vacon
DRIVEN BY DRIVES

user's manual

nx frequency converters

APFIF131
LineSynchronization

application manual

VACON LINE SYNCHRONIZATION APPLICATION MANUAL

INDEX

Document code: ud1177
Software code: APFIF131V124
Date: 2.12.2009

Line Synchronization Application

Software APFIF131

1. INTRODUCTION

This application is mend to run a motor to net frequency and make contactor change so that the motor is running directly from the network. This application supports up to eighth motors with own I/O. The motors used can be of different sizes but the nominal voltage needs to be the same with all motors. Line synchronization does not need additional chokes in output due to advanced control. The drive can compensate for delays which are faced in contactors.

1.1 General

This application is not considered to be backwards combatable. Read the application change note or the chapter in this application manual, “Version parameter compatibility issues” to see what needs to be noted when updating the application. See also updated parameter description from NCDrive when making commissioning.

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

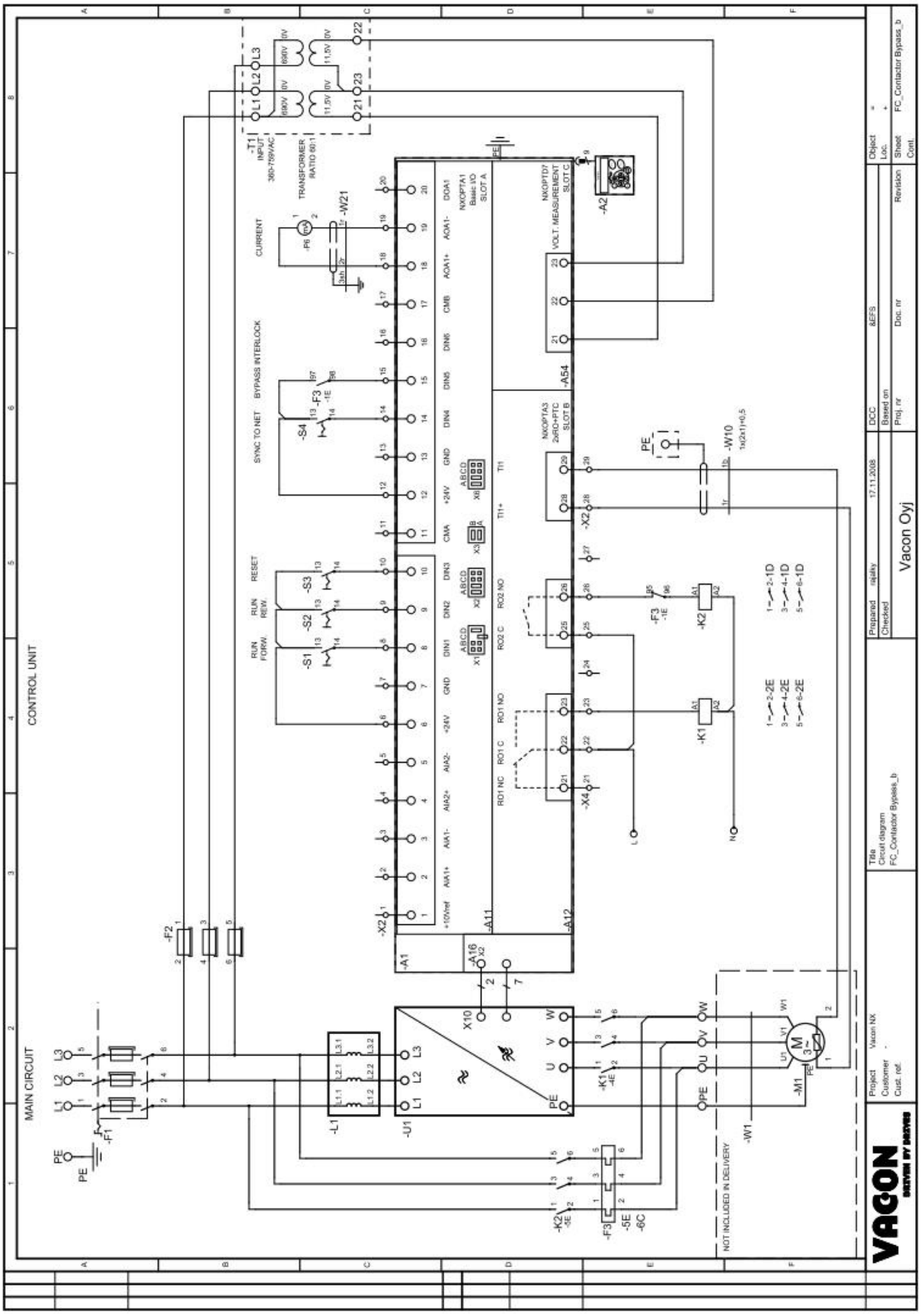
Additional functions:

- Line voltage monitoring
- Line frequency monitoring
- DC voltage monitoring
- CANOpen I/O communication monitoring
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Autofaultreset funtion
- Power limit functions
- Different power limits for motoring and generating side
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Possibility to connect the FB Process data to any parameter and some monitoring values

The parameters of the LineSynch Application are explained in Chapter 7 of this manual. The explanations are arranged according to the individual ID number of the parameter.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1.2 Connection example



2. LINE SYNCHRO GENERAL

2.1 Purpose

This application is meant to run motor to net frequency and make contactor change that motor is running directly from network.

2.2 Operation

The drive measures line voltage frequency and angle. When there is no synchronization command, the application works as a normal Multi-Purpose application.

2.2.1 To Net

When synchronization command is given [P:**ActiveSynchro** (DI:HIGH)], frequency reference is changed to net voltage frequency. When voltage frequency is within 0,10 Hz hysteresis with network voltage frequency the drive will make small adjustments to frequency reference so that line voltage angle and FC voltage angle are the same with given offset [P:**PhaseOffSetToNet**].

The drive remains at this synchronization until the command to end synchronization is given or the command to change network is given [P:**ActiveDirect**] (DI:HIGH)]. When the command to go to the network net is given (which can be given at the same time as synchronization command) thr application checks for 40 ms that [P:**PhaseHyst**] is correct for change. When an internal decision is made:

- The drive stops modulation within given delay [P:**DelayToCoasting**].
- The drive opens FC contactor within given delay [P:**DelayToOpen**].
- The drive closed NET contactor within given delay [P:**DelayToClose**].

Drive remains in stop state until:

1. SingleMotorControl [P: **ControlMode** = 0 / Single Motor]
   - [P:**ActiveDirect**] (DI:LOW)].

2. MultiMotorControl: [P: **ControlMode** = 1 - 3 / MultiMotor, InSecuence]
   - Controller motor is changed:[P:**ControlledMotor**].
   - Controlled motor control status is reset [P: **Reset Direct**]

2.2.2 To FC

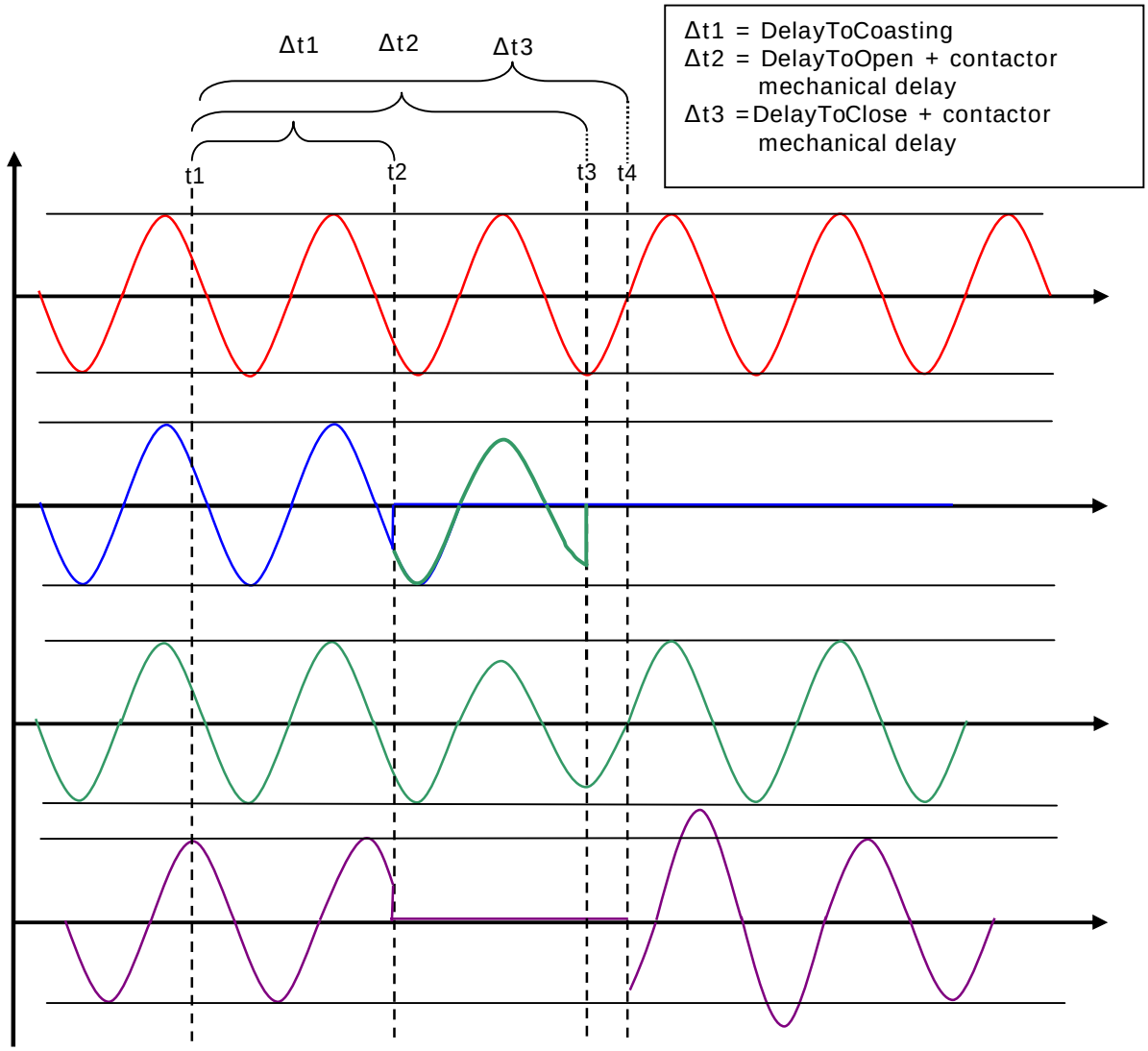
When controlled motor is in net:
Drive waits for back to FC command [**ResetDirect** (HIGH)] or [**ActiveDirect** (LOW)].
When command is given drive:

- Opens Net contactor immediately.
- Closes FC Contactor within half of [P:**StartDelayToFC**] time.
- Makes start within [P:**StartDelayToFC**] time. (Note restart delays)

Depending on the status of [P:**ActiveSynchro**], the drive will keep synchronization on start or follow the given reference.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

2.3 Timing



Line voltage, FC voltage, Motor voltage and Motor current

t1: Application makes decision to change to the network, command to open FC contactor is given.
t2: Drive stops modulation after delay [P:**DelayToCoasting**].

a. Motor BEM voltage starts to decrease.
b. Motor current goes to zero.
c. FC sees motor BEM voltage

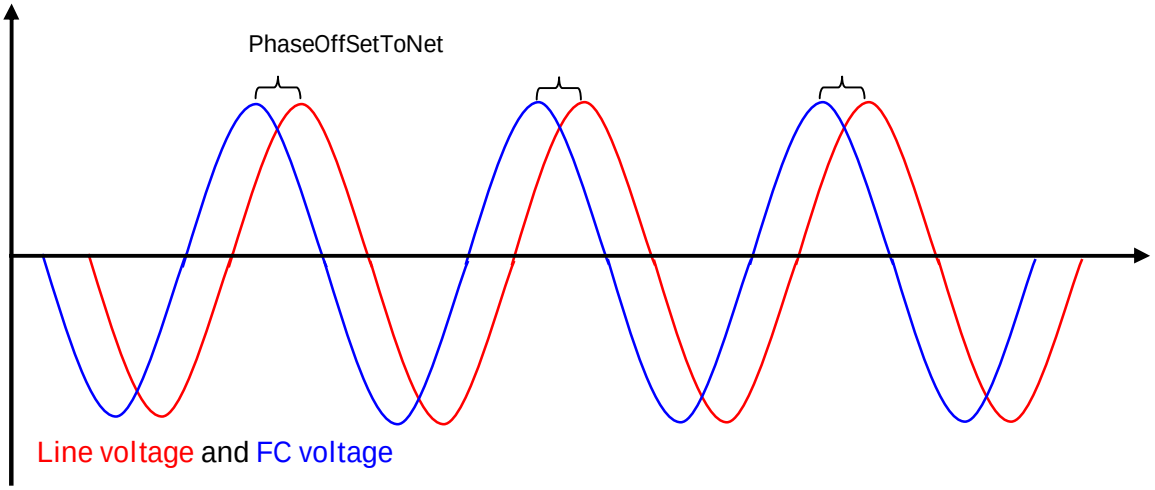
t3: FC Contactor is mechanically open.

d. FC does not see motor voltage.

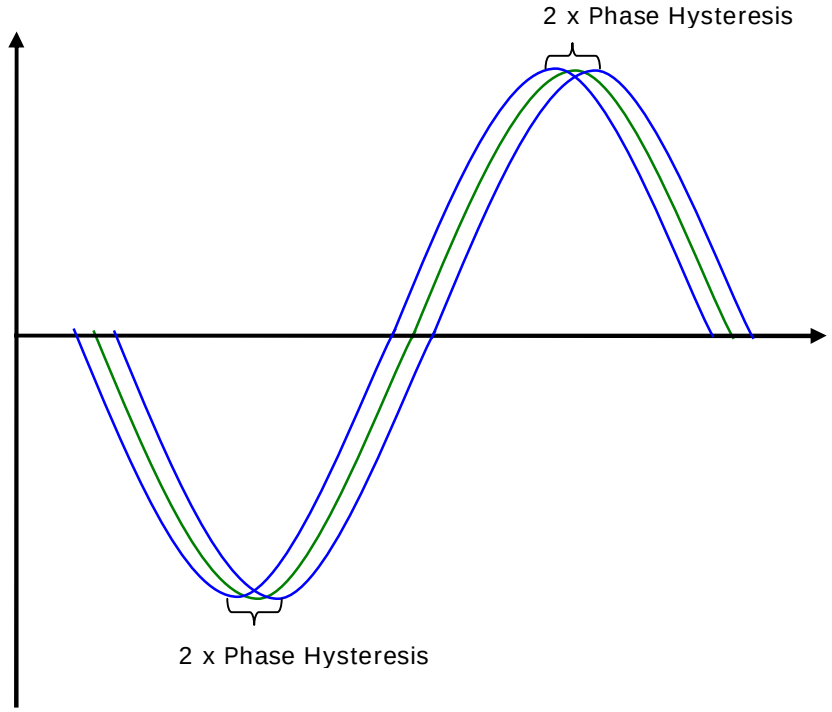
t4: NET contactor is mechanically closed

e. Motor voltage is the same as line voltage
f. Current goes to motor.

