1		1		1712	Web break is monitored but frequency limit is maximum frequency
2.9.1.14	Test Mode	0	2		0		1800	0 = Winder mode 1 = OL Freq Test 2 = Direct Ref

Table 5-22. Winder basic settings, G2.9.1

5.10.2 Tension control (Control keypad: Menu M2 → G2.9.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.2.1	Static Friction	0	25.0	%	0		1720	% of motor torque
2.9.2.2	Viscous friction	0	25.0	%	0		1721	% of motor torque
2.9.2.3	Full scale torque	0	150.0	%	0.0		1722	% of motor torque
2.9.2.4	Empty inertia	0	3200.0	%	0.0%		1723	% of motor torque
2.9.2.5	Full inertia	0	3200.0	%	0.0%		1724	% of motor torque
2.9.2.6	Inertia torque filtering time	0.06	10.00	s	0.06		1725	
2.9.2.7	Taper radius	0.00	100.00	%	100.00		1726	
2.9.2.8	Taper reference	-320.00	320.00	%	0.00		1727	% of motor torque

Table 5-23. Winder tension control, G2.9.2

5.10.3 Open loop torque control (Control keypad: Menu M2 → G2.9.2.9)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.2.9.1	Torque control Kp	0	32000		150		639	
2.9.2.9.2	Torque control Ki	0	32000		10		340	
2.9.2.9.3	Linearization maximum frequency	0	Max Frequency	Hz	15.00		1730	Do not use in closed loop
2.9.2.9.4	Linearization reference	0	40.0	%	0.0		1731	Do not use in closed loop
2.9.2.9.5								

Table 5-24. Winder tension control, G2.9.2

5.10.4 Tension PI control (Control keypad: Menu M2 → G2.9.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.3.1	Tension Kp	-1000.0	1000.0	%	5.0		1740	
2.9.3.2	Tension Ti	0.00	60.00	s	1.00		1741	
2.9.3.3	PI MaxCorrection	0	100.0	%	-10.0		1801	Related to motor nominal torque

Table 5-25. Winder tension PI control, G2.9.3

5.10.5 Slack recovery (Control keypad: Menu M2 → G2.9.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.4.1	Slack recovery frequency	0.00	20.00	Hz	0.00		1750	
2.9.4.2	Speed releasing Acceleration time	0.0	300.0	s	0.0		1751	Acc/Dec time have priority
2.9.4.3	Tension control Rewinder ramp	0	100	Hz/s	10		1752	Acc/Dec time have priority
2.9.4.4	Minimum time at slack frequency	0	60.0	s	0.0		1754	
2.9.4.5	Speed release torque limit	0	100.0	%	0.0		1755	Work as tension limit if P2.9.2.5 is greater than zero

Table 5-26. Winder slack recovery, G2.9.4

5.10.6 Winder fault handling (Control keypad: Menu M2 → G2.9.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
2.9.5.1	Web break response	0	2		0		1770	0 = No action 1 = Warning 2 = Fault
2.9.5.2	Rewinder stop mode	0	2		0		1771	0 = Coasting 1 = System default 2 = Ramping
2.9.5.3	Unwinder stop mode	0	2		0		1772	0 = Coasting 1 = System default 2 = Ramping
2.9.5.4	Time to web break response	0	320.0	s	0.0		1773	0.0 = Not in use
2.9.5.5	Actual line speed fault limit	-100.0	100.0		0		1775	

Table 5-27. Winder fault handling, G2.9.5

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 Vacon NX User's Manual.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	0=I/O terminal 1=Keypad 2=Fieldbus
R3.2	Keypad reference	Par. 2.1.1	Par. 2.1.2	Hz				
R3.3	Line speed reference	0.00	100.00	%	0.00			
R3.4	Line tension reference	0.00	100.00	%	0.00			
P3.5	Direction (on keypad)	0	1		0		123	0=Forward 1=Reverse
R3.6	Stop button	0	1		1		114	0=Limited function of Stop button 1=Stop button always enabled

Table 5-28. Keypad control parameters, M3

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 Chapter 7.3.6 in the Vacon NX User's Manual.

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 Chapter 7.3.7 in the Vacon NX User's Manual.

6. Description of parameters

6.1 BASIC PARAMETERS

2.1.1 Minimum frequency

Minimum frequency in the Winder application determines the acceleration and deceleration times scaling. The maximum value for the parameter is 320 Hz.

2.1.2 Maximum frequency

Defines the maximum frequency of the frequency converter.
The maximum value for the parameter is 320 Hz.
Maximum frequency is the output frequency at minimum radius with maximum line speed. Use formula below to calculate maximum frequency

$$f_{\max} = \frac{v_{\max} p G_r}{r_{\min} 2\pi} \qquad (1)$$

v_{max} = [m/s], p = polepair number, G_r = Gear ratio, r_{min} = [m], $2\pi \approx 6{,}283185$

2.1.3, 2.1.4 Acceleration time 1, deceleration time 1

These limits correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (par. 2.1.2).

2.1.5 Current limit

This parameter determines the maximum motor current from the frequency converter. To avoid motor overload, set this parameter according to the rated current of the motor. The current limit is 1.5 times the rated current (I_H) by default. In order to achieve a have good inertia compensation, you may have to use higher current limit in the Winder application.

2.1.6 Nominal voltage of the motor

Find this value U_n on the rating plate of the motor. This parameter sets the voltage at the field weakening point (parameter 2.6.5) to 100% x U_{nmotor}.

2.1.7 Nominal frequency of the motor

Find this value f_n on the rating plate of the motor. This parameter sets the field weakening point (parameter 2.6.4) to the same value.

2.1.8 Nominal speed of the motor

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

2.1.9 Nominal current of the motor

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

2.1.10 Motor cos phi

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

2.1.11 I/O frequency reference selection

Defines which frequency reference source is selected when controlled from the I/O control place. Default value is 0. This reference is used only during test run (Test mode = 1 & 2).

0 = Analogue voltage reference from terminals 2—3, e.g. potentiometer
1 = Analogue current reference from terminals 4—5, e.g. transducer
2 = Keypad reference from the Reference Page (Group M3)
3 = Reference from the fieldbus

2.1.12 Motor nominal power

Find this value P_N on the rating plate of the motor. Needed when using tension control with inertia compensation. Defines the value for base inertia (V1.2.23).

2.1.13 Line speed reference source

2.1.14 Line tension reference source

2.1.18 Preset radius source

2.1.19 Taper reference source

0 = Not in use
1 = I/O
2 = Keypad
3 = Reference from the fieldbus

2.1.15 Line speed actual source

2.1.16 Radius actual source

2.1.17 Line tension actual source

0 = Not in use
1 = I/O
2 = Reference from the fieldbus

2.1.20 Jogging speed reference

This parameter defines the jogging speed for the drive. The jogging speed can be activated by connecting parameter 2.2.2.7 to any of the digital inputs available. When jogging speed is activated drive internally changes control mode to speed and frequency reference to jogging speed.

2.1.20 Jogging Speed Reference Input

With this parameter it's possible to select input for jogging speed reference.

0 = Parameter 2.1.20
1 = Calculated speed reference

Calculated speed reference can be used when there is flying change of roll, when activating jogging speed with calculated speed reference roll surface speed can be synchronize with other roll.

6.2 INPUT SIGNALS

6.2.1 Basic Settings

2.2.1.1 Start/Stop logic selection

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

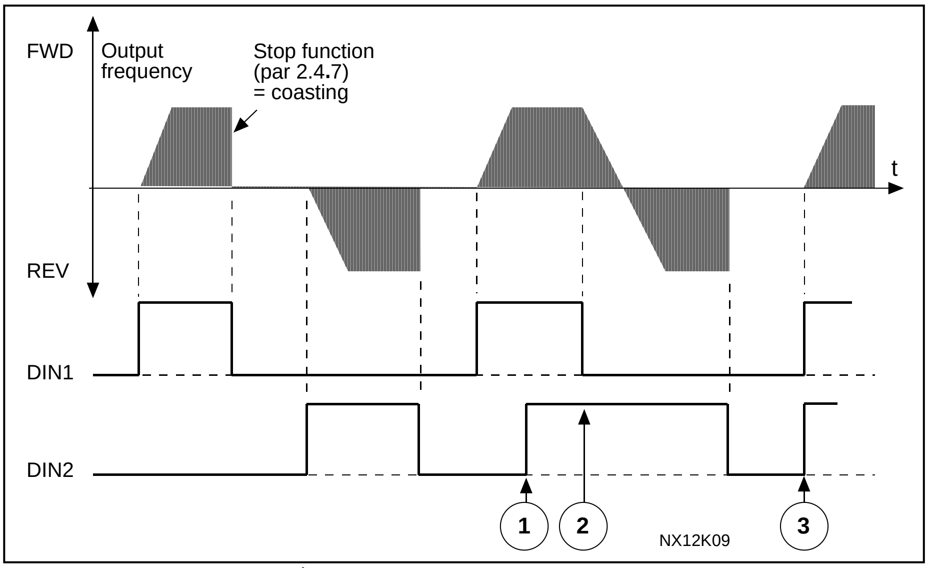


Figure 4. Start forward/Start reverse

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 Figure 5 below.

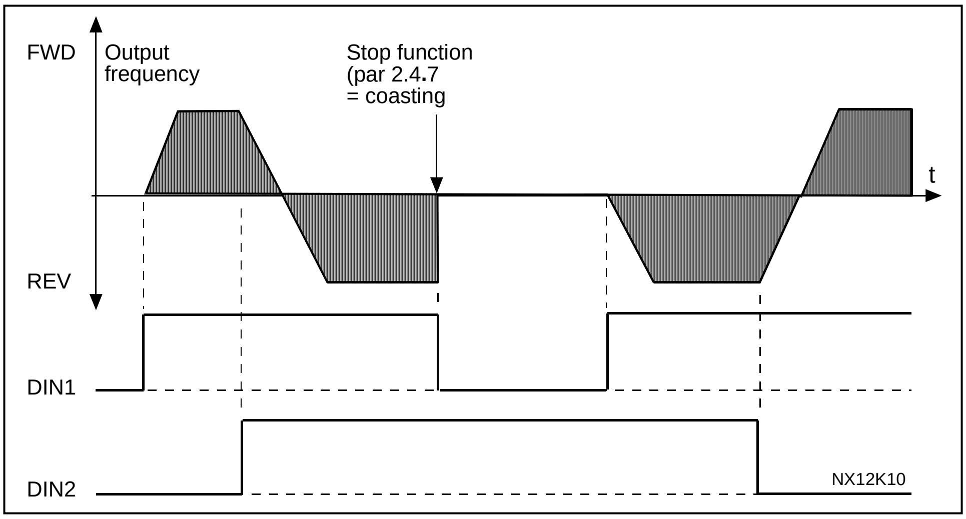


Figure 5. Start, Stop, Reverse

2 DIN1: closed contact = start open contact = stop
DIN2: closed contact = start enabled open contact = start disabled and drive stopped if running

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 6.