2.4 Phase Offset To Net



2.5 Phase Hysteresis



Voltage angle reference and FC voltage hysteresis area

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

2.6 Commissioning

During commission delay parameters should be set according to these rules:

- The drive should not be in run state when NET contactor is closed.
- The FC Contactor should not open until the drive is in stop state
- NET and FC contactors can be closed at the same time for a short period if the drive is not modulating.

During commissioning the following issues needs to be understood:

- Contactor delays may be from 3 ms up to 700 ms.
- NET and FC contactor delays may fluctuate from each other.
- Closing and opening delays may fluctuate.
- Contactor times may fluctuate even if application has same settings.

Use of interlocks:

- The NET contactor can not have an interlock from FC contactor.
    - What can be used momentarily if contactor delays are not know
- The FC Contactor can have an interlock from net contactor.
- If DOL thermal protection is used this trip should be connected to ByPass interlock and any situation that can cause motor input to interrupt.

Commissioning steps:

1. Use oscilloscope during commissioning.
    a. Motor current
    b. Line voltage
    c. FC Voltage
    d. Motor voltage
2. Make sure that the drive sees line voltages and frequency correctly.
    a. V1.25.1 Line (main) voltage.
        i. Only above 90% of motor nominal voltage is accepted.
    b. V1.25.2 Line frequency voltage
        i. Only positive frequency is accepted
3. Make sure that the direction of FC and NET is the same when synchronized.
    a. Measure voltage between two phases from drive output and motor DOL input.
4. Make test runs without any load on motor shaft, if possible.
5. When the timing of system is known
    a. Increase the coasting delay near the time when the FC contactor is mechanically open.
    b. Decrease or Increase Net contactor delays so that the opening of FC and the closing of Net contactor happens right after modulation stops.
        i. You may need to increase the modulation stop and FC opening delay if NET contactor closing delay is long.
6. Recommended time for no current situation is about 20 ms.
    a. Half of a cycle (5 ms) is the minimum due contactors aging.
7. Change [P:**PhaseOffSetToNet**] so that the motor BEM voltage and line voltage are at the same position when the line contactor is mechanically closed.

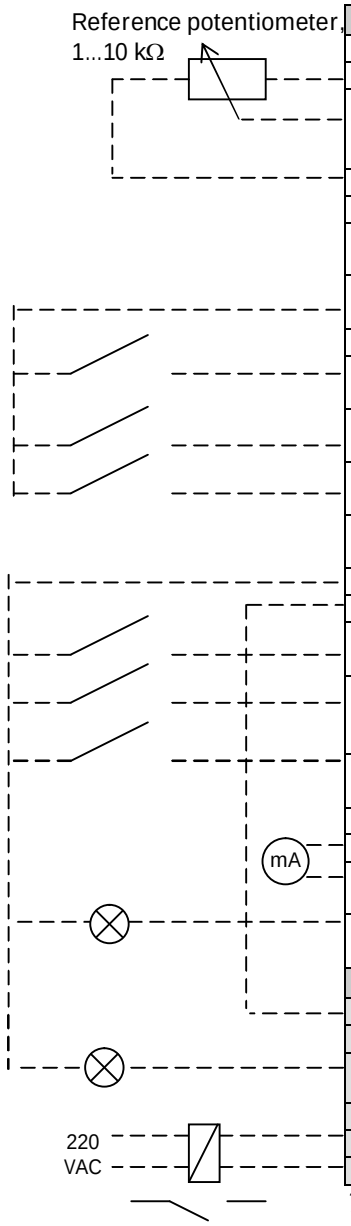
TIP:
Adjusting field weakening point voltage higher so that motor BEM voltage is the same as line voltage at the moment of closing the NET contactor this may decrease current spike.

3. VERSION PARAMETER COMPATIBILITY ISSUES

No compatibility issues.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4. CONTROL I/O



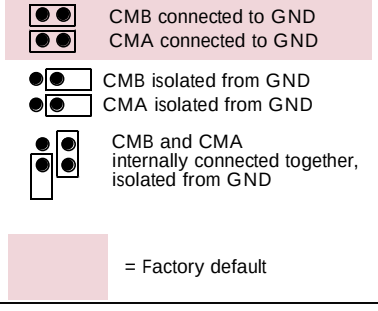
NXOPTA1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference voltage output	Voltage for potentiometer, etc.
2	AI1+	Analogue input 1. Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Analogue input 1 frequency reference. Input range selected by jumpers. Default range: Voltage 0 – 10 V
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input 2. Range 0-10V, R_i = 200Ω Range 0-20 mA R_i = 250Ω	Analogue input 2 frequency reference Input range selected by jumpers. Default range: Current 0 – 20 mA
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 G2.2.7	Contact closed = start forward Programmable start logic P2.2.1
9	DIN2	Start reverse Programmable G2.2.7	Contact closed = start reverse Programmable logic P2.2.1
10	DIN3	Fault reset Programmable G2.2.7	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	Activate synchronization Programmable G2.2.7	Drive will synchronize to net frequency and angle.
15	DIN5	Activate change to net Programmable G2.2.7	Permission to make change to NET when voltage is in synch.
16	DIN6	Reset Network run Programmable G2.2.7	Drive takes controlled motor off net. (Multi motor control feature)
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AOA1+	Analogue output 1 Programmable P2.3.1.2	Output range selected by jumpers. Range 0—20 mA. R_L, max. 500Ω Range 0—10 V. R_L > 1kΩ
19	AOA1-		
20	DOA1	Digital output	Programmable Open collector, I≤50mA, U≤48 VDC
NXOPTA2			
21	RO1	Relay output 1 FC Contactor control Programmable G2.3.3	Switching capacity 24 VCD / 8 A 250 VAC / 8 A 125 VDC / 0.4 A
22	RO1		
23	RO1		
24	RO2	Relay output 1 Net Contactor control Programmable G2.3.3	Programmable No function defined at default
25	RO2		
26	RO2		

Table 4-1. LineSynch application default I/O configuration and connection example.

Note: See Users Manual, chapter Control Connections, for hardware specification and configuration.

Note: See jumper selections below. More information in Vacon NX User's Manual, Chapter 6.2.2.2.

Jumper block X3:
CMA and CMB grounding



4.1 Control signal logic in LineSynch Application

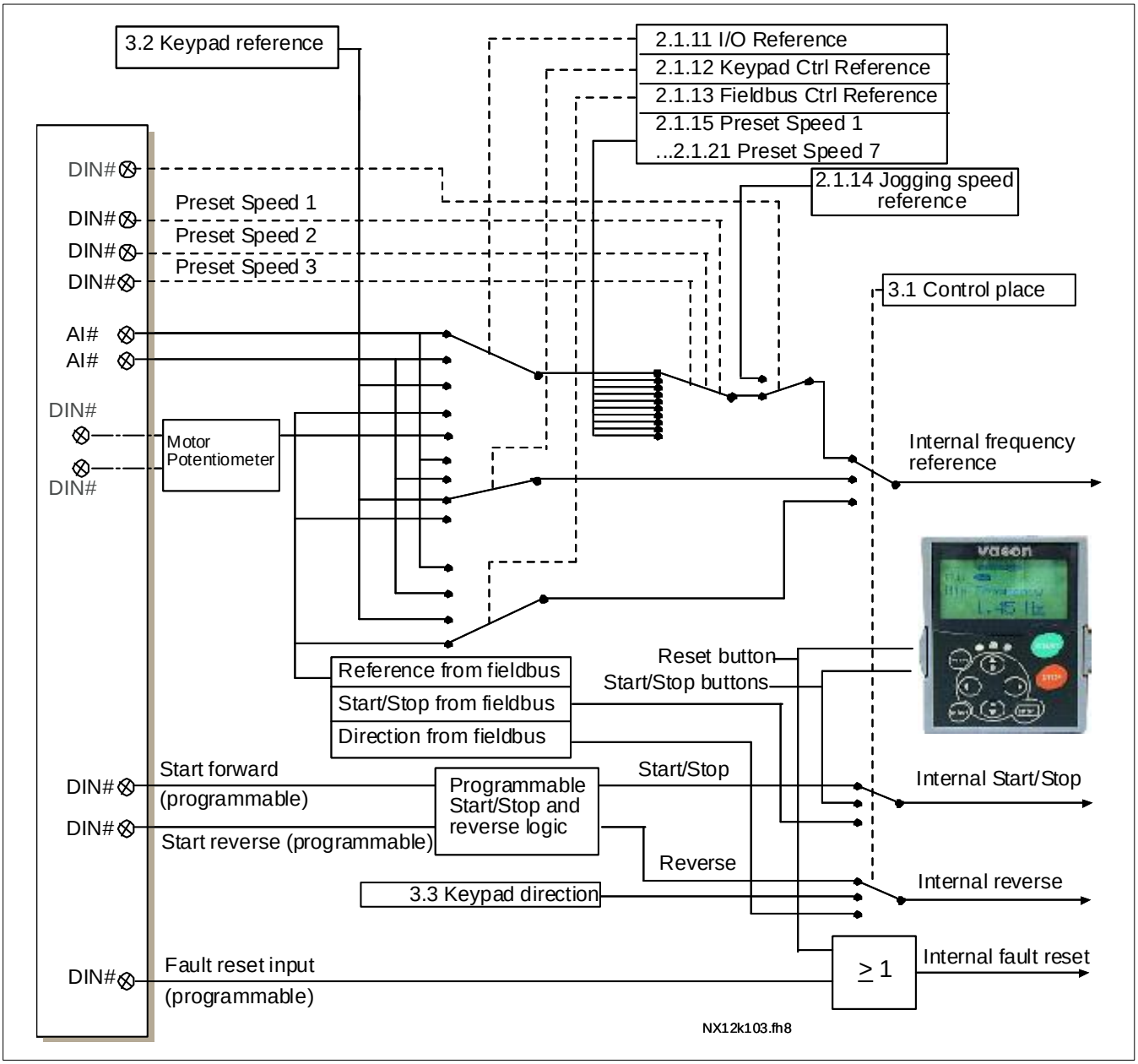


Figure 4-1. Control signal logic of the LineSynch Application

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

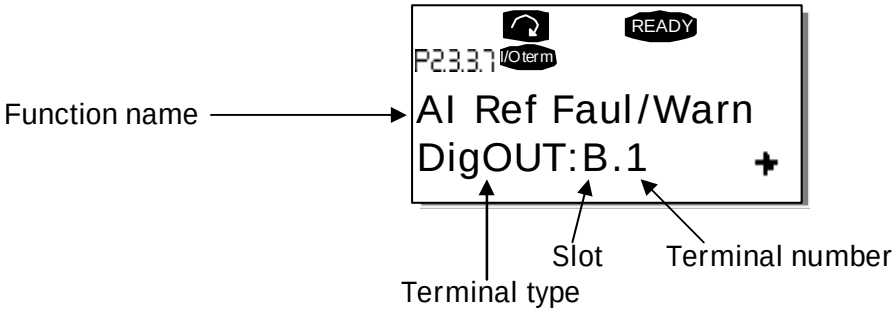
5. "TERMINAL TO FUNCTION" (TTF) PROGRAMMING PRINCIPLE

The programming principle of the input and output signals in the **Multipurpose Control Application NXP** as well as in the **Pump and Fan Control Application** (and partly in the other applications) is different compared to the conventional method used in other Vacon NX applications.

In the conventional programming method, *Function to Terminal Programming Method (FTT),* you have a fixed input or output that you define a certain function for. The applications mentioned above, however, use the *Terminal to Function Programming method (TTF)* in which the programming process is carried out the other way round: Functions appear as parameters which the operator defines a certain input/output for. See *Warning* on page 14.

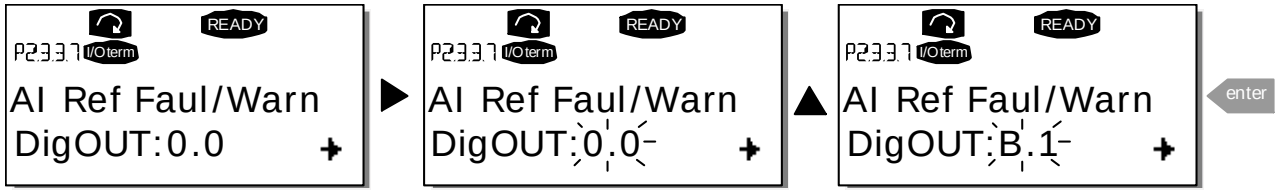
5.1 Defining an input/output for a certain function on keypad

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



Example: You want to connect the digital output function *Reference fault/warning* (parameter 2.3.3.7) to the digital output DO1 on the basic board NXOPTA1 (see Vacon NX User's Manual, Chapter 6.2).

First find the parameter 2.3.3.7 on the keypad. Press the *Menu button right* once to enter the edit mode. On the *value line*, you will see the terminal type on the left (DigIN, DigOUT, An.IN, An.OUT) and on the right, the present input/output the function is connected to (B.3, A.2 etc.), or if not connected, a value (0.#).
When the value is blinking, hold down the *Browser button up* or *down* to find the desired board slot and signal number. The program will scroll the board slots starting from **0** and proceeding from **A** to **E** and the I/O selection from **1** to **10**.
Once you have set the desired value, press the *Enter button* once to confirm the change.



5.2 Defining a terminal for a certain function with NCDrive programming tool

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

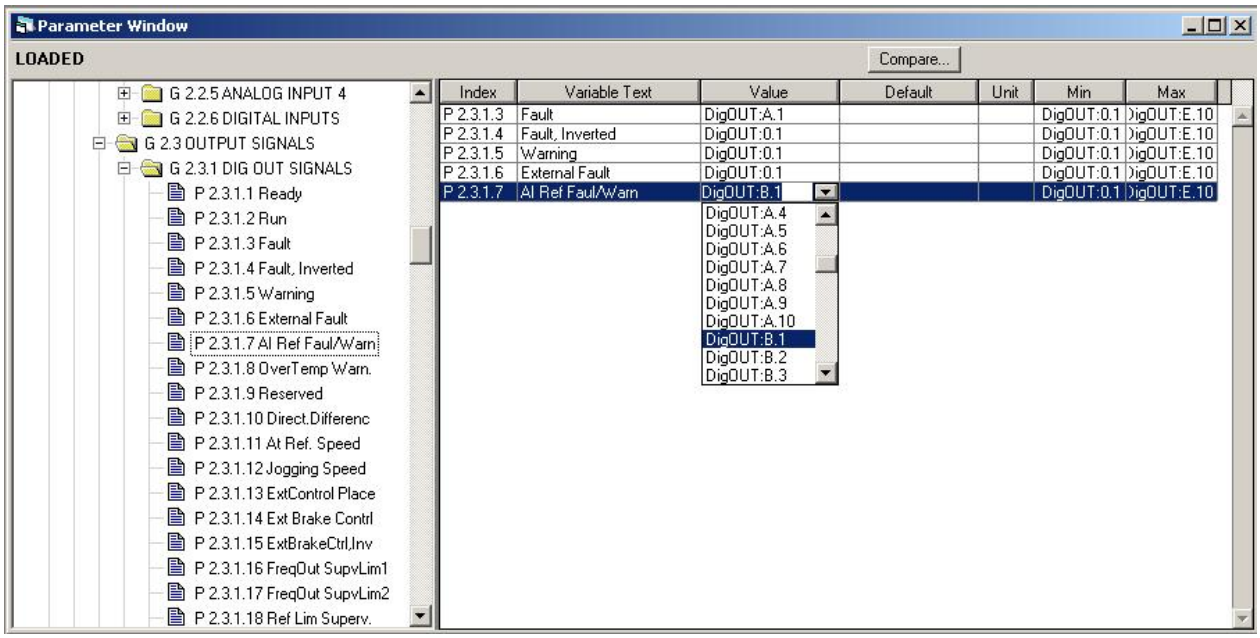


Figure 5-1. Screenshot of NCDrive programming tool; Entering the address code

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

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.3 Defining unused inputs/outputs

All unused inputs and outputs must be given the board slot value **0** and the value **1** also for the terminal number. The value **0.1** is also the default value for most of the functions. However, if you want to use the **values of a digital input signal** for e.g. testing purposes only, you can set the board slot value to **0** and the terminal number to any number between 2...10 to place the input to a TRUE state. In other words, the value 1 corresponds to 'open contact' and values 2 to 10 to 'closed contact'.

In case of analogue inputs, giving the value **1** for the terminal number corresponds to 0% signal level, value **2** corresponds to 20%, value **3** to 30% and so on. Giving value **10** for the terminal number corresponds to 100% signal level.

6. LINESYNCH 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 45 to 115.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present param. number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own setting
ID = ID number of the parameter
= On parameter code: Parameter value can only be changed after the FC has been stopped.
= Apply the Terminal to Function method (TTF) to these parameters (see chapter 5)
= Monitoring value is possible to control from fieldbus by ID number

6.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. See Vacon NX User's Manual, Chapter 7 for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	In % of Motor nominal torque
V1.6	Motor Input Power	kW	5	With one decimal accuracy
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	%	13	AI1
V1.12	Analogue input 2	%	14	AI2
V1.13	Analogue input 3	%	27	AI3
V1.14	Analogue input 4	%	28	AI4
V1.15	Analogue Out 1	%	26	AO1
V1.16	Analogue Out 2	%	50	AO2
V1.17	Analogue Out 3	%	51	AO3
V1.18	DIN1, DIN2, DIN3		15	Digital input statuses
V1.19	DIN4, DIN5, DIN6		16	Digital input statuses
V1.20	Torque reference	%	18	Used Torque Reference
V1.21	Measured temperature	Cº	42	Highest temperature of OPTB8 board. 4 s filtering.
G1.22	Multimonitoring items			Displays three selectable monitoring values

Table 6-1. Monitoring values

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.1 *Monitoring values 2 (Control keypad: menu M1.24)*

Code	Parameter	Unit	ID	Description
V1.23.1	Current	A	1113	Unfiltered motor current
V1.23.2	Torque	%	1125	Unfiltered motor torque
V1.23.3	DC Voltage	V	44	Unfiltered DC link voltage
V1.23.4	Status Word		43	See chapter 6.1.6
V1.23.5	Measured temperature 1	C°	50	
V1.23.6	Measured temperature 2	C°	51	
V1.23.7	Measured temperature 3	C°	52	
V1.23.8	ID Run Status		49	
V1.23.9	Analogue input 1	%	59	AI1
V1.23.10	Analogue input 2	%	60	AI2
V1.23.11	Analogue input 3	%	61	AI3
V1.23.12	Analogue input 4	%	62	AI4
V1.23.13	Final Frequency Reference	Hz	1131	
V1.23.14	Output power	kW	1508	Drive output power in kW

Table 6-2. Monitoring values 2

6.1.2 *FieldBus Monitoring values (Control keypad: menu M1.24)*

Code	Parameter	Unit	ID	Description
V1.24.1	FB Torque Reference	%	1140	Default Control of FB PD 1
V1.24.2	FB Limit Scaling	%	46	Default Control of FB PD 2
V1.24.3	FB Adjust Reference	%	47	Default Control of FB PD 3
V1.24.4	FB Analog Output	%	48	Default Control of FB PD 4
V1.24.5	Last Active Fault		37	
V1.24.6	FB Motor Current	A	45	Motor current (drive independent) given with one decimal point
V1.24.7	Din Status Word		56	
V1.24.8	Din Status Word 2		57	
V1.24.9	Last Active Warning		74	

Table 6-3. FieldBus Monitoring values

6.1.3 *Synch Monitoring values (Control keypad: menu M1.25)*

Code	Parameter	Unit	ID	Description
V1.25.1	Line Voltage	V	1650	OPT-D7 measured line voltage
V1.25.2	Line Voltage Frequency	Hz	1654	OPT-D7 measured line voltage frequency
V1.25.3	Phase error	Dec	1659	Phase error in Dec. from reference.
V1.25.4	Synchronization Status		1651	Synchronization status for NCDrive in CAN communication. Values are updated at 1 ms interval.
V1.25.5	Contactor Status		1652	Relay control status from application
V1.25.6	FB Synchronization control		1640	Line Synchronization control Word from fieldbus.
V1.25.7	Controlled Motor		1641	
V1.25.8	Line voltage L1 – L2	V	1655	Real time
V1.25.9	Line voltage L2 – L3	V	1656	Real time
V1.25.10	Line voltage L3 – L1	V	1657	Real time

Table 6-4. Synchro Monitoring values

27 ***Analogue Input 3***

28 ***Analogue Input 4***

It's possible to adjust this input value from fieldbus when ID 141 values is 0.1. That way its possible to adjust Free Analogue input from fieldbus and have all analogue inputs function available for fieldbus process datas. See also ID 1509.

46 ***FB Limit Scaling***

47 ***FB Adjust Reference***

48 ***FB Analogue Output***

1140 ***FB Torque Reference***

These are default controlling signals from LineSynch application. If these functions are not needed it's possible to free these input to control some other parameter or monitoring value.

6.1.4 *Digital input statuses: ID15 and ID16*

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.5 *Digital input statuses: ID56 and ID57*

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

6.1.6 *Application Status Word*

Application Status Word combains different drive statuses to one data word. See monitoring value V1.23.4 Status Word.

	Application Status Word ID43	
	FALSE	TRUE
b0		
b1	Not in Ready state	Ready
b2	Not Running	Running
b3	No Fault	Fault
b4		
b5	Emergency stop not active	Emergency stop active
b6	Run Disabled	Run Enable
b7	No Warning	Warning
b8		FC Contacto feedback
b9		Motor is synchronized with NET
b10		NET Contactor feedback
b11	No DC Brake	DC Brake is active
b12	No Run Request	Run Request
b13	No Limit Controls Active	Limit control Active
b14	External Brake Control OFF	External Brake Control ON
b15		

Table 6-5. Application Status Word Content.

6.1.7 *Synchronization Status Word: ID1651*

	Line Synch Status Word	
	Signal	Comment
b0	Drive Ready	Drive is in Ready state
b1	Drive Run	Drive is in Run state
b2	Active Synchro	Command to make synchronization is active
b3	Fine tuning Start	Line voltage frequency within 0,10 Hz from net frequency
b4	Fine tuning OK	Voltage angle is within hysteresis
b5	Active Direct	Command to change to net is active
b6	FC Active	Final control signal to FC relay
b7	Connect Direct	Internal command to close NET contactor
b8	Direct Active	Final control signals to NET relay
b9		
b10		
b11		
b12		
b13		
b14		
b15		

Table 6-6. Line Sync Status Word.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.8 *Contactor status Word*

Status of the relay outputs.

	Contactor Status Word ID1652	
	Signal	Comment
b0	Motor 1 FC Contactor	
b1	Motor 1 NET Contactor	
b2	Motor 2 FC Contactor	
b3	Motor 2 NET Contactor	
b4	Motor 3 FC Contactor	
b5	Motor 3 NET Contactor	
b6	Motor 4 FC Contactor	
b7	Motor 4 NET Contactor	
b8	Motor 5 FC Contactor	
b9	Motor 5 NET Contactor	
b10	Motor 6 FC Contactor	
b11	Motor 6 NET Contactor	
b12	Motor 7 FC Contactor	
b13	Motor 7 NET Contactor	
b14	Motor 8 FC Contactor	
b15	Motor 8 NET Contactor	

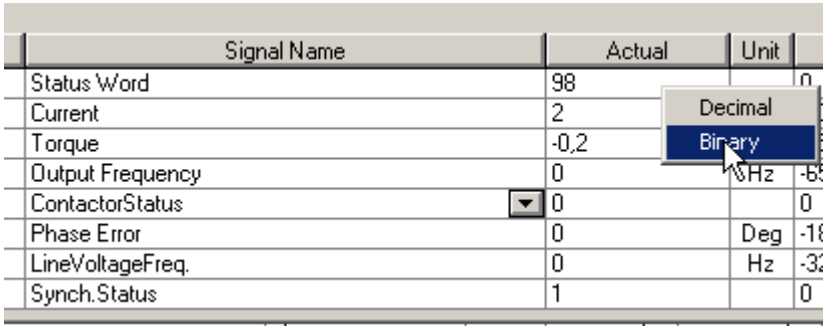
Table 6-7. Line Synch Control Word

6.1.9 *FB Line Synchronization control word*

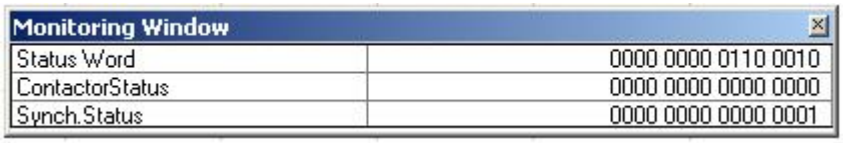
	FieldBus Line synchronization control word	
	Signal	Comment
b0	Activate synchronization	Drive will synchronize to net frequency
b1	Activate changeover to DOL	Drive will make change to DOL when synchronized
b2	Reset DOL contactor(s)	Drive will open closed net contactor(s)
b3		
b4	Single Start	Drive will not start automatically to next motor, rising edge start command required in FB control.
b5	Single to net	Drive will not make changeover to DOL automatically, rising edge for synchronization and changeover required. (ID1700.B1)
b6	Single reset	Rising edge of Reset DOL will open only one NET contactor. (ID1700.B3)
b7		
b8	Motor Bx control	B12 to 14 are used to select controlled motor in FB control.
b9	Start in sequence	Drive will put all motors to net while B0-B2 are active, cannot be used at the same time with B8.
b10		
b11		
b12	Motor select B0	
b13	Motor select B1	
b14	Motor select b2	
b15		

Table 6-8. Line Synch Control Word

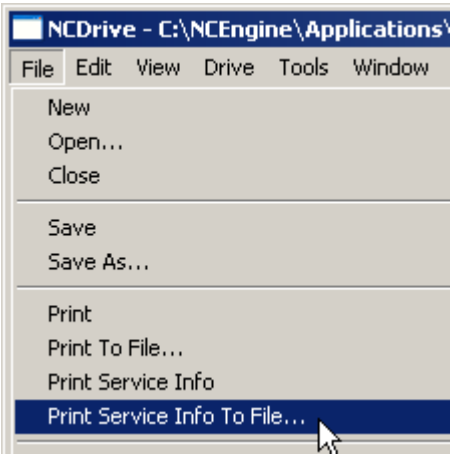
6.1.10 *Recommended signals for NCDrive*



In NCDrive use binary mode to monitor Application Status Word

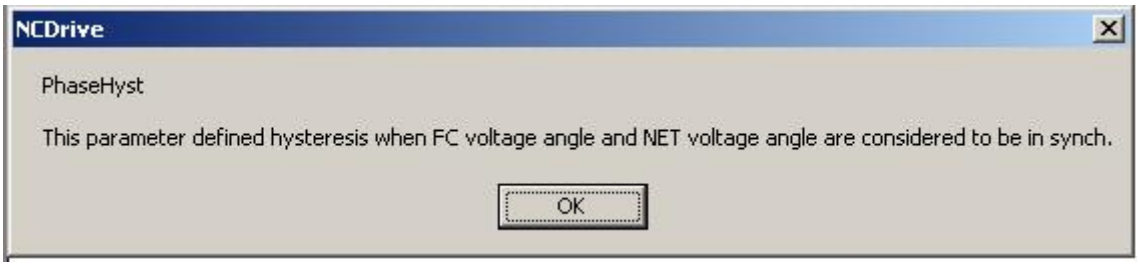


*.trn, *.par and Print Service info to file (*.txt) with situation description.



Tell at least application ID and version number.