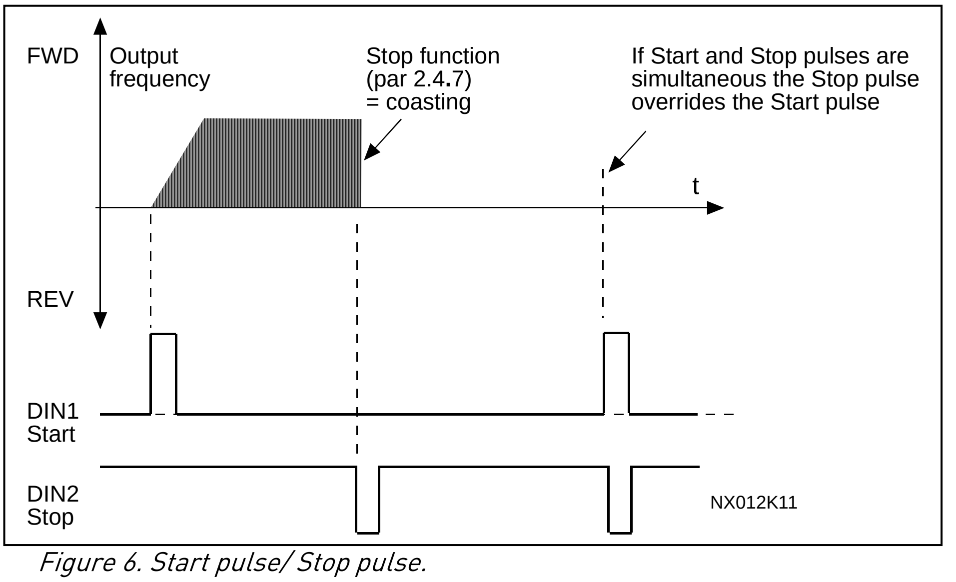


Figure 6. Start pulse/ Stop pulse.

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 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

2.2.1.2, 2.2.1.3 Reference scaling, minimum value/maximum value

Setting value limits: 0 ≤ par. 2.2.1.2 ≤ par. 2.2.1.3 ≤ par. 2.1.2. If parameter 2.2.1.3 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.

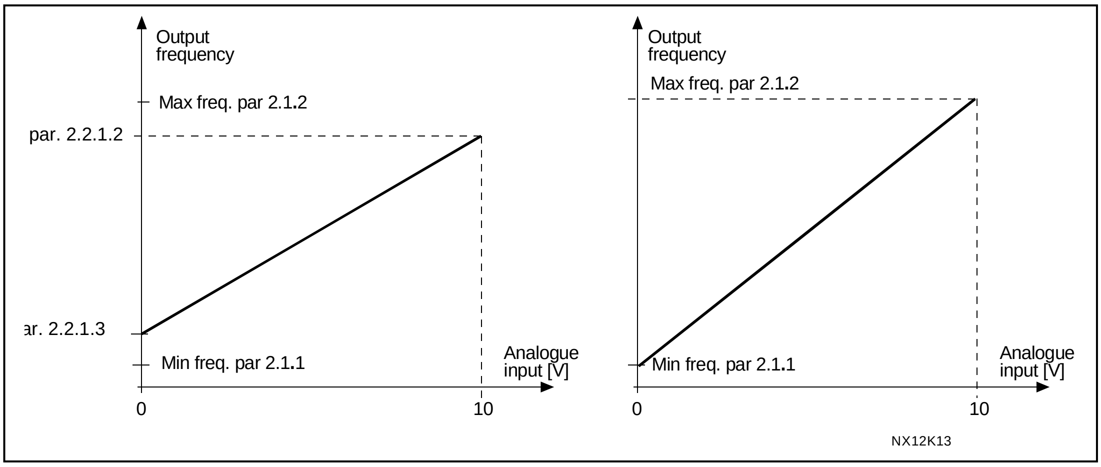


*Figure 7. **Left**: Reference scaling; **Right**: No scaling used (par. 2.2.1.3 = 0).*

2.2.1.4 Reference inversion

Inverts reference signal:
Max. ref. signal = Min. set freq.
Min. ref. signal = Max. set freq.

0 No inversion
1 Reference inverted

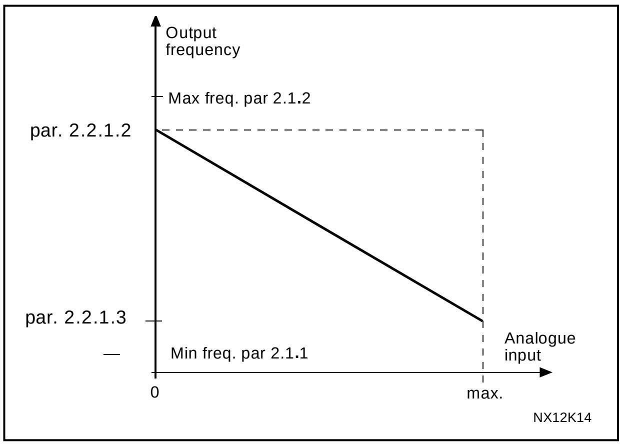


Figure 8. Reference invert.

2.2.1.5 Reference filter time

Filters out disturbances from the incoming analogue U_{in} signal. Long filtering time makes regulation response slower.

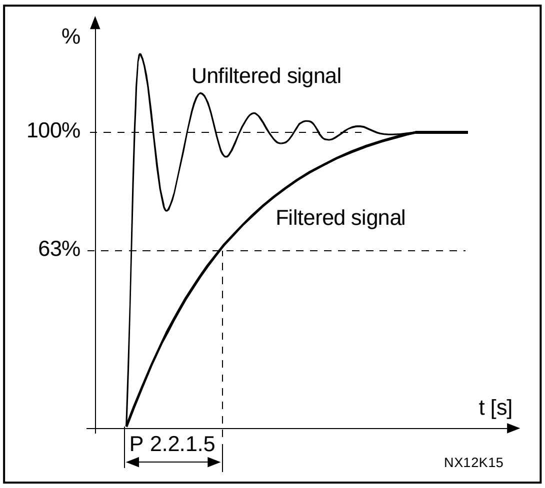


Figure 9. Reference filtering

6.2.2 Digital inputs

2.2.2.1 Run enable

Contact open: Start of motor disabled
Contact closed: Start of motor enabled

2.2.2.2 Reverse

Contact open: Forward
Contact closed: Reverse

2.2.2.3 Fault reset

Contact closed: All faults are reset.

2.2.2.4 External fault (close)

Contact closed: Fault is displayed and motor stopped

2.2.2.5 External fault (open)

Contact open: Fault is displayed and motor stopped.

2.2.2.6 Acceleration/Deceleration time selection

Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected

Set Acceleration/Deceleration times with parameters 2.1.3 and 2.1.4.

2.2.2.7 Jogging speed

Contact closed: Jogging speed selected for frequency reference
See parameter 2.1.20

2.2.2.8 Control from I/O terminal

Contact closed: Force control place to I/O terminal

2.2.2.9 Control from keypad

Contact closed: Force control place to keypad

2.2.2.10 Control from fieldbus

Contact closed: Force control place to fieldbus

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 3.1 (Keypad Control Place) does not change.
When the input opens the control place is selected according to keypad control parameter 3.1.

2.2.2.11 Winder mode

Contact open: Rewinder
Contact closed: Unwinder

DIN selection is updated to keypad if selection is A.1 or higher.

2.2.2.9 Control mode

Contact open: Speed control
Contact closed: Tension control

DIN selection is updated to keypad if selection is A.1 or higher.

2.2.2.13 Enable web break detection

When enabled, the drive generates a warning or an error when web break is detected. DIN selection is updated to keypad if selection is A.1 or higher.

2.2.2.14 Speed release

Speed limit remains in slack recovery until contactor is closed. Default value is 0.2 = TRUE

2.2.2.15 Set preset radius

Digital input command for setting the radius if parameter 2.9.1.7 is 0 or 2. Profibus preset radius command has the same priority than the digital input.

2.2.2.16 Web break

Digital input for external web break monitoring. Input operational regardless of parameter 2.9.5.4

2.2.2.17 DC Brake in stop

When activated the drive uses the DC brake when in stop state. See parameter 2.4.8.

6.3 LINE REFERENCES AND ACTUAL SIGNAL SELECTIONS

2.2.3.1 Line speed reference signal selection
2.2.4.1 Line tension reference signal selection
2.2.5.1 Line speed actual signal selection
2.2.6.1 Radius actual signal selection
2.2.7.1 Tension actual signal selection
2.2.8.1 Preset radius signal selection
2.2.9.1 Taper function signal selecion

Connect the desired signal to the analogue input of your choice with this parameter. See chapter 2 Programming principle of the Input signals in Winder application.

2.2.3.2 Line speed reference filtering time
2.2.4.2 Line tension reference filtering time
2.2.5.2 Line speed actual filtering time
2.2.6.2 Radius actual filtering time
2.2.7.2 Tension actual filtering time

Giving this parameter a value greater than 0 activates the function that filters out disturbances from the incoming analogue signal. Long filtering time makes the regulation response slower.

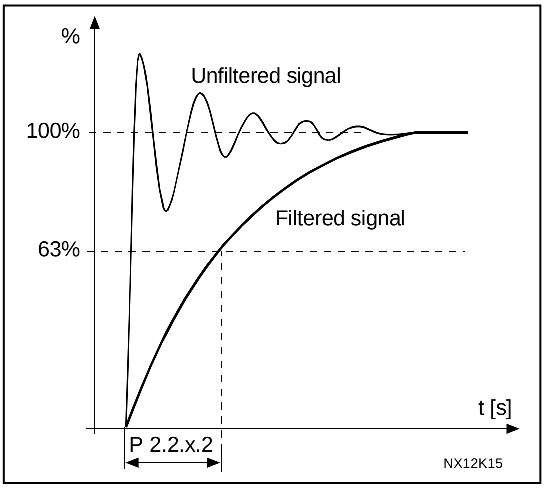
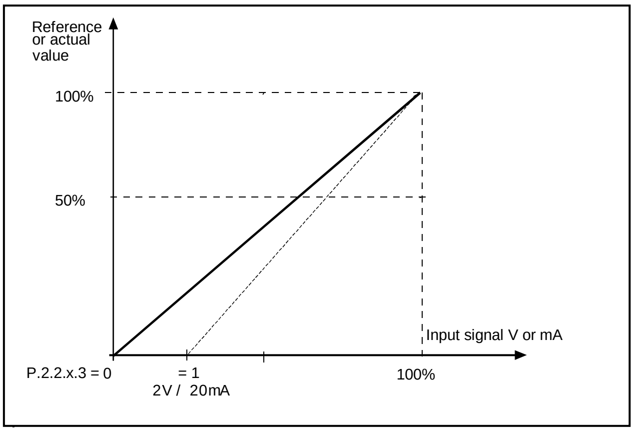


Figure 10. Reference filtering

2.2.3.3 Line speed reference signal range
2.2.4.3 Line tension reference signal range
2.2.5.3 Line speed actual signal range
2.2.6.3 Radius actual signal range
2.2.7.3 Tension actual signal range
2.2.8.2 Preset radius signal range
2.2.9.2 Taper function signal range

With these parameters you can select the signal range.