To access Parameter help: Select parameter and press F1



Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.2 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	Used is + 0,75 Hz
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	0 Hz to Max frequency
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	Max frequency to 0 Hz
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	Check the rating plate of the motor. Note also used connection Delta/Star.
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	I/O Reference	0	14		0		117	**0**=AI1 **1**=AI2 **2**=AI1+AI2 **3**=AI1-AI2 **4**=AI2-AI1 **5**=AI1xAI2 **6**=AI1 Joystick **7**=AI2 Joystick **8**=Keypad **9**=Fieldbus **10**=Motor potentiometer **11**=AI1, AI2 minimum **12**=AI1, AI2 maximum **13**=Max frequency **14**=AI1/AI2 selection
P2.1.12	Keypad control reference	0	9		8		121	**0**=AI1 **1**=AI2 **2**=AI1+AI2 **3**=AI1-AI2 **4**=AI2-AI1 **5**=AI1xAI2 **6**=AI1 Joystick **7**=AI2 Joystick **8**=Keypad **9**=Fieldbus
P2.1.13	Fieldbus control reference	0	9		9		122	See par. 2.1.12
P2.1.14	Jogging speed reference	0,00	Par. 2.1.2	Hz	5,00		124	See ID413.
P2.1.15	Preset speed 1	0,00	Par. 2.1.2	Hz	10,00		105	Multi-step speed 1
P2.1.16	Preset speed 2	0,00	Par. 2.1.2	Hz	15,00		106	Multi-step speed 2
P2.1.17	Preset speed 3	0,00	Par. 2.1.2	Hz	20,00		126	Multi-step speed 3
P2.1.18	Preset speed 4	0,00	Par. 2.1.2	Hz	25,00		127	Multi-step speed 4
P2.1.19	Preset speed 5	0,00	Par. 2.1.2	Hz	30,00		128	Multi-step speed 5
P2.1.20	Preset speed 6	0,00	Par. 2.1.2	Hz	40,00		129	Multi-step speed 6
P2.1.21	Preset speed 7	0,00	Par. 2.1.2	Hz	50,00		130	Multi-step speed 7

Table 6-9. Basic parameters G2.1

6.3 Input signals

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

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note		
P2.2.1.1	Start/Stop logic selection	0	7		0		300		Start signal **1** (Default: DIN1)	Start signal **2** (Default: DIN2)
								0	Start fwd	Start rvs
								1	Start/Stop	Reverse
								2	Start/Stop	Run enable
								3	Start pulse	Stop pulse
								4	Start	Mot.pot.UP
								5	Start fwd*	Start rvs*
								6	Start*/Stop	Reverse
								7	Start*/Stop	Run enable
P2.2.1.2	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331			
P2.2.1.3	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down		
P2.2.1.4	Adjust input	0	5		0		493	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=Fieldbus (see group G2.9)		
P2.2.1.5	Adjust minimum	0,0	100,0	%	0,0		494			
P2.2.1.6	Adjust maximum	0,0	100,0	%	0,0		495			

Table 6-10. Input signals: basic settings, G2.2.1

6.3.2 Analogue input 1 (Control keypad: Menu M2 → G2.2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.2.1	AI1 signal selection	0.1	E.10		A.1		377	TTF programming. See chapter 5
P2.2.2.2	AI1 filter time	0,00	10,00	s	0,10		324	**0**=No filtering
P2.2.2.3	AI1 signal range	0	3		0		320	**0**=0-10 V (0-20 mA*) **1**=2-10 V (4-20 mA*) **2**= -10V...+10V* **3**= Custom range*
P2.2.2.4	AI1 custom minimum setting	-160,00	160,00	%	0,00		321	% of input signal range. e.g.3 V = 30 %
P2.2.2.5	AI1 custom maximum setting	-160,00	160,00	%	100,00		322	e.g.9 V = 90 %
P2.2.2.6	AI1 reference scaling, minimum value	0,00	320,00	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal
P2.2.2.7	AI1 reference scaling, maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal
P2.2.2.8	AI1 joystick hysteresis	0,00	20,00	%	0,00		384	Dead zone for joystick input
P2.2.2.9	AI1 sleep limit	0,00	100,00	%	0,00		385	Drive goes to sleep mode if input is below this limit for set time.
P2.2.2.10	AI1 sleep delay	0,00	320,00	s	0,00		386	
P2.2.2.11	AI1 joystick offset	-100,00	100,00	%	0,00		165	Press 'Enter' for 1s to set offset, 'Reset' to set 0,00

Table 6-11. Analogue input 1 parameters, G2.2.2

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.3.3 *Analogue input 2 (Control keypad: Menu M2 → G2.2.3)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.1	AI2 signal selection	0.1	E.10		A.2		388	TTF programming. See chapter 5
P2.2.3.2	AI2 filter time	0,00	10,00	s	0,10		329	**0**=No filtering
P2.2.3.3	AI2 signal range	0	3		1		325	**0**=0-20 mA (0-10 V *) **1**=4-20 mA (2-10 V *) **2**= -10V...+10V* **3**= Custom range*
P2.2.3.4	AI2 custom minimum setting	-160,00	160,00	%	20,00		326	% of input signal range. e.g. 2 mA = 10 %
P2.2.3.5	AI2 custom maximum setting	-160,00	160,00	%	100,00		327	e.g. 18 mA = 90 %
P2.2.3.6	AI2 reference scaling, minimum value	0,00	320,00	Hz	0,00		393	Selects the frequency that corresponds to the min. reference signal
P2.2.3.7	AI2 reference scaling, maximum value	0,00	320,00	Hz	0,00		394	Selects the frequency that corresponds to the max. reference signal
P2.2.3.8	AI2 joystick hysteresis	0,00	20,00	%	0,00		395	Dead zone for joystick input, e.g. 10 % = +/- 5 %
P2.2.3.9	AI2 sleep limit	0,00	100,00	%	0,00		396	Drive goes to sleep mode if input is below this limit for set time.
P2.2.3.10	AI2 sleep delay	0,00	320,00	s	0,00		397	
P2.2.3.11	AI2 joystick offset	-100,00	100,00	%	0,00		166	Press 'Enter' for 1s to set offset, 'Reset' to set 0,00

Table 6-12. Analogue input 2 parameters, G2.2.3

6.3.4 *Analogue input 3 (Control keypad: Menu M2 → G2.2.4)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.4.1	AI3 signal selection	0.1	E.10		0.1		141	TTF programming. See chapter 5
P2.2.4.2	AI3 filter time	0,00	10,00	s	0,00		142	**0**=No filtering
P2.2.4.3	AI3 signal range	0	3		0		143	**0**=0-20 mA (0-10 V *) **1**=4-20 mA (2-10 V *) **2**= -10V...+10V* **3**= Custom range*
P2.2.4.4	AI3 custom minimum setting	-160,00	160,00	%	0,00		144	% of input signal range. e.g. 2 mA = 10 %
P2.2.4.5	AI3 custom maximum setting	-160,00	160,00	%	100,00		145	e.g. 18 mA = 90 %
P2.2.4.6	AI3 signal inversion	0	1		0		151	**0**=Not inverted **1**=Inverted

Table 6-13. Analogue input 3 parameters, G2.2.4

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

6.3.5 *Analogue input 4 (Control keypad: Menu M2 → G2.2.5)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.5.1	AI4 signal selection	0.1	E.10		0.1		152	TTF programming. See chapter 5
P2.2.5.2	AI4 filter time	0,00	10,00	s	0,00		153	**0**=No filtering
P2.2.5.3	AI4 signal range	0	3		1		154	**0**=0-20 mA (0-10 V *) **1**=4-20 mA (2-10 V *) **2**= -10V...+10V* **3**= Custom range*
P2.2.5.4	AI4 custom minimum setting	-160,00	160,00	%	20,00		155	% of input signal range. e.g. 2 mA = 10 %
P2.2.5.5	AI4 custom maximum setting	-160,00	160,00	%	100,00		156	e.g. 18 mA = 90 %
P2.2.5.6	AI4 signal inversion	0	1		0		162	**0**=Not inverted **1**=Inverted

Table 6-14. Analogue input 4 parameters, G2.2.5

6.3.6 *Free analogue input, signal selection (Keypad: Menu M2 → G2.2.6)*

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

Table 6-15. Free analogue input signal selection, G2.2.6

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.3.7 *Digital inputs (Control keypad: Menu M2 → G2.2.4)*

Use TTF programming method for all these parameters. See chapter 5.

Code	Parameter	Min	Default	Cust	ID	Note
P2.2.7.1	Start signal 1	0.1	A.1		403	See P2.2.1.1.
P2.2.7.2	Start signal 2	0.1	A.2		404	See P2.2.1.1.
P2.2.7.3	Run enable	0.1	0.2		407	Motor start enabled (cc)
P2.2.7.4	Reverse	0.1	0.1		412	Direction forward (oc) Direction reverse (cc)
P2.2.7.5	Preset speed 1	0.1	0.1		419	See preset speeds in Basic Parameters (G2.1)
P2.2.7.6	Preset speed 2	0.1	0.1		420	
P2.2.7.7	Preset speed 3	0.1	0.1		421	
P2.2.7.8	Motor potentiometer reference DOWN	0.1	0.1		417	Mot.pot. reference decreases (cc)
P2.2.7.9	Motor potentiometer reference UP	0.1	0.1		418	Mot.pot. reference increases (cc)
P2.2.7.10	Fault reset	0.1	A.3		414	All faults reset (cc)
P2.2.7.11	External fault (close)	0.1	0.1		405	Ext. fault (F51) displayed (cc)
P2.2.7.12	External fault (open)	0.1	0.2		406	Ext. fault (F51) displayed (oc)
P2.2.7.13	Acc/Dec time selection	0.1	0.1		408	Acc/Dec time 1 (oc) Acc/Dec time 2 (cc)
P2.2.7.14	Acc/Dec prohibit	0.1	0.1		415	Acc/Dec prohibited (cc)
P2.2.7.15	DC braking	0.1	0.1		416	DC braking active (cc)
P2.2.7.16	Jogging speed	0.1	0.1		413	Jogging speed selected for frequency reference (cc)
P2.2.7.17	AI1/AI2 selection	0.1	0.1		422	cc = AI2 is used as reference, when ID117 = 14
P2.2.7.18	Control from I/O terminal	0.1	0.1		409	Force control place to I/O terminal (cc)
P2.2.7.19	Control from keypad	0.1	0.1		410	Force control place to keypad (cc)
P2.2.7.20	Control from fieldbus	0.1	0.1		411	Force control place to fieldbus (cc)
P2.2.7.21	Parameter set 1/set 2 selection	0.1	0.1		496	Closed cont.=Set 2 is used Open cont.=Set 1 is used
P2.2.7.22	Motor control mode 1/2	0.1	0.1		164	Closed cont.=Mode 2 is used Open cont.=Mode 1 is used See par 2.6.1, 2.6.12
P2.2.7.23	Cooling monitor	0.1	0.2		750	Used with liquid-cooled unit
P2.2.7.24	Enable inching	0.1	0.1		532	Enables Inching function
P2.2.7.25	Inching reference 1	0.1	0.1		530	Inching reference 1. (Default Forward 2 Hz. See P2.4.16) **This will start the drive**
P2.2.7.26	Inching reference 2	0.1	0.1		531	Inching reference 2. (Default Forward 2 Hz. See P2.4.17) **This will start the drive**
P2.2.7.27	Emergency stop	0.1	0.2		1213	Low signal activates EM
P2.2.7.28	Input switch acknowledgement	0.1	0.2		1209	Low signal generates fault (F64)
P2.2.7.29	Active synchronization	0.1	A.4		I600	
P2.2.7.30	Active direct	0.1	A.5		1601	
P2.2.7.31	Reset direct	0.1	A.6		1612	
P2.2.7.32	FC Contactor acknowledge	0.1	0.1		1630	
P2.2.7.33	Net contactor acknowledge	0.1	0.1		1631	
P2.2.7.34	Motor selection B0	0.1	0,1		1670	
P2.2.7.35	Motor selection B1	0.1	0.1		1671	
P2.2.7.36	Motor selection B2	0,1	0.1		1672	

P2.2.7.37	ByPass Inter Lock Falling (OC) Edge	0,1	0.2		1636	Interlock from device that monitors if motor input is OK. Falling edge will activate protection function F87.
P2.2.7.38	ByPass Inter Lock Rising (CC) Edge	0,1	0.1		1637	Interlock from device that monitors if motor input is OK. Rising edge will activate protection function F87.

Table 6-16. Digital input signals, G2.2.4

cc = closing contact
oc = opening contact

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.4 Output signals

6.4.1 Delayed digital output 1 (Keypad: Menu M2 → G2.3.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1.1	Digital output 1 signal selection	0.1	E.10		0.1		486	TTF programming. See chapter 5. Possible to invert with ID1084 (NXP only)
P2.3.1.2	Digital output 1 function	0	26		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reverse **10**=Jogging spd selected **11**=At speed **12**=Mot. regulator active **13**=Freq. limit 1 superv. **14**=Freq. limit 2 superv. **15**=Torque limit superv. **16**=Ref. limit supervision **17**=Not used **18**=I/O control place act. **19**=FC temp. limit superv. **20**=Reference inverted **21**=Not used **22**=Therm. fault or warn. **23**=AI supervision **24**=Fieldbus DIN 1 **25**=Fieldbus DIN 2 **26**=Fieldbus DIN 3
P2.3.1.3	Digital output 1 on delay	0,00	320,00	s	0,00		487	0,00 = On delay not in use
P2.3.1.4	Digital output 1 off delay	0,00	320,00	s	0.00		488	0,00 = Off delay not in use

Table 6-17. Delayed digital output 1 parameters, G2.3.1

6.4.2 Delayed digital output 2 (Keypad: Menu M2 → G2.3.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.2.1	Digital output 2 signal selection	0.1	E.10		0.1		489	TTF programming. See chapter 5. Possible to invert with ID1084 (NXP only)
P2.3.2.2	Digital output 2 function	0	26		0		490	See par. 2.3.1.2
P2.3.2.3	Digital output 2 on delay	0,00	320,00	s	0,00		491	0,00 = On delay not in use
P2.3.2.4	Digital output 2 off delay	0,00	320,00	s	0,00		492	0,00 = Off delay not in use

Table 6-18. Delayed digital output 2 parameters, G2.3.2

6.4.3 *Digital output signals (Control keypad: Menu M2 → G2.3.3)*

Use TTF programming method for all these parameters. See chapter 5.

Code	Parameter	Min	Default	Cust	ID	Note
P2.3.3.1	Ready	0.1	A.1		432	Ready to Run
P2.3.3.2	Run	0.1	0.1		433	Running
P2.3.3.3	Fault	0.1	0.1		434	Drive in fault state
P2.3.3.4	Inverted fault	0.1	0.1		435	Drive not in fault state
P2.3.3.5	Warning	0.1	0.1		436	Warning active
P2.3.3.6	External fault	0.1	0.1		437	External fault active
P2.3.3.7	Reference fault/warning	0.1	0.1		438	4 mA fault or warning active
P2.3.3.8	Overtemperature warning	0.1	0.1		439	Drive overtemperature active
P2.3.3.9	Reverse	0.1	0.1		440	Output frequency < 0 Hz
P2.3.3.10	Unrequested direction	0.1	0.1		441	Actual direction <> requested direction
P2.3.3.11	At speed	0.1	0.1		442	Reference = Output frequency
P2.3.3.12	Jogging speed	0.1	0.1		443	Jogging or preset speed command active
P2.3.3.13	I/O control place	0.1	0.1		444	IO control active
P2.3.3.14	External brake control	0.1	0.1		445	See explanations on page
P2.3.3.15	External brake control, inverted	0.1	0.1		446	
P2.3.3.16	Output frequency limit 1 supervision	0.1	0.1		447	See ID315.
P2.3.3.17	Output frequency limit 2 supervision	0.1	0.1		448	See ID346.
P2.3.3.18	Reference limit supervision	0.1	0.1		449	See ID350.
P2.3.3.19	Temperature limit supervision	0.1	0.1		450	Drive temperature supervision. See ID354.
P2.3.3.20	Torque limit supervision	0.1	0.1		451	See ID348.
P2.3.3.21	Themistor fault or warning	0.1	0.1		452	
P2.3.3.22	Analogue input supervision limit	0.1	0.1		463	See ID356
P2.3.3.23	Motor regulator activation	0.1	0.1		454	
P2.3.3.24	Fieldbus DIN 1	0.1	0.1		455	See fieldbus manual
P2.3.3.25	Fieldbus DIN 2	0.1	0.1		456	See fieldbus manual
P2.3.3.26	Fieldbus DIN 3	0.1	0.1		457	See fieldbus manual
P2.3.3.27	Fieldbus DIN 4	0.1	0.1		169	See fieldbus manual
P2.3.3.28	Fieldbus DIN 5	0.1	0.1		170	See fieldbus manual
P2.3.3.29	DC ready pulse	0.1	0.1		1218	For external DC charger
P2.3.3.30	Safe Disable Active	0.1	0.1		756	
P2.3.3.31	Drive in Synch	0.1	0.1		1625	
P2.3.3.32	Motor 1 FC Control	0.1	B.1		1602	
P2.3.3.33	Motor 1 DL Control	0.1	B.2		1603	
P2.3.3.34	Motor 2 FC Control	0.1	0.1		1604	
P2.3.3.35	Motor 2 DL Control	0.1	0.1		1605	
P2.3.3.36	Motor 3 FC Control	0.1	0.1		1606	
P2.3.3.37	Motor 3 DL Control	0.1	0.1		1607	
P2.3.3.38	Motor 4 FC Control	0.1	0.1		1615	
P2.3.3.39	Motor 4 DL Control	0.1	0.1		1616	
P2.3.3.40	Motor 5 FC Control	0.1	0.1		1617	

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

P2.3.3.41	Motor 5 DL Control	0.1	0.1		1618	
P2.3.3.42	Motor 6 FC Control	0.1	0.1		1645	
P2.3.3.43	Motor 6 DL Control	0.1	0.1		1646	
P2.3.3.44	Motor 7 FC Control	0.1	0.1		1617	
P2.3.3.45	Motor 7 DL Control	0.1	0.1		1648	
P2.3.3.46	Motor 8 FC Control	0.1	0.1		1664	
P2.3.3.37	Motor 8 DL Control	0.1	0.1		1665	

Table 6-19. Digital output signals, G2.3.3

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

6.4.4 *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	2		0		315	**0**=Not used **1**=Low limit supervision **2**=High limit supervision
P2.3.4.2	Output frequency limit 1; Supervised value	0,00	320,00	Hz	0,00		316	
P2.3.4.3	Output frequency limit 2 supervision	0	2		0		346	**0**=Not used **1**=Low limit supervision **2**=High limit supervision
P2.3.4.4	Output frequency limit 2; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.4.5	Torque limit supervision	0	2		0		348	**0**=Not used **1**=Low limit supervision **2**=High limit supervision
P2.3.4.6	Torque limit supervision value	-300,0	300,0	%	100,0		349	For brake control absolute values are used
P2.3.4.7	Reference limit supervision	0	2		0		350	**0**=Not used **1**=Low limit **2**=High limit
P2.3.4.8	Reference limit supervision value	0,0	100,0	%	0,0		351	**0,0**=Min frequency **100,0**=Max frequency
P2.3.4.9	FC temperature supervision	0	2		0		354	**0**=Not used **1**=Low limit **2**=High limit
P2.3.4.10	FC temperature supervised value	–10	100	°C	40		355	
P2.3.4.11	Analogue supervision signal	0	4		0		356	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4
P2.3.4.12	Analogue supervision low limit	0,00	100,00	%	10,00		357	DO Off limit. See P2.3.3.22
P2.3.4.13	Analogue supervision high limit	0,00	100,00	%	90,00		358	DO Off limit. See P2.3.3.22

Table 6-20. Limit settings, G2.3.4

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.4.5 *Analogue output 1 (Control keypad: Menu M2 → G2.3.5)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.5.1	Analogue output 1 signal selection	0.1	E.10		A.1		464	TTF programming. See chapter 5.
P2.3.5.2	Analogue output 1 function	0	15		1		307	**0**=Not used (20 mA / 10 V) **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V) **9**=AI1 **10**=AI2 **11**=Output freq. (f_{min} - f_{max}) **12**=Motor torque (–2...+2xT_{Nmot}) **13**=Motor power (–2...+2xT_{Nmot}) **14**=PT100 temperature **15**=FB analogue output ProcessData4 (NXS)
P2.3.5.3	Analogue output 1 filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.5.4	Analogue output 1 inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5.5	Analogue output 1 minimum	0	1		0		310	**0**=0 mA (0 V) **1**=4 mA (2 V)
P2.3.5.6	Analogue output 1 scale	10	1000	%	100		311	
P2.3.5.7	Analogue output 1 offset	-100,00	100,00	%	0,00		375	

Table 6-21. Analogue output 1 parameters, G2.3.5

6.4.6 *Analogue output 2 (Control keypad: Menu M2 → G2.3.6)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.6.1	Analogue output 2 signal selection	0.1	E.10		0.1		471	TTF programming. See chapter 5.
P2.3.6.2	Analogue output 2 function	0	15		4		472	See par. 2.3.5.2
P2.3.6.3	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.6.4	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.6.5	Analogue output 2 minimum	0	1		0		475	**0**=0 mA (0 V) **1**=4 mA (2 V)
P2.3.6.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.6.7	Analogue output 2 offset	-100,00	100,00	%	0,00		477	

Table 6-22. Analogue output 2 parameters, G2.3.6

6.4.7 *Analogue output 3 (Control keypad: Menu M2 → G2.3.7)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.7.1	Analogue output 3 signal selection	0.1	E.10		0.1		478	TTF programming See chapter 6.2 and 6.4
P2.3.7.2	Analogue output 3 function	0	15		5		479	See par. 2.3.5.2
P2.3.7.3	Analogue output 3 filter time	0,00	10,00	s	1,00		480	**0**=No filtering
P2.3.7.4	Analogue output 3 inversion	0	1		0		481	**0**=Not inverted **1**=Inverted
P2.3.7.5	Analogue output 3 minimum	0	1		0		482	**0**=0 mA (0 V) **1**=4 mA (2 V)
P2.3.7.6	Analogue output 3 scale	10	1000	%	100		483	
P2.3.7.7	Analogue output 3 offset	-100,00	100,00	%	0,00		484	

Table 6-23. Analogue output 3 parameters, G2.3.7

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/running **4**=Used when running (no testing)
P2.4.6	Start function	0	2		0		505	**0**=Ramp **1**=Flying start **2**=Conditional flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0	I_L	A	I_H		519	
P2.4.14	DC-brake current at stop	0	I_L	A	0,1 x I_H		1080	
P2.4.15	Inching reference 1	-320,00	320,00	Hz	2,00		1239	
P2.4.16	Inching reference 2	-320,00	320,00	Hz	-2,00		1240	
P2.4.17	Inching ramp	0,1	3200,0	s	1,0		1257	
P2.4.18	Emergency stop mode	0	1		0		1276	**0**=Coasting **1**=Ramp
P2.4.19	Control options	0	65536		0		1084	Change allowed only in Stop state
P2.4.20	Short Delay CL	0	60,000	s	Varies		672	CL and Flying Start
P2.4.21	Restart Delay	0	60,000	S	Varies		1424	

Table 6-24. Drive control parameters, G2.4

6.6 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	-1,00	320,00	Hz	0,00		509	**0**=Not used
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,00		510	**0**=Not used
P2.5.3	Prohibit frequency range 2 low limit	0,00	320,00	Hz	0,00		511	**0**=Not used
P2.5.4	Prohibit frequency range 2 high limit	0,00	320,00	Hz	0,00		512	**0**=Not used
P2.5.5	Prohibit frequency range 3 low limit	0,00	320,00	Hz	0,00		513	**0**=Not used
P2.5.6	Prohibit frequency range 3 high limit	0,00	320,00	Hz	0,00		514	**0**=Not used
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 6-25. Prohibit frequencies, (G2.5)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.7 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	2		0		600	**0**=Frequency control **1**=Speed control **2**=Torque control
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
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	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 7-9 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	2		1		608	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping to zero)
P2.6.12	Motor control mode 2	0	4		2		521	See par. 2.6.1
P2.6.13	Speed controller P gain (open loop)	0	32767		3000		637	
P2.6.14	Speed controller I gain (open loop)	0	32767		300		638	
P2.6.15	Load drooping	0,00	100,00	%	0,00		620	
P2.6.16	Identification	0	2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run
P2.6.17	Restart delay	0,000	65,535	s	Varies		1424	OL delay for coasting stop
P2.6.18	Load drooping time	0	32000	ms	0		656	For dynamic changes
P2.6.19	Negative frequency limit	-320,00	320,00	Hz	-320,00		1286	Alternative limit for negative direction
P2.6.20	Positive frequency limit	-320,00	320,00	Hz	320,00		1285	Alternative limit for positive direction
P2.6.21	Generator torque limit	0,0	300,0	%	300,0		1288	
P2.6.22	Motoring torque limit	0,0	300,0	%	300,0		1287	
P2.6.23	Load share	0,0	500,0	%	100,0		1248	
P2.6.24	Modulation limit	0	150	%	100		655	If sinus filter is used set this value to 96%

Table 6-26. Motor control parameters

6.7.1 NXP drives: PMS Motor control parameters (Control keypad: Menu M2 → G2.6.24)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.24.1	Motor type	0	1		0		650	**0**=Induction Motor **1**=PMS Motor
P2.6.24.2	Flux Current Kp	0	32000		5000		651	
P2.6.24.3	Flux Current Ti	0	1000		25		652	
P2.6.24.4	EnableRsIdentifi	0	1		1		654	**0**=No **1**=Yes
P2.6.24.5	Torque stabilator gain	0	1000		100		1412	
P2.6.24.6	Torque stabilator damping	0	1000		900		1413	For PMSM, use value 980
P2.6.24.7	Torque stabilator gain FWP	0	1000		50		1414	

Table 6-27. PMS Motor control parameters, NXP drives

6.7.2 NXP drives: Identification parameters (Control keypad: Menu M2→ G2.6.25)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.25.1	Rs voltage drop	0	30000		Varies		662	Used for torque calculation in Open Loop
P2.6.25.2	Ir add zero point voltage	0	30000		Varies		664	
P2.6.25.3	Ir add generator scale	0	30000		Varies		665	
P2.6.25.4	Ir add motoring scale	0	30000		Varies		667	
P2.6.25.5	Iu Offset	-32000	32000		0		668	
P2.6.25.6	Iv Offset	-32000	32000		0		669	
P2.6.25.7	Iw Offset	-32000	32000		0		670	

Table 6-28. Identification parameters, NXP drives

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

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

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		0		700	**0**=No response **1**=Warning **2**=Warning+Previous freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	4		2		701	**0**=No response **1**=Warning **2**=Fault, stop acc. to 2.4.7 **3**=Fault, stop by coasting **4**=Fault, Open and Lock DOL contactors
P2.7.4	Input phase supervision	0	3		0		730	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Earth fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	150	%	100		708	
P2.7.13	Stall protection	0	3		0		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,00	Par. 2.1.2	Hz	25,00		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10,0	150,0	%	50,0		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protec-tion time limit	2,00	600,00	s	20,00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Resp. to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	How many inputs have been used in PT100 board.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.25	Response to PT100 fault	0	4		0		740	**0**=No response **1**=Warning **2**=Fault, stop acc. to 2.4.7 **3**=Fault, stop by coasting **4**=Fault, Open and Lock DOL contactors
P2.7.26	PT100 warning limit	–30,0	200,0	Cº	120,0		741	
P2.7.27	PT100 fault limit	–30,0	200,0	Cº	130,0		742	
P2.7.28	Cooling fault delay	0,00	7,00	s	2,00		751	
P2.7.29	Safe disable mode	1	2		1		755	**1**=Warning, stop by coasting **2**=Fault, stop by coasting
P2.7.30	DC Low Response	0	2		1		1680	**0**=No response **1**=Warning **2**=Fault, stop by coasting
P2.7.31	DC Low Limit	333	1200	V	470		1681	
P2.7.32	Line Voltage low response	0	2		1		1685	**0**=No response **1**=Warning **2**=Fault, stop by coasting
P2.7.33	Line Voltage low limit	180	800	V	180		1686	