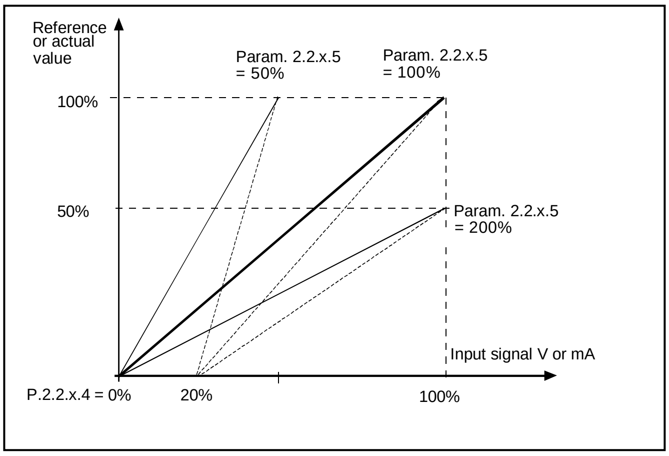
0 Signal range 0…10V, 0…20mA
1 Signal range 2…10V, 4…20mA
2 Customised signal range defined with parameters 2.2.x.4 and 2.2.x.5



gure 11. Reference scaling

2.2.3.4 Line speed reference input minimum value
2.2.3.5 Line speed reference input maximum value
2.2.4.4 Line tension reference input minimum value
2.2.4.5 Line tension reference input maximum value
2.2.5.4 Line speed actual input minimum value
2.2.5.5 Line speed actual input maximum value
2.2.6.4 Radius actual input minimum value
2.2.6.5 Radius actual input maximum value
2.2.7.4 Tension actual input minimum value
2.2.7.5 Tension actual input maximum value
2.2.8.3 Preset radius input minimum value
2.2.8.4 Preset radius input maximum value
2.2.9.3 Taper function input minimum value
2.2.9.4 Taper function input maximum value

Set the custom minimum and maximum levels for input signals within 0…10V or 0…20mA



Note: Line speed actual values are not limited when 2.2.3.5 is less than 100%. Internal values are more than 100% when input is 10V or 20mA.

2.2.3.6 Line speed reference signal inversion
2.2.4.6 Line tension reference signal inversion
2.2.5.6 Line speed actual signal inversion
2.2.6.6 Radius actual signal inversion
2.2.7.6 Tension actual signal inversion
2.2.8.5 Preset radius signal inversion
2.2.9.5 Taper function signal inversion

0 = No inversion
1 = Signal inverted

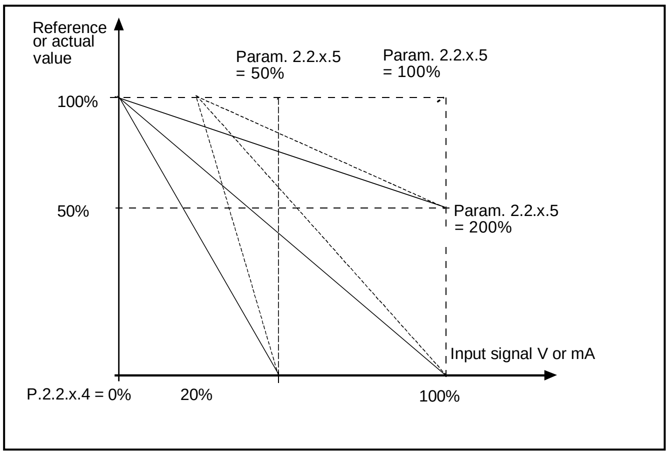


Figure 13. Reference inversion

2.2.3.7 Line speed reference ramping rate

With this parameter you can set ramping rate for internally used speed reference. This parameter can be used for stabilize inertia compensation. Note every other drive acc/deceleration time or line speed reference most be set accordingly.

2.2.9.7 Taper function minimum reference
2.2.9.8 Taper function maximum reference

With these parameters can be set limit for taper function tension reference.

6.4 OUTPUT SIGNALS

6.4.1 Digital outputs

All parameters of this group shall be programmed using the *Terminal to Function Programming method (TTF)*. In other words, all functions (parameters) that you wish to use shall be connected to a certain output on a certain option board. For more information, see Chapter 2.

2.3.1.1 Ready

The frequency converter is ready to operate.

2.3.1.2 Run

The frequency converter operates (the motor is running).
Default programming: A.1.

2.3.1.3 Fault

A fault trip has occurred.
Default programming: A.2.

2.3.1.4 Inverted fault

No fault trip has occurred.

2.3.1.5 Overtemperature warning

The heatsink temperature exceeds +70°C.

2.3.1.6 External fault or warning

Fault or warning depending on parameter 2.7.3.

2.3.1.7 Reference fault or warning

Fault or warning depending on parameter 2.7.1.

2.3.1.8 Warning

General warning signal.

2.3.1.9 Reverse

The Reverse command has been selected.

2.3.1.10 Jogging speed

The jogging speed command has been selected

2.3.1.11 At speed

The output frequency has reached the set reference.

2.3.1.12 Motor regulator activation

Overvoltage or overcurrent regulator has been activated.

2.3.1.13 Output frequency limit 1 supervision

The output frequency goes outside the set supervision low limit/high limit (see parameters 2.3.4.1 and 2.3.4.2)

2.3.1.14 External control place

Control from I/O terminal selected (Menu M3; par. 3.1).

2.3.1.15 Thermistor warning

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

NOTE: This parameter will not work unless you have Vacon NXOPTA3 or NXOPTB2 (thermistor relay board) connected.

2.3.1.16 FB digital input 1

Indication of status FieldBus digital input 1.

2.3.1.17 Slack recovery ON

Indication when slack recovery is operating.

2.3.1.18 Slack recovery OFF

Indication when slack recovery is operating, negated.

2.3.1.19 Web Break fault/warning

Web break fault or warning is active

2.3.1.20 Brake control

Brake open command is given when drive has start command and it's in run state. While in closed loop motor control also motor flux is monitored.

Note: Use ramping stop while using drive controlled brake.

6.4.2 Analogue output 1

2.3.2.1 Analogue output function

This parameter selects the desired function for the analogue output signal.
See Table 5-15. Analogue output 2, G2.3 on page 21 for the parameter values.

2.3.2.2 Analogue output filter time

Defines the filtering time of the analogue output signal.

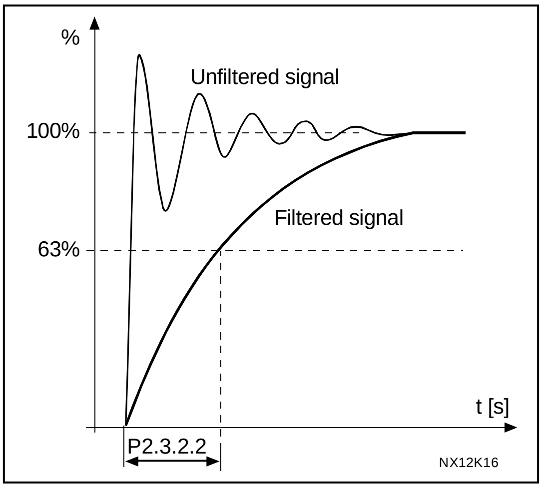


Figure 14. Analogue output filtering

2.3.2.3 Analogue output invert

Inverts the analogue output signal:

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

See parameter 2.3.2.5 below.

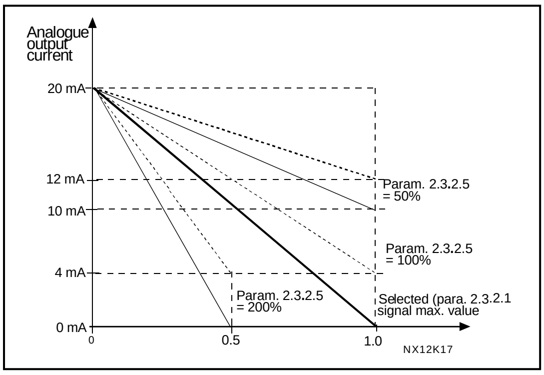


Figure 15. Analogue output invert

2.3.2.4 Analogue output minimum

Defines the signal minimum to either 0 mA or 4 mA (living zero). Note the difference in analogue output scaling in parameter 2.3.5 (Figure 2-9).

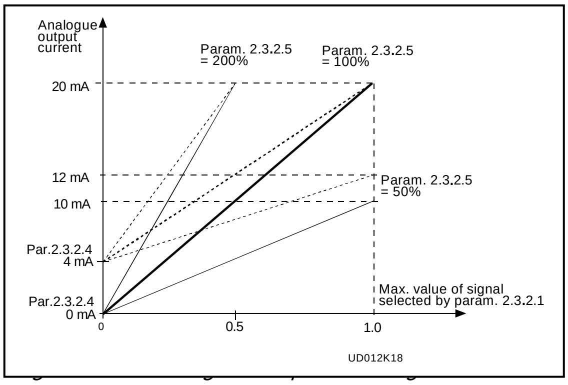
0 Set minimum value to 0 mA
1 Set minimum value to 4 mA

2.3.2.5 Analogue output scale

Scaling factor for analogue output.

Signal	Max. value of the signal
Output frequency	Max frequency (par. 2.1.2)
Freq. Reference	Max frequency (par. 2.1.2)
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

Table 6-1. Analogue output scaling



6.4.3 Analogue output 2

2.3.3.1 Analogue output 2 signal selection

Connect the AO2 signal to the analogue output of your choice with this parameter. For more information, see Pump and fan control application manual, Chapter 2.

2.3.3.2 Analogue output 2 function
2.3.3.3 Analogue output 2 filter time
2.3.3.4 Analogue output 2 inversion
2.3.3.5 Analogue output 2 minimum
2.3.3.6 Analogue output 2 scaling

For more information on these five parameters, see the corresponding parameters for the analogue output 1 on pages 41 and 41.