Table 6-29. Protections, G2.7

6.9 Auto fault reset parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 6-30. Autofault reset parameters, G2.8

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.10 Fieldbus parameters (Control Keypad: Menu M2 →G2.9)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.9.1	Fieldbus min scale	0,00	320,00	Hz	0,00		850	
P2.9.2	Fieldbus max scale	0,00	320,00	Hz	0,00		851	
P2.9.3	Fieldbus process data out 1 selection	0	10000		1		852	Choose monitoring data with parameter ID Def: Output Frequency
P2.9.4	Fieldbus process data out 2 selection	0	10000		2		853	Choose monitoring data with parameter ID Def:Motor Speed
P2.9.5	Fieldbus process data out 3 selection	0	10000		45		854	Choose monitoring data with parameter ID Def:Motor Current to FB
P2.9.6	Fieldbus process data out 4 selection	0	10000		4		855	Choose monitoring data with parameter ID Def: Motor Torque
P2.9.7	Fieldbus process data out 5 selection	0	10000		5		856	Choose monitoring data with parameter ID Def: Motor Power
P2.9.8	Fieldbus process data out 6 selection	0	10000		6		857	Choose monitoring data with parameter ID Def: Motor Voltage
P2.9.9	Fieldbus process data out 7 selection	0	10000		7		858	Choose monitoring data with parameter ID Def: DC-Link Voltage
P2.9.10	Fieldbus process data out 8 selection	0	10000		37		859	Choose monitoring data with parameter ID Def: Last Active Fault
P2.9.11	Fieldbus process data in 1 selection	0	10000		1140		876	Choose controlled data with parameter ID Def: FB Torque Reference
P2.9.12	Fieldbus process data in 2 selection	0	10000		46		877	Choose controlled data with parameter ID Def: FB Limit Scaling
P2.9.13	Fieldbus process data in 3 selection	0	10000		47		878	Choose controlled data with parameter ID Def: FB Adjust Reference
P2.9.14	Fieldbus process data in 4 selection	0	10000		48		879	Choose controlled data with parameter ID Def: FB Analogue Output.
P2.9.15	Fieldbus process data in 5 selection	0	10000		0		880	Choose controlled data with parameter ID
P2.9.16	Fieldbus process data in 6 selection	0	10000		0		881	Choose controlled data with parameter ID
P2.9.17	Fieldbus process data in 7 selection	0	10000		0		882	Choose controlled data with parameter ID
P2.9.18	Fieldbus process data in 8 selection	0	10000		0		883	Choose controlled data with parameter ID

Table 6-31. Fieldbus parameters

6.11 Torque control parameters (Control Keypad: Menu M2 →G2.10)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.10.1	Torque limit	0,0	300,0	%	300,0		609	Combination of ID1288 & ID1287, lower is used.
P2.10.2	Torque limit control P-gain	0,0	32000		3000		610	Used only in Open Loop control mode
P2.10.3	Torque limit control I-gain	0,0	32000		200		611	
P2.10.4	Torque reference selection	0	8		0		641	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=AI1 joystick (-10 ...10 V) **6**=AI2 joystick (-10 ...10 V) **7**=Torque reference from keypad, R3.5 **8**=Fieldbus torque ref.
P2.10.5	Torque reference max.	–300,0	300,0	%	100		642	
P2.10.6	Torque reference min.	–300,0	300,0	%	0,0		643	
P2.10.7	Torque speed limit (OL)	0	2		1		644	**0=**Max. frequency **1=**Selected frequency ref. **2=**Preset speed 7
P2.10.8	Minimum frequency for open loop torque control	0,00	50,00	Hz	3,00		636	
P2.10.9	Torque controller P gain	0	32000		150		639	
P2.10.10	Torque controller I gain	0	32000		10		640	
P2.10.11	Torque reference filtering time	0	32000	ms	0		1244	

Table 6-32. Torque control parameters, G2.10

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.12 Line Synch parameters (Control keypad: Menu M2 → G2.12)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.11.1	Control Mode	0	0		0		1626	**0**=Single motor **1**=Multi motor **2**=In Secuence
P2.11.2	Controlled motor	0	7		0		1611	Controlled motor when using multi motor mode
P2.11.3	Phase offset to NET	-179,0	179,0	Dec	0		1608	
P2.11.4	Phase Hysteresis	0,0	180,0	Dec	3,0		1620	
P2.11.5	Delay to Coasting	0	30000	ms	0		1621	
P2.11.6	Delay to Open	0	30000	ms	0		1623	
P2.11.7	Delay to Close	0	30000	ms	0		1624	
P2.11.8	Number of motors	1	8	Pcs	1		1627	

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.11.9.1	Smoot / Speed ratio	0	10		0		1690	**0**=Smoothest . . . **10**=Fastest
P2.12.9.2	Synchronization options	0	65535		0		1700	
P2.12.9.3	Start Delay to FC	0	30000	ms	200		1628	
P2.12.9.4	Commissioning Test modes	0	4		0		1634	**0**=Line Synchronization **1**=FC, DL Timing **2**=FC On, DL Off **3**=FC Off, DL On
P2.12.9.5	Commissioning test activation	0.1	E.10		0.1		1635	

Table 6-33. Line Synch parameters, G2.12

6.13 Keypad control (Control keypad: Menu M3)

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

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		2		125	**0**=PC Control **1**=I/O terminal **2**=Keypad **3**=Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0**=Forward **1**=Reverse
P3.4	Stop button	0	1				114	**0**=Limited function of Stop button **1**=Stop button always enabled
R3.5	Torque reference	0,0	100,0	%	0,0			

Table 6-34. Keypad control parameters, M3

6.14 System menu (Control keypad: Menu M6)

For parameters and functions related to the general use of the frequency converter, such as application and language selection, customised parameter sets or information about the hardware and software, see Chapter 7.3.6 in the Vacon NX User's Manual.

6.15 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see Chapter 7.3.7 in the Vacon NX User's Manual.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7. DESCRIPTION OF PARAMETERS

On the following pages you will find the parameter descriptions arranged according to the individual ID number of the parameter. A shaded parameter ID number (e.g. ***418 Motor potentiometer UP***) indicates that the *TTF programming method* shall be applied to this parameter (see chapter 5). Some parameter names are followed by a number code indicating the "All in One" applications in which the parameter is included. If **no code** is shown the parameter is available in **all applications**. See below. The parameter numbers under which the parameter appears in different applications are also given.

Note: These is parameter ID numbers that are not used in this application or there are selections that are not available in this application, refer to parameter list table for right functions and selections. See also Vacon Advanced application APFIFF08.

101 ***Minimum frequency*** *(2.1.1)*
102 ***Maximum frequency*** *(2.1.2)*

Defines the frequency limits of the frequency converter.
The maximum value for these parameters is 320 Hz with standard software.
Maximum frequency internally is 0,75 Hz higher than set parameter.

103 ***Acceleration time 1*** *(2.1.3)*
104 ***Deceleration time 1*** *(2.1.4)*

These parameters defines time required for the output frequency to increase from the zero frequency to maximum frequency (ID102) and reverse.

105 ***Preset speed 1*** *(2.1.15)*
106 ***Preset speed 2*** *(2.1.16)*

These parameters defines reference when Preset Speed digital inputs are activated. See also Digital inputs Preset Speed 1 (ID419) and 2 (ID420).

Speed	Preset speed 1 ID419	Preset speed 2 ID420
Basic reference	0	0
ID105	1	0
ID106	0	1

Table 7-1. Preset speed

107 ***Current limit*** *(2.1.5)*

This parameter determines the maximum motor current from the frequency converter. The parameter value range differs from size to size. When Current limit is changed stall current limit (ID710) is internally calculated to 90% of current limit if value is greater. When current limit is active drive output frequency is lowered.

108 U/f ration selection 234567 (2.6.3)

Linear:
0 The voltage of the motor changes linearly from zero point voltage (ID606) with the frequency in the constant flux area from 0 Hz to the field weakening point (ID602) where the voltage at FWP (ID602) is supplied to the motor.

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

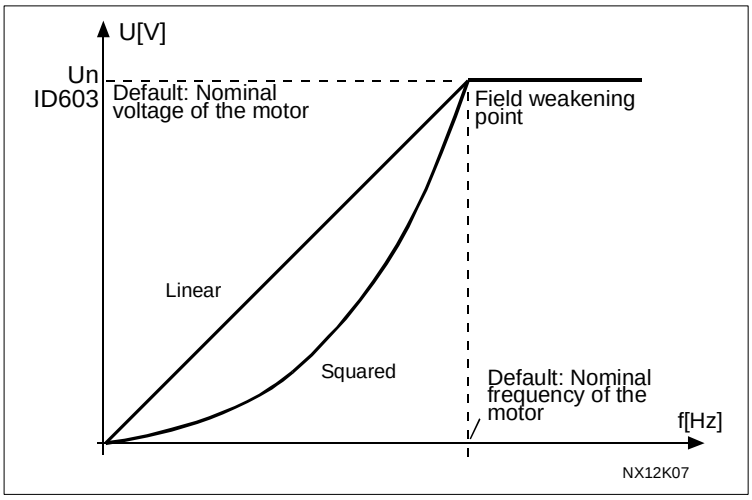


Figure 7-1. Linear and squared change of motor voltage

Programmable U/f curve:
2 The U/f curve can be programmed with three different points. Additionally Mid point frequency (ID604) and Mid point voltage (ID605). Programmable U/f curve can be used if more torque is needed on low frequencies. Make identification for optimal setting (ID631).

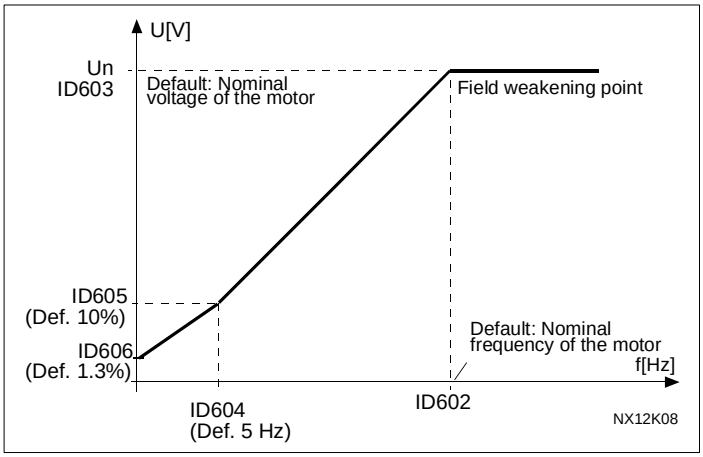


Figure 7-2. Programmable U/f curve

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Linear with flux optimisation:

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

109 ***U/f optimisation*** *(2.6.2.1)*

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

EXAMPLE:

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

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

Option 1: Automatic functins

Step 1: Make identification run. P2.1.11 (ID631) Identification.

Step 2: Activate speed control P2.6.1 (ID600) or U/f optimization (ID109).

Step 3: Activate both speed control P2.6.1 (ID600) and U/f optimization (ID109).

Option 2: Manual tuning
Programmable U/f curve
To get torque you need to set the zero point voltage (ID606) and midpoint voltage/frequency (ID604 & ID605) so that the motor takes one-third of nominal current at low frequencies. Use higher current if more torque is needed at low frequencies. First set parameter U/f ratio (ID108) to Programmable U/f curve (**2**). Increase zero point voltage (ID606) to get enough current at zero speed. Set then the midpoint voltage (ID605) to 1.4142*ID606 (Output voltage at zero speed) and midpoint frequency (ID604) to value ID606/100%*ID111. (Output voltage at zero speed) / 100 % * Nominal frequency

NOTE! *In high torque – low speed applications – it is likely that the motor will overheat. If the motor has to run long times under these conditions, special attention must be paid to cooling of the motor. Use external cooling for the motor if the temperature tends to rise too high.*

110 ***Nominal voltage of the motor*** *(2.1.6)*

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

111 ***Nominal frequency of the motor*** *(2.1.7)*

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

112 ***Nominal speed of the motor*** *(2.1.8)*

Find this value n_n on the rating plate of the motor. Note also nominal freqyency.

113 ***Nominal current of the motor*** *(2.1.9)*

Find this value I_n on the rating plate of the motor. If magnetization current is provided set also Magnetization current (ID612) before identification run.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

117 *I/O frequency reference selection* *(2.1.11)*

Defines which frequency reference source is selected when control place is I/O terminal ID125.

Applic. Sel.	6
0	Analogue input 1 (AI1). See ID377
1	Anlogue input 2 (AI2). See ID388
2	AI1+AI2
3	AI1–AI2
4	AI2–AI1
5	AI1*AI2
6	AI1 joystick (-10 -- + 10 V)
7	AI2 joystick
8	Keypad reference (R3.2)
9	Fieldbus reference
10	Potentiometer reference; controlled with ID418 (TRUE=increase) and ID417 (TRUE=decrease)
11	AI1 or AI2, whichever is lower
12	AI1 or AI2, whichever is greater
13	Max. frequency ID102 (recommended in torque control only)
14	AI1/AI2 selection, see ID422

Table 7-2. Selections for parameter ID117

Priority order of frequency reference:

1. PC Control
2. Acceleration prohibited input
3. Inching frequency references
4. Jogging speed
5. Preset speeds
6. 4 mA fault frequency
7. 2nd Maximum frequency limit
8. Selected control place frequency reference

120 *Motor cos phi* *(2.1.10)*

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

121 *Keypad frequency reference selection* *(2.1.12, 2.1.13, 2.2.6, 2.2.1.2)*

Defines which frequency reference source is selected when control place is keypad ID125.

Applic. Sel.	6
0	Analogue Input 1 (AI1)
1	Analogue Input 2 (AI2)
2	AI1+AI2
3	AI1–AI2
4	AI2–AI1
5	AI1*AI2
6	AI1 joystick
7	AI2 joystick
8	Keypad reference (R3.2)
9	Fieldbus reference*

Table 7-3. Selections for parameter ID121

*FBSpeedReference

122 *Fieldbus frequency reference selection* *(2.1.13, 2.1.14, 2.2.7, 2.2.1.3)*

Defines which frequency reference source is selected when control place is Fieldbus ID125. For selections in different applications, see keypad reference selection ID121.

124 *Jogging speed reference* *(2.1.14, 2.1.15, 2.1.19)*

Defines the jogging speed reference when activated by digital input. See parameter Jogging Speed (ID413).

126 *Preset speed 3* *(2.1.17)*
127 *Preset speed 4* *(2.1.18)*
128 *Preset speed 5* *(2.1.19)*
129 *Preset speed 6* *(2.1.20)*
130 *Preset speed 7* *(2.1.21)*

Parameter values define the Preset speeds references activated by digital inputs. See Preset Speeds digital inputs ID419, ID420 and ID421.

Speed	Preset speed 1 ID419	Preset speed 2 ID420	Preset speed 3 ID421
Basic speed	0	0	0
P2.1.15 (1)	1	0	0
P2.1.16 (2)	0	1	0
P2.1.17 (3)	1	1	0
P2.1.18 (4)	0	0	1
P2.1.19 (5)	1	0	1
P2.1.20 (6)	0	1	1
P2.1.21 (7)	1	1	1

Table 7-4. Preset speeds 1 to 7

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

131 ***I/O frequency reference selection 2*** *(2.2.1.7)*

See the values of the parameter I/O Frequency Reference (ID117) selection above.

141 ***AI3 signal selection*** *(2.2.4.1)*

Connect the AI3 signal to the analogue input of your choice with this parameter. For more information, see Chapter 5 “Terminal To Function” (TTF) programming principle. When this input is set to 0.1 you can control AI3 from fieldbus.

142 ***AI3 signal filter time*** *(2.2.4.2)*

When this parameter is given a value greater than 0 the function that filters out disturbances from the incoming analogue signal is activated. Long filtering time makes the regulation response slower. See parameter AI1 signal filter time (ID324).

144 ***AI3 custom setting minimum*** *(2.2.4.4)*
145 ***AI3 custom setting maximum*** *(2.2.4.5)*

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

151 ***AI3 signal inversion*** *(2.2.4.6)*

0 = No inversion
1 = Signal inverted

152 ***AI4 signal selection*** *(2.2.5.1)*

Connect the AI4 signal to the analogue input of your choice with this parameter. For more information, see Chapter 5 “Terminal To Function” (TTF) programming principle. In NXP when this input is set to 0.1 you can control AI3 from fieldbus.

153 ***AI4 filter time*** *(2.2.5.2)*

When this parameter is given a value greater than 0,0 the function that filters out disturbances from the incoming analogue signal is activated. See Figure 8 – 20.

155 ***AI4 custom setting minimum*** *(2.2.5.4)*
156 ***AI4 custom setting maximum*** *(2.2.5.5)*

Set the custom minimum and maximum input levels for the AI4 signal within -160...160%. E.g. min 40 %, max 80 % = 8...16 mA

162 ***AI4 signal inversion*** *(2.2.44, 2.2.5.6)*

0 = No inversion
1 = Signal inverted

164 ***Motor control mode 1/2*** *(2.2.7.22)*

Contact is open = Motor control mode 1 is selected
Contact is closed = Motor control mode 2 is selected
See parameter Motor Control Mode (ID600) and Motor Control Mode 2 (ID521).
When changing between open loop and closed loop control modes, make change in stop state.

165 ***AI1 joystick offset*** *(2.2.2.11)*

Define the frequency zero point as follows: With this parameter on display, place the potentiometer at the assumed zero point and press *Enter* on the keypad.
Note: This will not, however, change the reference scaling.
Press *Reset* button to change the parameter value back to 0,00%.

166 ***AI2 joystick offset*** *(2.2.3.11)*

See parameter AI1 joystick offset (ID165).

169 ***Fieldbus input data 4 (FBFixedControlWord, bit 6)*** *(2.3.3.27)*
170 ***Fieldbus input data 5 (FBFixedControlWord, bit 7)*** *(2.3.3.28)*

The data from the fieldbus (FBFixedControlWord) can be led to frequency converter digital outputs. See details from used fieldbus board manual.

179 ***Scaling of Motoring Power Limit***

The motoring power limit is equal to parameter Motoring Power Limit (ID1289) if value '0' is selected. If any of the inputs is selected the motoring power limit is scaled between zero and parameter Motoring Power Limit (ID1289). This parameter is available for Closed Loop control mode only. Input level zero causes power limit zero.

0 = Not Used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FieldBus Scaling ID46 (Monitoring Value)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

300 Start/Stop logic selection (2.2.1.1)

0 DIN1: closed contact = start forward (D403)
DIN2: closed contact = start reverse (ID404)

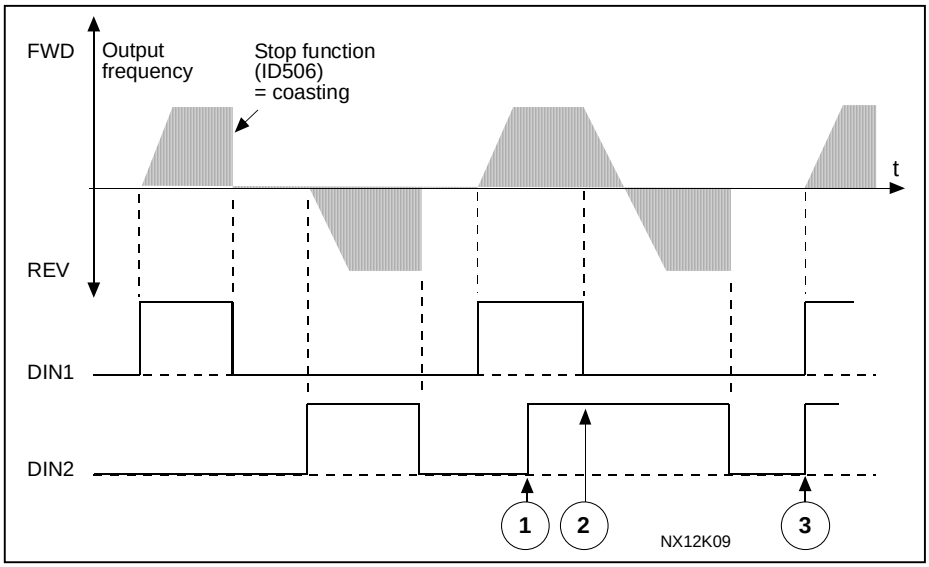


Figure 7-3. Start forward/Start reverse

① The first selected direction has the highest priority.

② When the DIN1 contact opens the direction of rotation starts the change.

③ If Start forward (D403) and Start reverse (ID404) signals are active simultaneously the Start forward signal (D403) has priority.

1 DIN1: closed contact = start open contact = stop
DIN2: closed contact = reverse open contact = forward
See below.

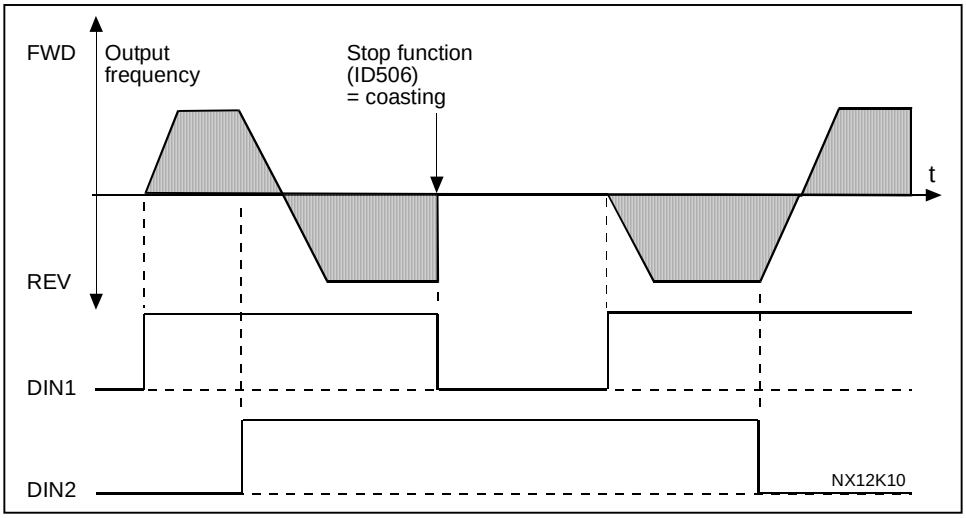


Figure 7-4. Start, Stop, Reverse

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

3 3-wire connection (pulse control):
DIN1: closed contact = start pulse
DIN2: open contact = stop pulse

See Figure 7-5.

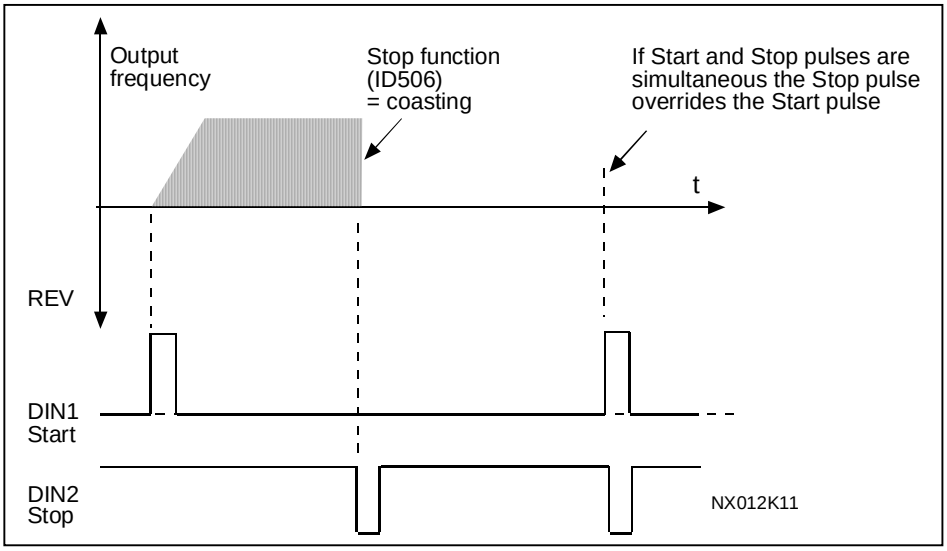


Figure 7-5. Start pulse/ Stop pulse.

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

4 DIN1: closed contact = start forward
DIN2: closed contact = Increases motor potentiometer reference; this parameter is

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

When multi motor controlled, this selection will put only on motor to net until next rising edge start command.

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

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

Reverse (ID412) can be used on those start logics that do not have reversion in Start Signal 2 (ID404)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

303 Reference scaling, minimum value (2.2.2.6)
304 Reference scaling, maximum value (2.2.2.7)

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

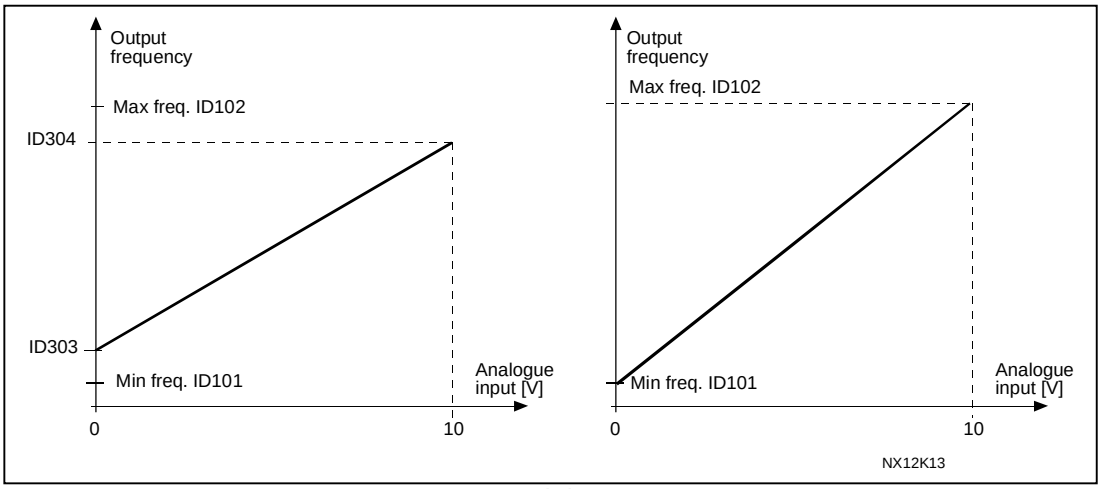


Figure 7-6. ***Left****: Reference scaling;* ***Right****: No scaling used (par. ID303 = 0).*

307 Analogue output function (2.3.5.2)

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

Selection	Function	Comment
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	AI1	
10	AI2	
11	Output freq. (f_{min} - f_{max})	
12	Motor torque (-T_{nMotor} —T_{nMotor})	
13	Motor power (-P_{nMotor} —P_{nMotor})	
14	PT100 temperature	
15	FB analogue output ID48 Monitoring signal	

308 Analogue output filter time *(2.3.5.3)*

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

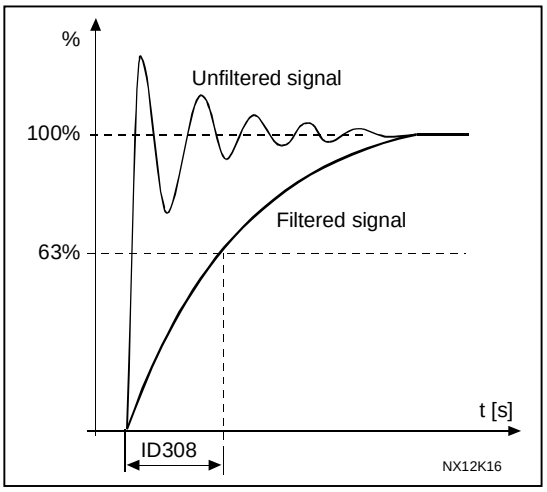


Figure 7-7. Analogue output filtering

309 Analogue output inversion *(2.3.5.4)*

Inverts the analogue output signal:

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

See parameter Analogue output scale (ID311) below.

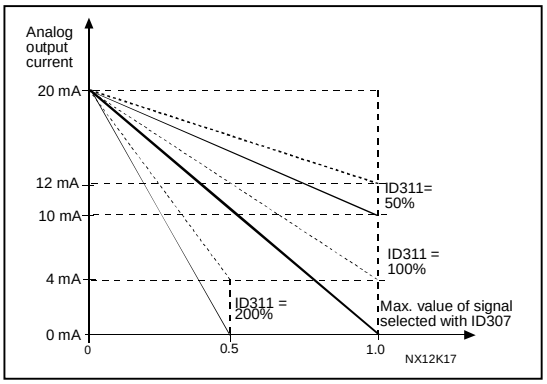


Figure 7-8. Analogue output invert

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

310 Analogue output minimum *(2.3.5.5)*

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

0 Set minimum value to 0 mA (0 %)
1 Set minimum value to 4 mA (20 %)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

311 Analogue output scale (2.3.5.6)

Scaling factor for analogue output.