6.4.4 Limit settings

2.3.4.1 Output frequency limit supervision function

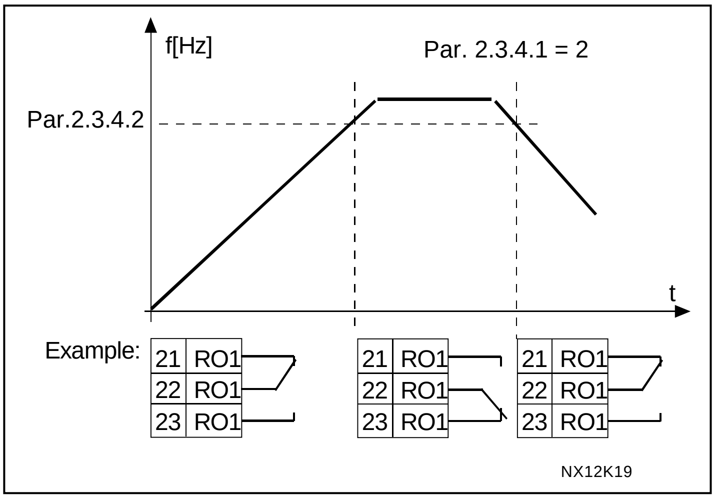
0 No supervision
1 Low limit supervision
2 High limit supervision

If the output frequency goes under/over the set limit (P 2.3.4.2) this function generates a warning message via the digital output DO1 and via the relay output RO1 or RO2 depending on the setting of parameter 2.3.1.13.

2.3.4.2 Output frequency limit supervision value

Selects the frequency value supervised by parameter 2.3.4.2.

Figure 17. Output frequency supervision



6.5 DRIVE CONTROL

2.4.1 Acceleration/Deceleration ramp 1 shape
2.4.2 Acceleration/Deceleration ramp 2 shape

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 2.1.3/2.1.4 (2.4.3/2.4.4).

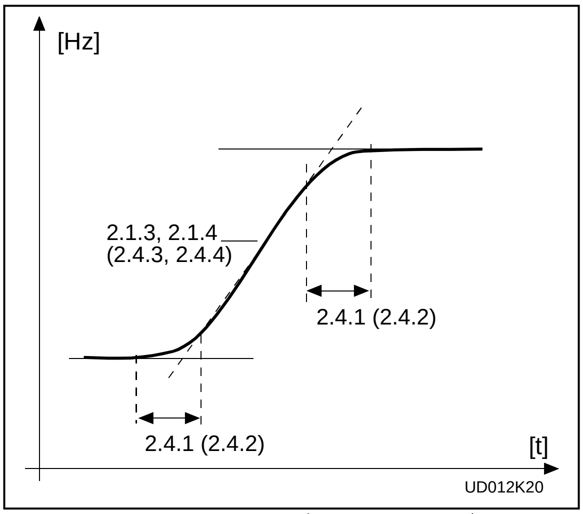


Figure 18. Acceleration/Deceleration (S-shaped)

2.4.3 Acceleration time 2
2.4.4 Deceleration time 2

These parameters give you the possibility to set two different acceleration/ deceleration time sets for one application. Connect the *Acceleration time selection* signal (Parameter 2.2.2.6) to one of the digital inputs and choose the active Acceleration/Deceleration time by setting the contact open (Acc/Dec time 1) or close (Acc/Dec time 2).

2.4.5 Brake chopper

0 No brake chopper used
1 Brake chopper used and tested in Run state
2 External brake chopper
3 Used and tested in Ready state

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.

2.4.6 *Start function*

Ramp:

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

Flying start:

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

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

2.4.7 *Stop function*

Coasting:

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

Ramp:

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

Normal stop: Ramp/ Run Enable stop: coasting

2 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters. However, when Run Enable is selected (e.g. DIN3), 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 (e.g. DIN3), 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.

2.4.8 DC-braking current

Defines the current injected into the motor during DC-braking also when DC-braking in stop mode is selected (P2.2.2.17).

2.4.9 DC-braking time at stop

Determines if braking is ON or OFF and the braking time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, parameter 2.4.7.

0 DC-brake is not used

>0 DC-brake is in use and its function depends on the Stop function, (param. 2.4.7). The DC-braking time is determined with this parameter

2.4.10 DC-braking frequency at stop

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

Par. 2.4.7 = 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 2.4.9 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter 2.4.9.

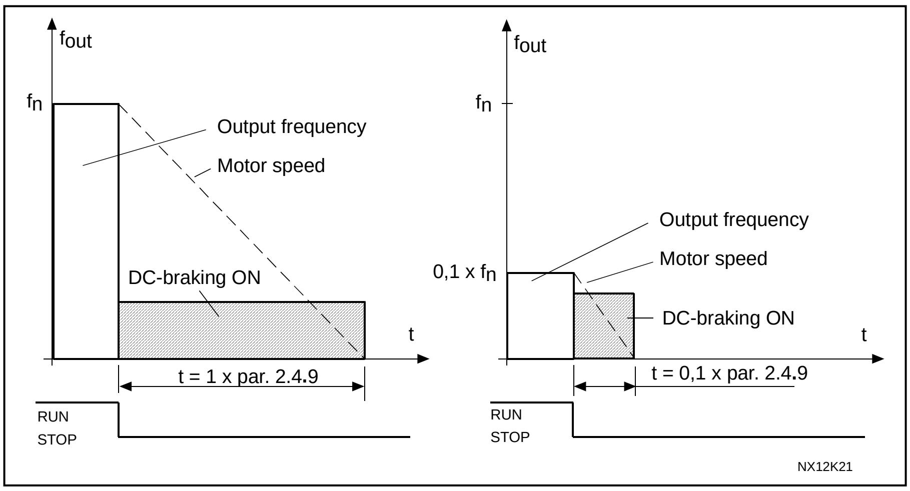


Figure 19. DC-braking time when Stop mode = Coasting.

Par. 2.4.7 = 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 2.4.10, where the DC-braking starts.

The braking time is defined with parameter 2.4.9. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See Figure 20.

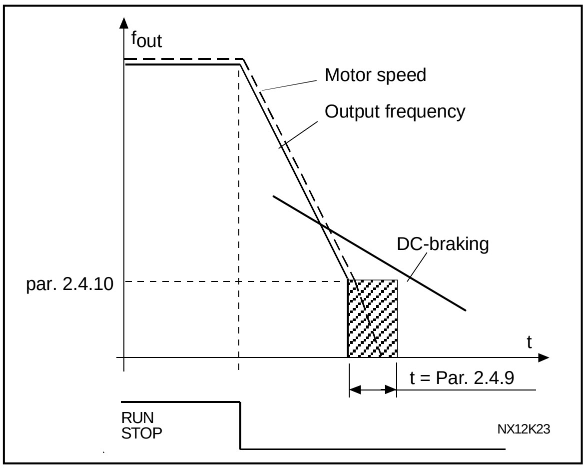


Figure 20. DC-braking time when Stop mode = Ramp

2.4.11 DC-braking time at start

DC-brake is activated when the start command is given. This parameter defines the time before the brake is released. After the brake is released, the output frequency increases according to the set start function by parameter 2.4.6.

2.4.12 Flux brake

The flux braking can be set ON or OFF.

0 = Flux braking OFF
1 = Flux braking ON

2.4.13 Flux braking current

Defines the flux braking current value. It can be set between 0.1 x I_{nMot} and the Current limit.

2.4.14 Zero speed level

Below this value frequency reference is interpret as zero speed. When frequency reference goes below this value and start command is removed brake will close.

6.6 PROHIBIT FREQUENCIES

2.5.1, 2.5.2 Prohibit frequency area; Low limit/High limit

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 21.

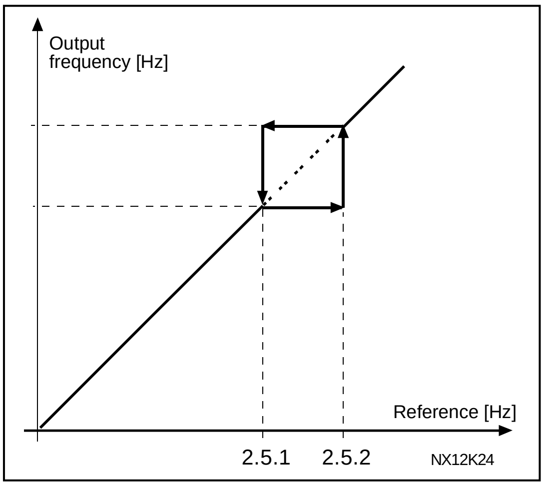


Figure 21. Prohibit frequency area setting.

2.5.3 Acc/dec ramp speed scaling ratio between prohibit frequency limits

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits (parameters 2.5.1 and 2.5.2). 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.

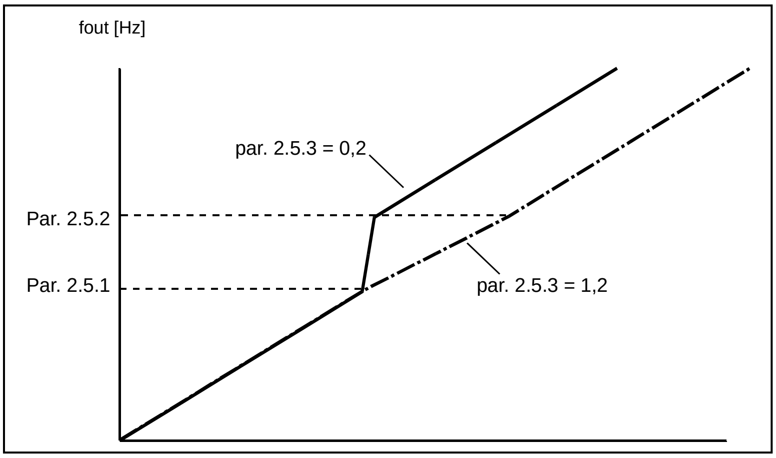


Figure 22. Ramp speed scaling between prohibit frequencies

6.7 MOTOR CONTROL

Motor control mode is internally determined by logic speed or torque control. Select only control mode type.

When using NXS drive it is recommended to use the programmable U/f curve to have a good speed and torque accuracy when operating near zero frequency.

NXS drive uses mode 0 only while for NXP drive all control modes are available.

2.6.1 Motor control mode

0	Open loop	NXS/NXP drive
1	Closed loop:	NXP drive with encoder on motor shaft

2.6.2 U/f optimisation

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).
- Motor Control Mode = 0 (Frequency control) and 1 (Speed control)

Option 1: Activate the Automatic torque boost (par. 2.6.2).

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. 2.6.3 to *Programmable U/F-curve* (value 2). Increase zero point voltage (P2.6.8) to get enough current at zero speed. Set then the midpoint voltage (P2.6.7) to 1.4142*P2.6.8 and midpoint frequency (P2.6.6) to value P2.6.7/100%*P2.1.7.

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.*

2.6.3 U/f ratio selection

When setting parameter for the programmable U/f-curve use test mode 1 at P2.9.6.

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 ratio should be used in constant torque applications. See Figure 23.
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 under magnetised 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.

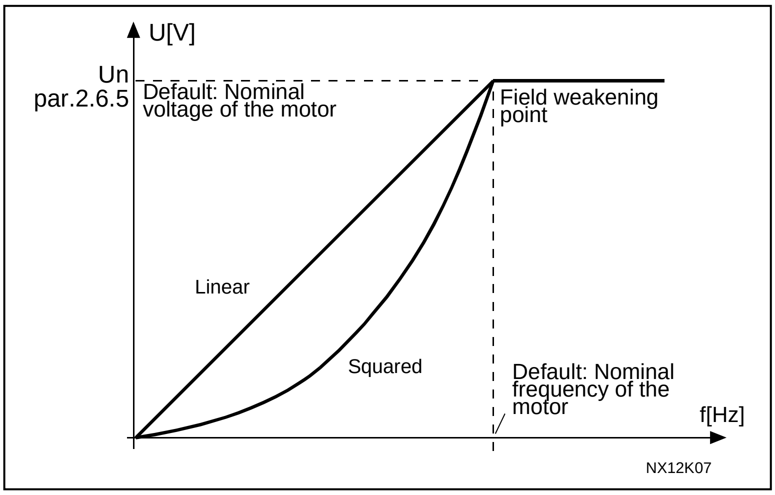


Figure 23. Linear and squared change of motor voltage

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.

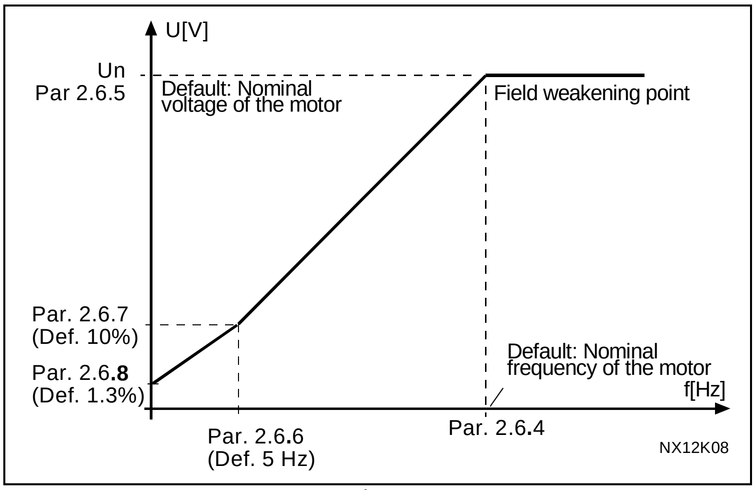


Figure 24. Programmable U/f curve

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.

2.6.4 *Field weakening point*

The field weakening point is the output frequency at which the output voltage reaches the set (par. 2.6.5) maximum value.

2.6.5 *Voltage at field weakening point*

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the U/f curve parameters. See parameters 2.6.2, 2.6.3, 2.6.6 and 2.6.7.

When the parameters 2.1.6 and 2.1.7 (nominal voltage and nominal frequency of the motor) are set, the parameters 2.6.4 and 2.6.5 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 2.1.6 and 2.1.7.

2.6.6 *U/f curve, middle point frequency*

If the programmable U/f curve has been selected with the parameter 2.6.3 this parameter defines the middle point frequency of the curve. See Figure 24.

2.6.7 *U/f curve, middle point voltage*

If the programmable U/f curve has been selected with the parameter 2.6.3 this parameter defines the middle point voltage of the curve. See Figure 24.

2.6.8 *Output voltage at zero frequency*

If the programmable U/f curve has been selected with the parameter 2.6.3 this parameter defines the zero frequency voltage of the curve. See Figure 24.

2.6.9 Switching frequency

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:

Up to NX5 0061: 1…16 kHz
>NX5 0072: 1…10 kHz

2.6.10 Overvoltage controller
2.6.11 Undervoltage controller

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.

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

0 Controller switched off
1 Controller switched on, no ramping
2 Controller switched on, ramping

If DC-voltage drops under 80% of DC nominal voltage, with undervoltage control mode 2, the drive will ramp down to zero speed.

2.6.12 Measured Rs voltage drop

With this parameter it's possible to improve torque measurement. Set DC-braking current to motor nominal current and DC braking time at start to 2,1 second and start the drive at zero speed reference. When measurement is made, default values can be restore.

2.6.13 Load drooping

The drooping function enables speed drop as a function of load. The amount of allowed speed drop is proportional to the load or speed controller output (Iq reference). This parameter sets that amount corresponding to 100% load of the motor.

2.6.14 Identification

Detects the motor parameters automatically if the motor is started within 20 seconds after activation of this parameter.

6.8 CLOSED LOOP PARAMETERS

The following parameters are used in Vacon NXP only.

Full torque control at zero speed cannot be maintained without feedback. When a speed error of less than 0,5% or full torque control at all speeds is required in the application, motor control based on feedback from an encoder is an absolute necessity. This capability is incorporated into the NXP.

In addition to the current measurement system used in the NXS, the NXP utilises feedback values from the encoder. The enhanced microprocessor provided with the NXP is capable of fast calculations.

The NXP control unit can be used for closed loop applications requiring high precision and for open loop applications requiring high dynamic performance.

Note! For closed loop applications, NXOPTA4 or NXOPTA5 has to be installed.

2.6.15.1 Magnetising current

Set here the rated magnetizing current for the motor. This parameter is used for adjusting the motor in no-load condition.

2.6.15.2 Speed control Kp

Sets the gain for the speed controller in % per Hz.

2.6.15.3 Speed control Ti

Sets the integral time constant for the speed controller

2.6.15.4 Acceleration compensation

Sets the inertia compensation to improve speed response during acceleration and deceleration. Time is defined as acceleration time to nominal speed with nominal torque.

2.6.15.5 Slip adjust

The motor name plate speed is used to calculate the nominal slip. This value should be used to adjust motor voltage when loaded. Reducing the slip adjust value increases the motor voltage when the motor is loaded.

2.6.15.6 Start, magnetizing current

Set here the magnetizing current to reduce flux building time during start.

2.6.15.7 Start, magnetizing time

Time for start magnetisation current.

2.6.15.8 Start zero speed time

After giving the start command the drive will remain at zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time is elapsed from the instant where the command is given.

2.6.15.9 Stop zero speed time

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.

2.6.15.10 Start up torque

Startup torque is used to reduce erratic motion after start. Torque Memory is used in crane applications. Startup Torque FWD/REV can be used in other applications to help speed controller.

0 = Not Used
1 = TorqMemory
2 = Torque Ref
3 = Torq.Fwd/Rev

2.6.15.11 Start-up torque forward

Sets the start-up torque for forward direction if selected with par 2.10.11.

2.6.15.12 Start-up torque reverse

Sets the start-up torque for reverse direction if selected with par 2.10.11.

2.6.15.13 Encoder 1, filter time

Sets the filter time constant for speed measurement.

2.6.15.14 Current control Kp

Sets the gain for the current controller. This controller is active only in closed loop and advanced open loop modes. The controller generates the voltage vector reference to the modulator.

6.9 PROTECTIONS

2.7.1 Monitored signal

With this parameter you can select which signal is monitored for reference fault

2.7.2 Response to reference fault

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset Frequency (Par. 2.7.3) is set as reference
4 = Fault, stop mode after fault according to parameter 2.4.7
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.

2.7.3 4 mA Fault: preset frequency reference

If the value of parameter 2.7.1 is set to 3 and the 4 mA fault occurs then the frequency reference to the motor is the value of this parameter.

2.7.4 Response to external fault

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
3 = Fault, stop mode after fault always by coasting

A warning or a fault action and message is generated from the external fault signal (parameters 2.2.7.11 and 2.2.7.12) in the digital input selected. The information can also be programmed into the digital output or the relay outputs (par. 2.3.3.6).

2.7.5 Input phase supervision

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
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.

2.7.6 Response to undervoltage fault

1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
3 = Fault, stop mode after fault always by coasting

For the undervoltage limits see Vacon NX User's Manual, Table 4-2.

2.7.7 Output phase supervision

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
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.

2.7.8 Earth fault protection

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
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.

Parameters 2.7.9—2.7.13, Motor thermal protection:
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.

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

2.7.9 *Motor thermal protection*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
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%.

2.7.10 *Motor thermal protection: Motor ambient temperature factor*

When the motor ambient temperature must be taken into consideration, it is recommended to set a value for this parameter. The value of the factor can be set between −100.0% and 100.0% where −100.0% corresponds to 0°C and 100.0% to the maximum running temperature of the motor. Setting this parameter value to 0% assumes that the ambient temperature is the same as the temperature of the heatsink at power-on.

2.7.11 *Motor thermal protection: Zero frequency current*

The current can be set between 0—150.0% x I_{nMotor}. This parameter sets the value for thermal current at zero frequency. See Figure 25.

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 nameplate data, parameter 2.1.9 (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 2.1.5 alone.

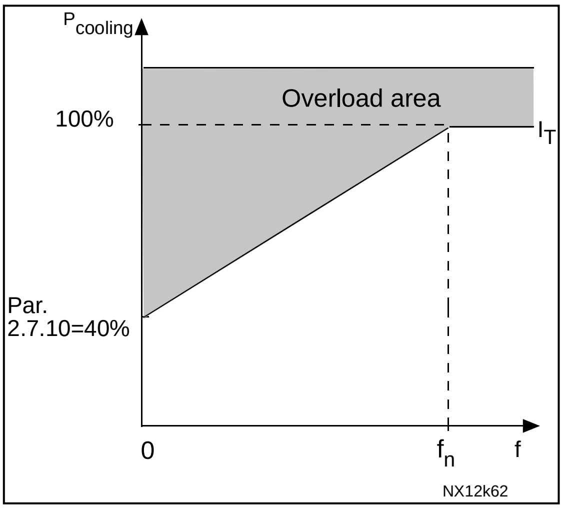


Figure 25. Motor thermal current I_T curve

2.7.12 *Motor thermal protection: Time constant*

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.

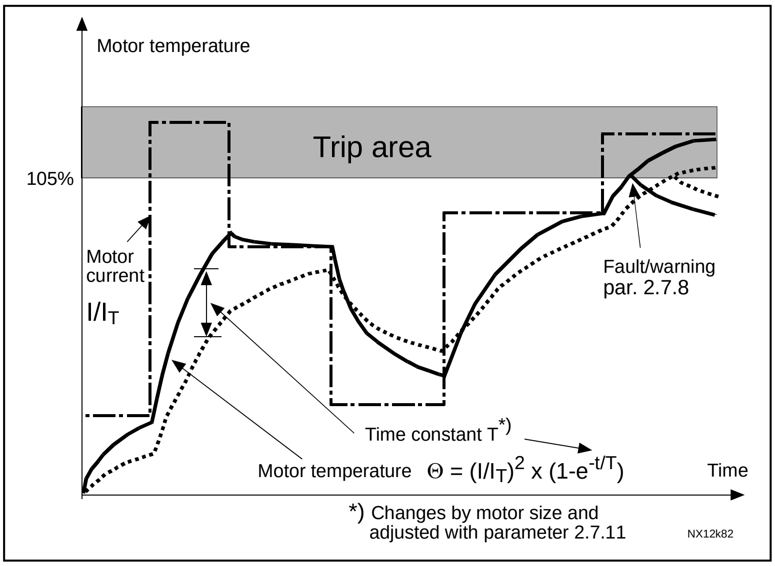
The motor thermal time is specific to the motor design and it varies between different motor manufacturers.

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. See also Figure 26.

2.7.13 *Motor thermal protection: Motor duty cycle*

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

Figure 26. Motor temperature calculation



Parameters 2.7.14—2.7.17, Stall protection:

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, 2.7.15 (Stall current) and 2.7.17 (Stall frequency). If the current is higher than the set limit and output frequency is lower than the set limit, the stall state is true. There is actually no real indication of the shaft rotation. Stall protection is a type of overcurrent protection.

2.7.14 Stall protection

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
3 = Fault, stop mode after fault always by coasting

Setting the parameter to 0 will deactivate the protection and reset the stall time counter.

2.7.15 Stall current limit

The current can be set to 0.0...6000.0 A. For a stall stage to occur, the current must have exceeded this limit. See Figure 27. This value is set in percentage of the motor's nameplate data (parameter 2.1.9). If the parameter 2.1.9 Nominal current of motor is changed, this parameter is automatically restored to the default value.

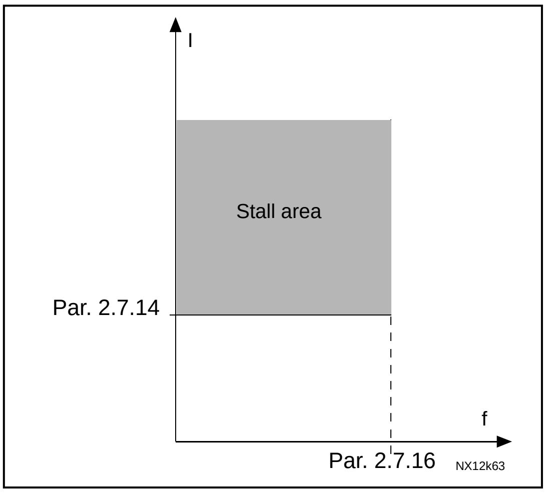


Figure 27. Stall characteristics settings

2.7.16 Stall time

This time can be set between 1.0 and 120.0s.
This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter.
If the stall time counter value goes above this limit the protection will cause a trip (see parameter 2.7.14).

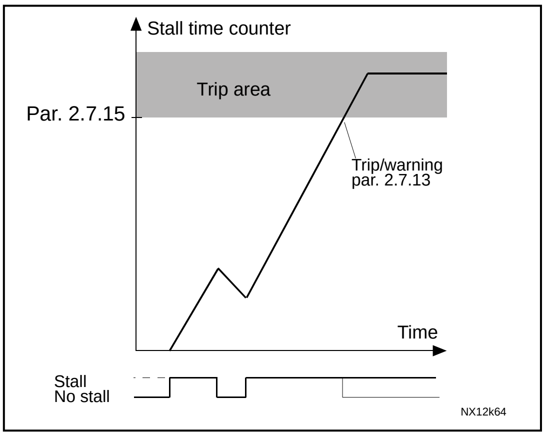


Figure 28. Stall time count

2.7.17 Maximum stall frequency

The frequency can be set between 1–f_{max} (par. 2.1.2).
For a stall state to occur, the output frequency must have remained below this limit.

Parameters 2.7.18—2.7.21, Underload protection:

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 2.7.19 (Field weakening area load) and 2.7.20 (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.

2.7.18 Underload protection

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
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.

2.7.19 *Underload protection, field weakening area load*

The torque limit can be set between 10.0—150.0 % x T_{nMotor}.
This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point. See Figure 29.

If you change the parameter 2.1.9 (Motor nominal current) this parameter is automatically restored to the default value.

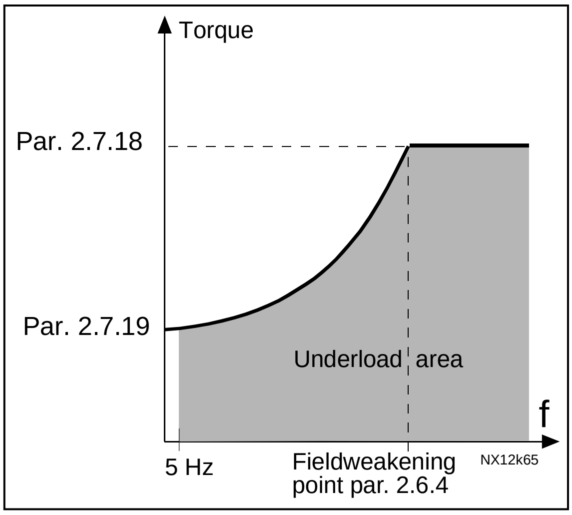


Figure 29. Setting of minimum load

2.7.20 *Underload protection, zero frequency load*

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 29.

If you change the value of parameter 2.1.9 (Motor nominal current) this parameter is automatically restored to the default value.

2.7.21 *Underload time*

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 2.7.18). If the drive is stopped the underload counter is reset to zero. See Figure 30.

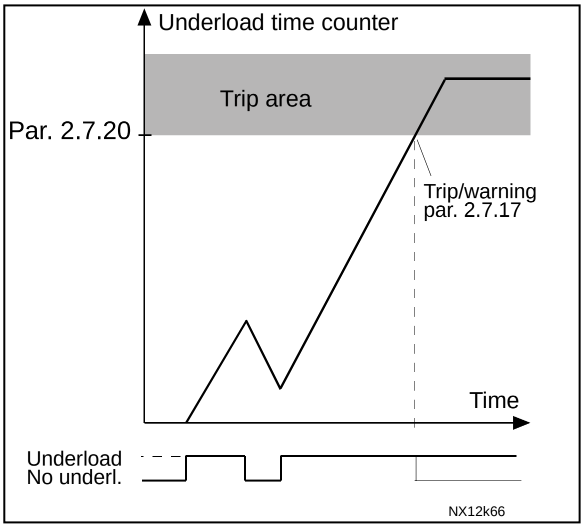


Figure 30. Underload time counter function

2.7.22 Response to thermistor fault

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.7
3 = Fault, stop mode after fault always by coasting

Setting the parameter to 0 will deactivate the protection and reset the stall time counter.

2.7.23 Response to fieldbus fault

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 2.7.22.

2.7.24 Response to slot fault

Set here the response mode for a board slot fault due to missing or broken board.

See parameter 2.7.22.

2.7.25 Brake in system fault

In some faults drive can't make ramming stop. On those situations drives ramp generator is zeroed which causes brake to close immediately. With this parameter application leaves break open if drive is in coasting stop on fault situations.

6.10 AUTO RESTART PARAMETERS

2.8.1 Automatic restart: Wait time

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

2.8.2 Automatic restart: Trial time

The Automatic restart function restarts the frequency converter when the faults selected with parameters 2.8.4 to 2.8.10 have disappeared and the waiting time has elapsed.

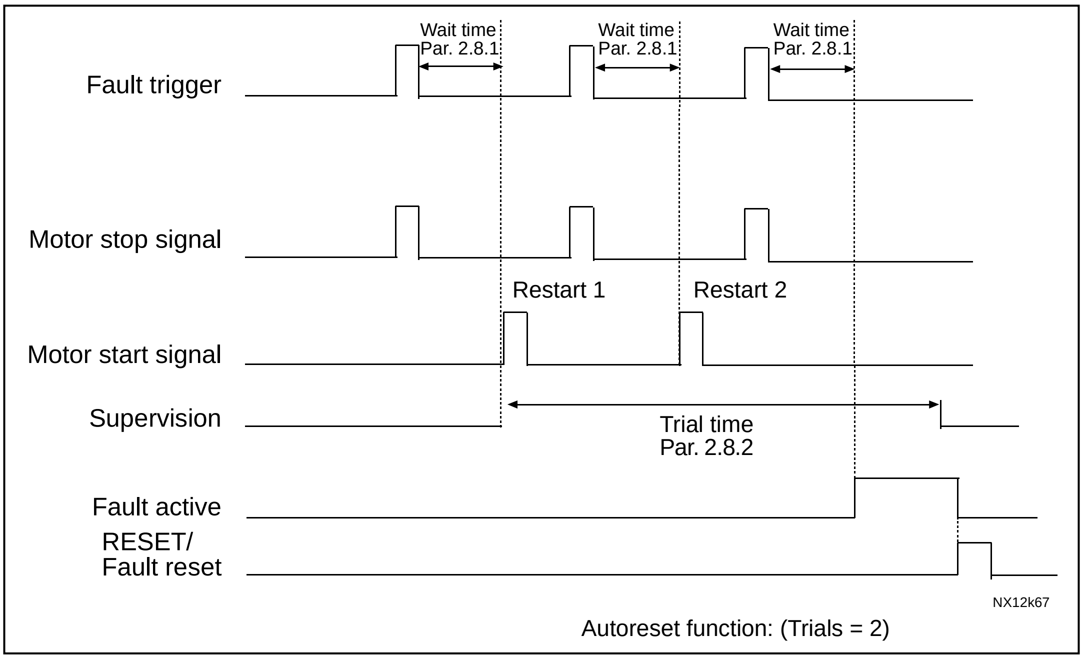


Figure 31. Example of Automatic restart with two restarts.

Parameters 2.8.4 to 2.8.10 determine the maximum number of automatic restarts during the trial time set by parameter 2.8.2. The time count starts from the first autorestart. If the number of faults occurring during the trial time exceeds the values of parameters 2.8.4 to 2.8.10, the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault starts the trial time count again.

If a single fault remains during the trial time, a fault state is true.

2.8.3 Automatic restart, start function

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

0 = Start with ramp
1 = Flying start
2 = Start according to par. 2.4.6

2.8.4 Automatic restart: Number of tries after undervoltage fault trip

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2 after an undervoltage trip.

0	=	No automatic restart after undervoltage fault trip
>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.

2.8.5 Automatic restart: Number of tries after overvoltage trip

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2 after an overvoltage trip.

0	=	No automatic restart after overvoltage fault trip
>0	=	Number of automatic restarts after overvoltage fault. The fault is reset and the drive is started automatically after the DC-link voltage has returned to the normal level.

2.8.6 Automatic restart: Number of tries after overcurrent trip

(NOTE! IGBT temp Fault also included)
This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2.

0	=	No automatic restart after overcurrent fault trip
>0	=	Number of automatic restarts after overcurrent trip, saturation trip and IGBT temperature faults.

2.8.7 Automatic restart: Number of tries after reference trip

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2.

0	=	No automatic restart after reference fault trip
>0	=	Number of automatic restarts after the analogue current signal (4…20 mA) has returned to the normal level ($\geq$4 mA)

2.8.8 Automatic restart: Number of tries after motor temperature fault trip

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2.

0 = No automatic restart after Motor temperature fault trip
>0 = Number of automatic restarts after the motor temperature has returned to its normal level.

2.8.9 Automatic restart: Number of tries after external fault trip

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.8.2.

0 = No automatic restart after External fault trip
>0 = Number of automatic restarts after External fault trip

6.11 WINDER PARAMETERS

6.11.1 Basic parameters

2.9.1.1 Minimum Radius

Value of empty winder radius. The value must be specified in percent of maximum diameter. Allowed range is 10 to 100%.

2.9.1.2 Winder Mode

This parameter controls the operation mode of the winder:

0 = Rewinder
1 = Unwinder

The operation mode can be controlled by a programmable digital input. In this case, the DI input takes priority over the value of Par. 2.9.1.2.

2.9.1.3 Control mode

This parameter enables tension/speed control.

0 = Speed control
1 = Tension control

The operation mode can be controlled by a programmable digital input. In this case, the DI input takes priority over the value of Par. 2.9.1.3.

2.9.1.4 Calculated radius filtering time

The parameter defines the filtering time for calculated radius, which is useful in line speed control when the actual motor speed is changing rapidly due to the speed controller in closed loop control. This parameter has no effect when radius is measured.

2.9.1.5 Radius ramping rate

This parameter specifies the response rate of the ramp filter at the output of the radius calculator block. One unit stands for 1% change rate per second. Allowed range is 1%/s to 10%/s. The parameter has no effect when radius is measured.

2.9.1.6 Radius holding frequency

Minimum frequency of operation for the radius calculator. When the frequency corresponding to actual line speed or motor actual speed is lower than this threshold, the radius calculator holds the last value until the frequency is increased higher than the threshold again. The range is 0 to 20 Hz. For NXS drive it is recommended to use higher values.

2.9.1.7 *Radius reset mode*

The parameter defines the manner the radius value is reset to the initial value (Par. 2.9.1.1 in rewind mode, 100.0% in unwind mode) or using preset value.

0 = On command, value of radius is reset only when resetting command is given.
1 = Reset on start, value of radius is reset only when the drive goes to run mode
2 = Reset on command to preset radius
3 = Reset on start to preset radius

In case of power brakedown the radius value is stored in memory.

2.9.1.8 *Motoring torque limit*

This parameter defines motoring torque limit or tension. Used in speed control to limit motor torque if line is suddenly locked up. In tension control defines maximum limit for tension torque. This value limits also speed controlled acceleration compensation torque.

When line speed references are changing and the empty winder inertia is greater than the zero motoring torque the limit is set to 300 % to allow the motor to accelerate to its new reference speed, see P2.9.1.9.

NOTE: If parameter 2.9.2.4 Empty winder inertia is greater than zero this parameter acts as tension limit.

2.9.1.9 *Torque limit down ramp*

In Speed controlled rewinding the motor torque can be limited with parameter 2.9.1.8 but when increasing the line speed reference the motor has to produce more torque to accelerate to the new reference. When the line speed reference increases the motoring torque limit is set to 300 percent (Limited by motoring torque limit) and then it decreases according to this parameter. Ramping rate is given in percent per second.

Note: If parameter 2.9.2.4 Empty winder inertia is zero the motoring torque limit is as defined with parameter 2.9.1.8.

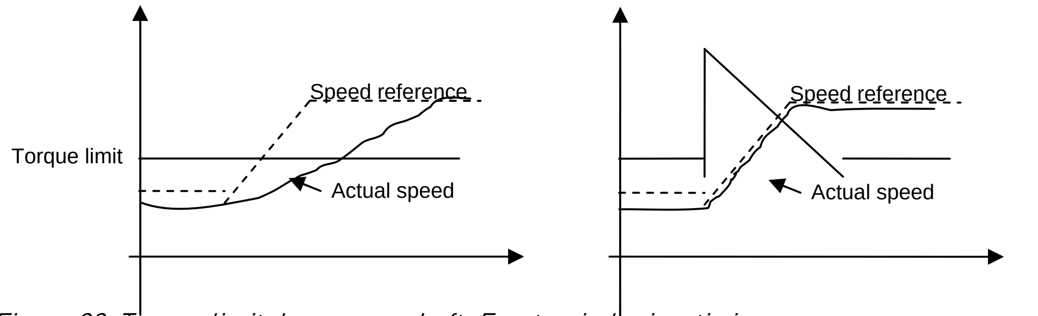


Figure 32. Torque limit down ramp. Left: Empty winder inertia is zero. Right: Empty winder inertia parameter is greater than zero.

2.9.1.10 *Calculate from actual line speed*

While in tension control with Yes selected the drive will use the actual line speed channel to calculate radius. This parameter also sets inertia calculation to use actual line speed value. On speed control drive uses always actual line speed channel.

2.9.1.11 *Preset radius*

Give preset radius if preset radius source is keypad P2.1.18.

2.9.1.12 Frequency addition to speed limit function

This value is added to calculated frequency reference to calculated speed limit. E.g. if set to 3 Hz in case of web break (rewinder modes) the motor speed will increase by only 3 Hz. The drive will generate web break fault in certain time (P 2.9.5.4) at the speed limit frequency.

2.9.1.13 Speed limited by calculated radius

With this parameter its possible to disable speed limit function. In case of web break motor speed may increase up to maximum frequency.

6.11.2 Tension control

2.9.2.1 Static friction compensation

Value of constant torque term, which is added to (in rewind mode) or subtracted (in unwind mode) from the torque reference to compensate static friction. The allowed range is 0 to 25% of motor torque.

2.9.2.2 Viscous friction compensation

Torque term proportional to motor speed, which is added to (in rewind mode) or subtracted from (in unwind mode) the reference to compensate viscous friction. The parameter specifies value at full motor speed, which is at max line speed and minimum radius. The allowed range is 0 to 25% of rated motor torque.

2.9.2.3 Full scale torque

This parameter specifies the amount of torque required when tension reference is at full scale and radius equals maximum (100%). The unit is percent of motor rated torque.

Inertia compensation

Speed reference value is used for inertia compensation. When tension controlled drive speed reference is changed the torque reference must change so that a correct tension can be maintained. The line speed reference is used for calculating this correction of torque reference. An approximate formula to calculate correct value for inertia compensation and a table for adjusting these values below.

	Tension is too small		Tension is too high	
	Unwind	Rewind	Unwind	Rewind
Accelerating	Value is too high	Value is too low	Value is too low	Value is too high
Decelerating	Value is too low	Value is too high	Value is too high	Value is too low

Table 6-2. Commissioning inertia parameters.

2.9.2.4 Empty winder inertia

Value of inertia corresponding to the empty winder reel (Radius = min, Par.2.9.1.1), as seen from the motor shaft, and including the motor and gearbox terms. The value is specified in percent of motor base inertia (V1.19).

$$J\min\% = \frac{J\min[kgm^2]}{J_{base}[kgm^2]}$$

Note: In speed control setting this parameter greater than zero activates a higher torque limit when line speed reference is changed. See parameters 2.9.1.8 and 9.

2.9.2.5 Full winder inertia

Value of inertia of the winder fully loaded with material (diameter = 100%), as seen at the motor shaft, and including the motor and gearbox terms. Value is specified as percent of

Drive base inertia (V1.2.22). Range is 0 to 3276.7 % (note that values >> 100% are fairly common for direct drive winders).

$$J\max\% = \frac{J\max[kgm^2]}{J_{base}[kgm^2]}$$

2.9.2.6 *Inertia torque filtering time*

Filtering time for calculated inertia torque. Too high a value makes compensation slow.

2.9.2.7 *Taper radius*

This parameter specifies the % radius at which the tension starts to change linearly from the input reference when the non-zero taper is applied. See P 2.9.2.8.

2.9.2.8 *Taper reference*

Keypad taper tension reference. The tension reference which is added to final tension reference at maximum radius starting from taper radius P2.9.2.7. See Figure 33.

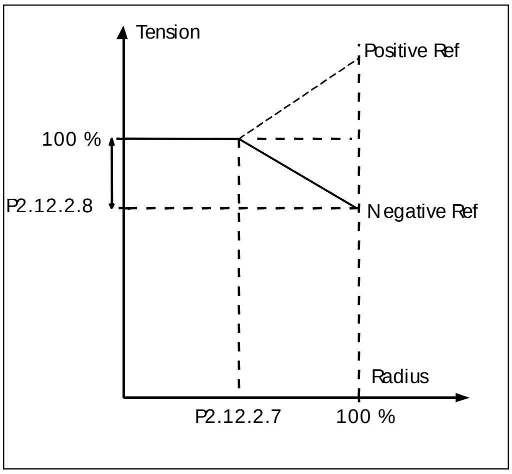


Figure 33. Taper function

2.9.2.9.1 *Open loop torque control Kp*

Gain for open loop torque control.

2.9.2.9.2 *Open loop torque Control Ki*

Gain for open loop controller integration.

2.9.2.9.3 *Open loop torque linearization maximum frequency*

Maximum frequency where P2.9.2.9.4 reference still affects due to miscalculation of torque in low frequencies in open loop. With these parameters you can compensate those miscalculations.

2.9.2.9.4 Open loop torque linearization reference

Torque which is added in zero frequency to motoring torque limit and final torque reference.

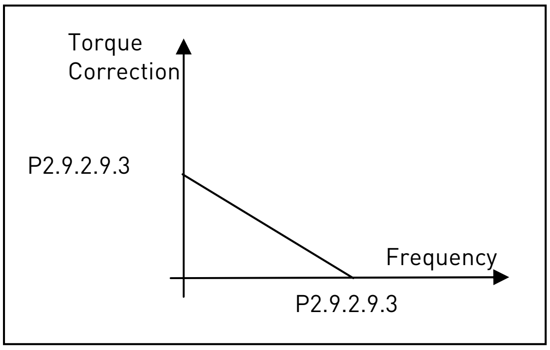


Figure 34. Open loop torque linearization

6.11.3 Tension PI control

Tension PI control is activated when actual tension source is selected.

2.9.3.1 Tension control gain

This parameter defines the gain of the PID controller. If the value of the parameter is set to 100% a change of 10% in the error value causes the controller output to change by 10%. If the parameter value is set to 0 the PID controller operates as ID-controller.

2.9.3.2 Tension control integration time

The parameter 2.9.3.2 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.

2.9.3.3 PI control maximum correction

With these parameters you can set the maximum correction for PI controller. Percentage value from motor torque.

6.11.4 Slack recovery

2.9.4.1 Slack recovery frequency

In speed control, this parameter acts as frequency reference for slack recovery, until the Time at slack recovery frequency (P2.9.4.5) and/or the Speed releasing torque limit are reached.

In tension control, the rewinder operation is the same as in speed control. In tension controlled unwinder mode, the parameter defines the speed limit for rewinder direction.

While the drive is in slack recovery mode the control mode is speed control.

Using high frequencies may cause web rapture due to winder inertia.
Using this parameter is greatly dependable on how U/F curve is defined when using open loop control mode.

2.9.4.2 Speed control release acceleration time

This parameter defines the acceleration time from 0 to maximum frequency after slack recovery. When value is zero drive uses normal acceleration times.

2.9.4.3 Tension control rewinding ramp

This parameter defines the frequency limit rising time from slack recovery speed limit to tension controlled rewinding speed limit. Decreases torque shock when control mode changes.

2.9.4.4 Minimum time at slack recovery frequency

This is the minimum duration of staying at slack recovery frequency until the speed releasing torque limit can unfreeze the limit.

2.9.4.5 Speed releasing torque limit

Minimum torque, which must be reached before the frequency reference or torque reference can reach its operating level.

If parameter 2.9.2.3 full-scale torque is greater than zero this parameter represents the percentage of line tension.

6.11.5 Winder faults

Web break monitoring

Web break monitoring monitors the output frequency. When the output frequency is greater than the calculated speed limit the time to web break timer is activated. Web break monitoring principle is that the radius can not change into wrong direction. In line speed control the limit is reached when the calculated radius changes into wrong direction. In line tension control a web break can be noticed clearly because a line break causes speed to run away. When the radius is measured in line speed control and line break appears speed stays same. Then it is possible to use underload protection.

2.9.5.1 Web break response

Web break can be noticed only in rewinder mode. Unwinder will automatically go to slack recovery reference in case of web break.

1 = No Action
2 = Warning
3 = Fault, stop mode defined with Par. 2.4.7

2.9.5.2 Rewinding stop mode
2.9.5.3 Unwinding stop mode

0 = Coasting
1 = Stop mode defined with Par. 2.4.7
2 = Ramping

2.9.5.4 Time to web break response

Time at web break condition until the action defined with P2.9.5.1 is performed. If time is zero web break monitoring is disabled.

2.9.5.5 Actual line speed fault limit

If line speed actual goes below this value while motor is running faster than radius-holding frequency it is interpreter as web break.

6.11.6 TEST MODE Parameters

2.9.6 Test mode

0 = Winder mode

1 = Open Loop frequency test
The drive is working under frequency reference. This mode can be used for setting the programmable U/f curve.

2 = Control mode with direct reference
Speed control, 3 Closed loop and 5 open loop control modes use frequency reference selected with Par. 2.1.11 (I/O Reference). Minimum and maximum frequencies are used for scaling. See also Par. 2.2.1.2 and Par. 2.2.1.3

Torque control, 4 closed loop and 6 open loop control modes uses line tension reference, only I/O tension reference source is accepted, if selected otherwise torque reference is set to zero. Torque reference is scaled from 0% T_N to Par. 2.9.2.3 (Full scale torque). Friction and/or inertia torque are added to final torque reference.
Note: While in tension control, motor speed is limited via line speed reference.

6.12 SETTING PROFIBUS

Use mode "PROFIDRIVE" with winder application. See PROFIBUS DP OPTION BOARD manual for detail information.

6.12.1 Winder control word

The Winder application does not use the normal reference value except in the test mode. This is why the additional direction bit is provided, Fielbus DIN1, CW bit 11.

Bit	Description	
	Value = 0	Value = 1
0	STOP 1 (by ramp)	ON 1
1	STOP 2 (by coast)	ON 2
2	STOP 3 (by ramp)	ON 3
3	RUN DISABLE	ENABLE
4	No Action	START
5	No Action	START
6	No Action	START
7	No Action	FAULT RESET (0 -> 1)
8	No Action	No Action
9	No Action	No Action
10	Disable Profibus control	Enable Profibus control
11	Forward	Reverse
12	No Action	Reset radius command (0 -> 1)
13	No Action	Web break input command
14	No Action	Jogging speed command
15	Fieldbus DIN5=OFF	Fieldbus DIN5=ON

6.12.2 Winder process data in

Data	Value	Unit	Scale
Process data IN 1	Line speed reference	%	0,01 %
Process data IN 2	Line tension reference	%	0,01 %
Process data IN 3	Line speed actual	%	0,01 %
Process data IN 4	Radius actual	%	0,01 %
Process data IN 5	Line tension actual	%	0,01 %
Process data IN 6	Preset radius	%	0,01 %
Process data IN 7	Taper reference	%	0,01 %
Process data IN 8	Not used	-	-

Line speed actual value is limited to 150% other to 100%

6.13 KEYPAD CONTROL PARAMETERS

3.1 Control Place

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).

3.2 Keypad Test mode frequency reference

The frequency reference can be adjusted from the keypad with this parameter.

The output frequency can be copied as the keypad reference by pushing the *Stop button* for 3 seconds when you are on any of the pages of menu *M3.* For more information, see the product's User's Manual.

Keypad line speed reference

The line speed reference can be adjusted from the keypad with this parameter.

3.4 Keypad line tension reference

The line tension reference can be adjusted from the keypad with this parameter.

3.5 Keypad Direction

0 Forward: The rotation of the motor is forward, when the keypad is the active control place.
1 Reverse: The rotation of the motor is reversed, when the keypad is the active control place.

For more information, see the product's User's Manual.

3.6 Stop button activated

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 3.1.

7. Control signal logic in Winder Application

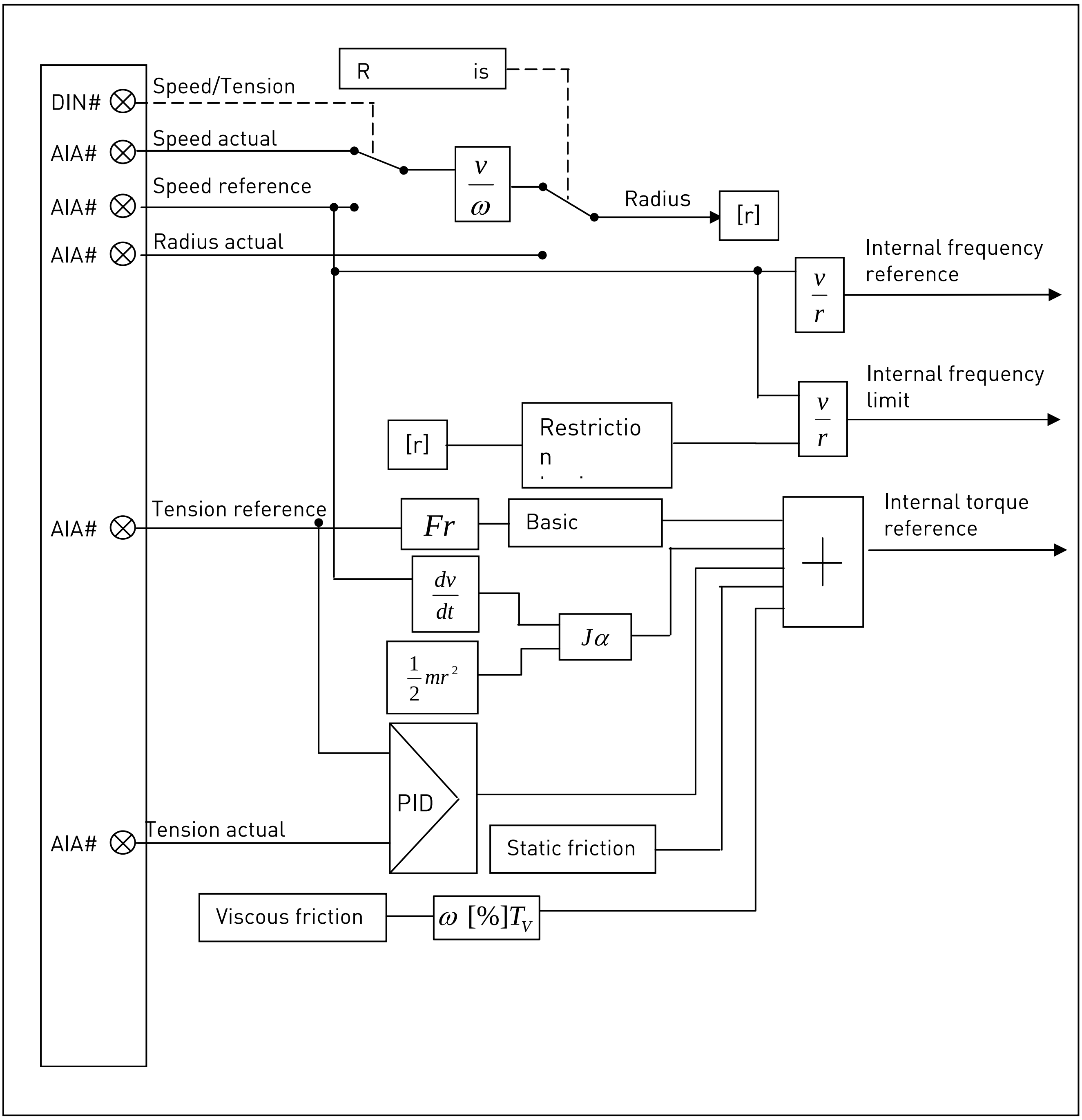


Figure 35. Control signal logic of the Winder Application

8. Fault codes

The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults 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.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current (>4*I_n) in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits. – too short a deceleration time – high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available as options)
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.	
7	Saturation trip	Various causes, e.g. defective component	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
8	System fault	- component failure - faulty operation Note exceptional fault data record.	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. – most probable cause: too low a supply voltage – frequency converter internal fault	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 and cable.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.

Fault code	Fault	Possible cause	Correcting measures
12	Brake chopper supervision	– no brake resistor installed – brake resistor is broken – brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact the distributor near to you.
13	Frequency converter under-temperature	Heatsink temperature is under –10°C	
14	Frequency converter overtemperature	Heatsink temperature is over 90°C. Overtemperature warning is issued when the heatsink temperature exceeds 85°C.	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.
16	Motor overtemperature	Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	Motor underload	Motor underload protection has tripped.	
22 23	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	
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.	Cancel prevention of start-up.
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)
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.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit
37	Device change	Option board changed. Different power rating of drive.	Reset **Note:** No fault time data record!
38	Device added	Option board added. Drive of different power rating added.	Reset **Note:** No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact the distributor near to you.

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.
42	Brake resistor overtemperatur e	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
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.	
52	Keypad communication fault	The connection between the control keypad 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.
80	Web break	1. Web is broken. 2. Wrong parameters 3. Control signal is broken	Check line. Check parameters. Check connections.

Table 8-1. Fault codes

Vaasa
Vacon Plc (Head office and production)
Runsorintie 7
65380 Vaasa
firstname.lastname@vacon.com
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Vacon Plc
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fax: +358 (0)201 212 750

Vacon Traction Oy
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fax: +43 2256 651 66 66

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fax: +33 (0)1 69 89 60 40

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fax: +44 (0)1455 611 517

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fax: +39 0522 276890

The Netherlands
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fax: +31 (0)183 642 971

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