Signal	Max. value of the signal
Output frequency	Max frequency (ID102)
Freq. Reference	Max frequency (ID102)
Motor speed	Motor nom. speed $1xn_{mMotor}$
Output current	Motor nom. current $1xI_{nMotor}$
Motor torque	Motor nom. torque $1xT_{nMotor}$
Motor power	Motor nom. power $1xP_{nMotor}$
Motor voltage	100% x U_{nmotor}
DC-link voltage	1000 V

Table 7-5. Analogue output scaling

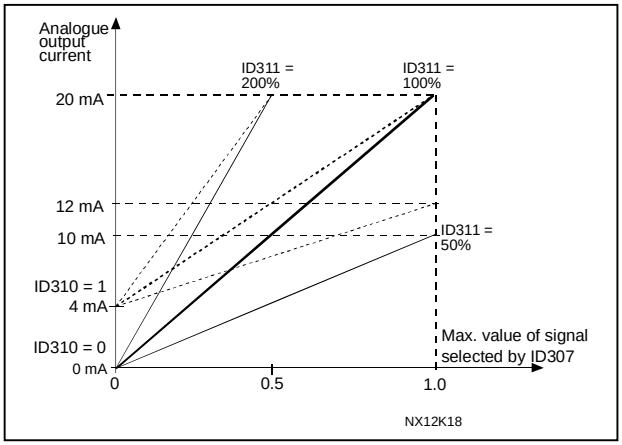


Figure 7-9. Analogue output scaling

312 Digital output function (2.3.7, 2.3.1.2)
313 Relay output 1 function (2.3.8, 2.3.1.3)
314 Relay output 2 function (2.3.9)

Setting value	Signal content
0 = Not used	Out of operation
	Digital output DO1 sinks the current and programmable relay (RO1, RO2) is activated when:
1 = Ready	The frequency converter is ready to operate
2 = Run	The frequency converter operates (motor is running)
3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip not occurred
5 = Frequency converter overheat warning	The heat-sink temperature exceeds +70°C
6 = External fault or warning	Fault or warning depending on par. ID701
7 = Reference fault or warning	Fault or warning depending on par. ID700 - if analogue reference is 4—20 mA and signal is <4mA
8 = Warning	Always if a warning exists
9 = Reversed	The reverse command has been selected
10 = Jogging speed	The jogging, preset or inching speed has been activated with digital input
11 = At speed	The output frequency has reached the set reference
12 = Motor regulator activated	One of the limit regulators is activated
13 = Output frequency limit 1 supervision	The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 315 and 316 below)
14 = Output frequency limit 2 supervision	The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 346 and 347 below)

15 = Torque limit supervision	The motor torque goes beyond the set supervision low limit/high limit (par. ID348 and ID349).
16 = Reference limit supervision	Active reference goes beyond the set supervision low limit/high limit (par. ID350 and ID351)
17 = External brake control	External brake ON/OFF control with programmable delay (par. ID352 and ID353)
18 = Control from I/O terminals	External control mode (Menu **M3**; ID125)
19 = Frequency converter temperature limit supervision (Appl. 3456)	Frequency converter heatsink temperature goes beyond the set supervision limits (par. ID354 and ID355).
20 = Reference inverted (Appl. 6)	Rotation direction is different from the requested one.
21 = External brake control inverted (Appl. 3456)	External brake ON/OFF control (par. ID352 and ID353); Output active when brake control is OFF
22 = Thermistor fault or warning (Appl.3456)	The thermistor input of option board indicates overtemperature. Fault or warning depending on parameter ID732.
23 = Analogue input supervision	Selects the analogue input to be monitored. See par. ID356, ID357, ID358 and ID463.
24 = Fieldbus input data 1	Fieldbus data (FBFixedControlWord) to DO/RO
25 = Fieldbus input data 2	Fieldbus data (FBFixedControlWord) to DO/RO
26 = Fieldbus input data 3	Fieldbus data (FBFixedControlWord) to DO/RO

Table 7-6. Output signals via DO1 and output relays RO1 and RO2.

315 Output frequency limit supervision function *(2.3.4.1)*

0 No supervision
1 Low limit supervision
2 High limit supervision

If the output frequency goes under/over the set limit (ID316) this function generates a message via digital output depending on to which output the supervision signal 1 (ID447) is connected.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

316 Output frequency limit supervision value *(2.3.4.2)*

Selects the frequency value supervised by parameter ID315. See Figure 7-10.

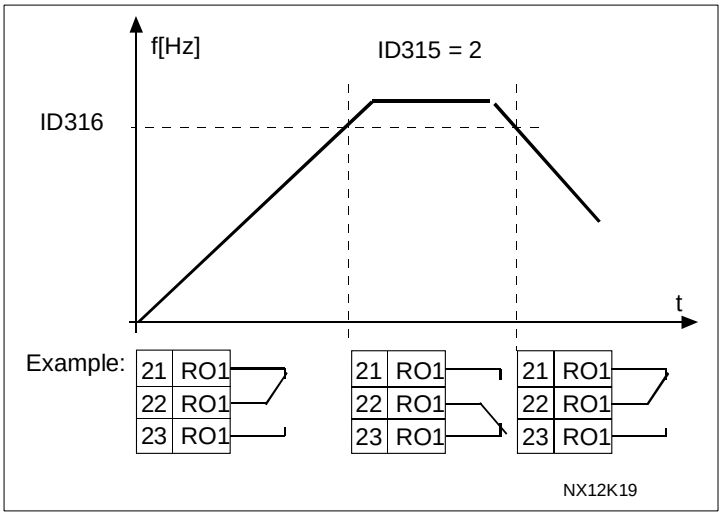


Figure 7-10. Output frequency supervision

320 AI1 signal range *(2.2.2.3)*

Applic. Sel.	APFIF131
0	0...100%
1	20...100%
2	–10...+10V (0...100%)
3	Customised

Table 7-7. Selections for parameter ID320

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

321 AI1 custom setting minimum *(2.2.2.4)*
322 AI1 custom setting maximum *(2.2.2.5)*

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

324 AI1 signal filter time *(2.2.2.2)*

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

Long filtering time makes the regulation response slower. See Figure 7-11.

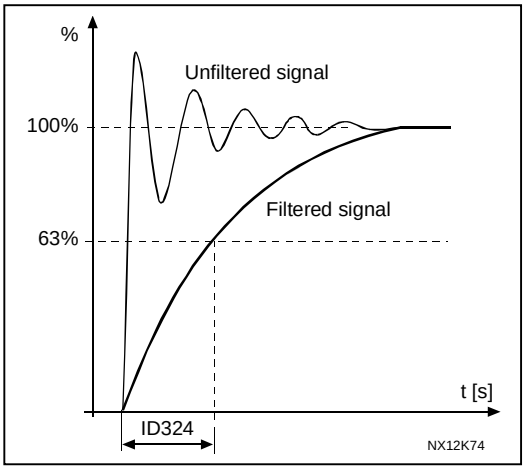


Figure 7-11. AI1 signal filtering

325 Analogue input AI2 signal range *(2.2.3.3)*

Applic. Sel.	APFIF131
0	0...100%
1	20...100%
2	–10...+10V
3	Customised

Table 7-8. Selections for parameter ID325

For selection 'Customised', see parameters ID326 and ID327.

326 Analogue input AI2 custom setting min. *(2.2.3.4)*
327 Analogue input AI2 custom setting max. *(2.2.3.5)*

These parameters set the analogue input 2 signal for any input signal span within -160—160%. E.g. if signal input scaling is set to 40 % to 80 % reference is changing between Minimum Frequency (ID101) and Maximum Frequency (ID102) with mA signal 8 mA to 16 mA

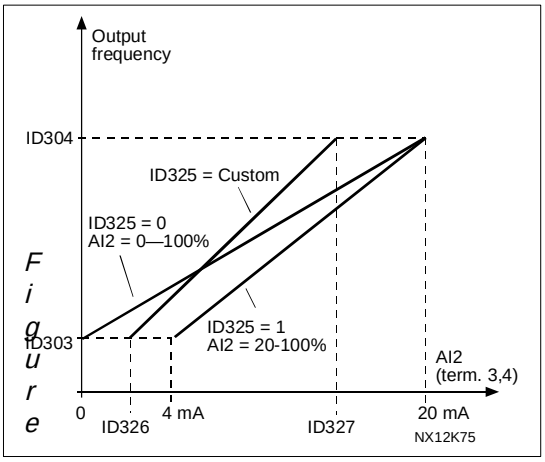


Figure 7-12. Analogue input AI2 scaling.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

329 ***Analogue input 2 (AI2) filter time*** *(2.2.3.2)*

When this parameter is given a value greater than 0 the function filters out disturbances from the incoming analogue signal.
See AI1 signal filtering time (ID324).

331 ***Motor potentiometer ramp time*** *(2.2.1.2)*

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

346 ***Output freq. limit 2 supervision function*** *(2.3.4.3)*

0 No supervision
1 Low limit supervision
2 High limit supervision

If the output frequency goes under/over the set limit (ID347) this function generates a message via digital output depending on to which output the supervision signal 2 (ID448) is connected.

347 ***Output frequency limit 2 supervision value*** *(2.3.4.4)*

Selects the frequency value supervised by parameter ID346. See Figure 7-10.

348 ***Torque limit, supervision function*** *(2.3.4.5)*

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

If the calculated torque value falls below or exceeds the set limit (ID349) this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2 depending on to which output the supervision signal (par. ID451) is connected.

349 ***Torque limit, supervision value*** *(2.3.4.6)*

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

350 ***Reference limit, supervision function*** *(2.3.4.7)*

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

If the reference value falls below or exceeds the set reference limit (ID351), this function generates a message via the digital output depending on to which output the reference limit supervision signal (ID449) is connected

351 ***Reference limit, supervision value*** *(2.3.4.8)*

The frequency value to be supervised with the parameter ID350. % value between minimum and maximum frequency.

354 ***Frequency converter temperature limit supervision*** *(2.3.4.11)*

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

If the temperature of the frequency converter unit falls below or exceeds the temperature limit value (ID355), this function generates a message via the digital output depending on to which output the temperature limit supervision signal (ID450) is connected.

355 ***Frequency converter temperature limit value*** *(2.3.4.12)*

This temperature value is supervised by parameter ID354.

356 ***Analogue ON/OFF supervision signal*** *(2.3.4.13)*

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

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4

357 ***Analogue OFF supervision control limit*** *(2.3.4.14)*
358 ***Analogue ON supervision control limit*** *(2.3.4.15)*

These parameters set the low and high limits of the signal selected with par. ID356. See Figure 7-13.

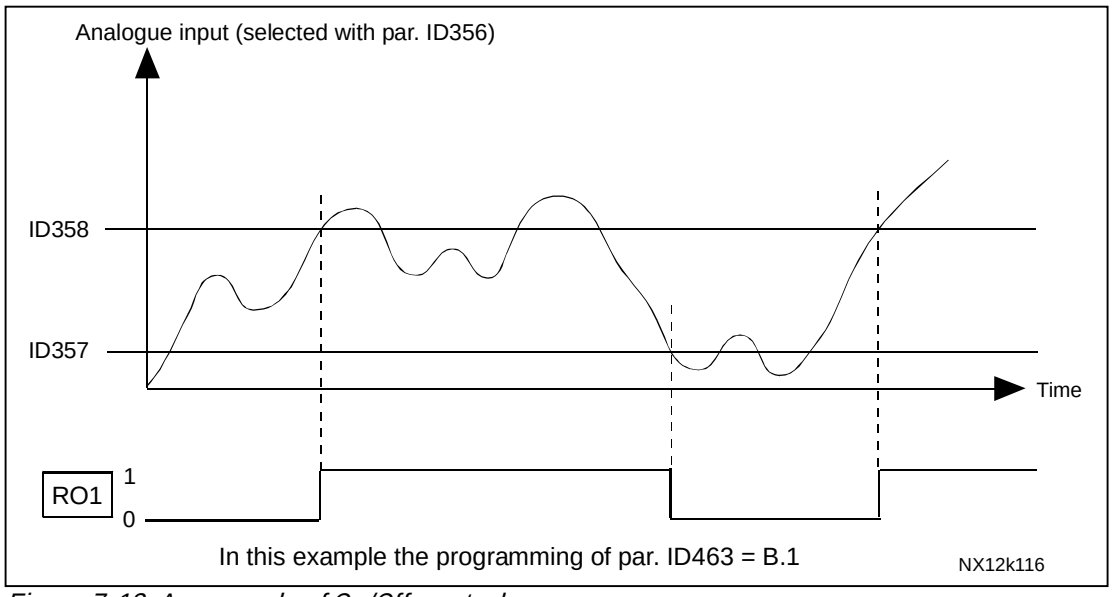


Figure 7-13. An example of On/Off-control

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

366 ***Motor potentiometer reference copy*** *(2.2.1.8)*

0 Keep reference
1 Copy reference
2 Copy actual

This function copies reference frequency or actual frequency from other IO reference place when IO Reference is changed to Motor potentiometer reference with ID422.

367 ***Motor potentiometer memory reset (Frequency reference)*** *(2.2.1.3)*

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

375 ***Analogue output offset*** *(2.3.5.7)*

Add –100.0 to 100.0% to the analogue output.

377 ***AI1 signal selection*** *(2.2.2.1)*

Connect the AI1 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

384 ***AI1 joystick hysteresis*** *(2.2.2.8)*

This parameter defines the joystick hysteresis between 0 and 20 %.
When the joystick or potentiometer control is turned from reverse to forward, the output frequency falls linearly to the selected minimum frequency (joystick/potentiometer in middle position) and stays there until the joystick/potentiometer is turned towards the forward command. It depends on the amount of joystick hysteresis defined with this parameter, how much the joystick/potentiometer must be turned to start the increase of the frequency towards the selected maximum frequency.
If the value of this parameter is 0, the frequency starts to increase linearly immediately when the joystick/potentiometer is turned towards the forward command from the middle position. When the control is changed from forward to reverse, the frequency follows the same pattern the other way round. See Figure 7-14.

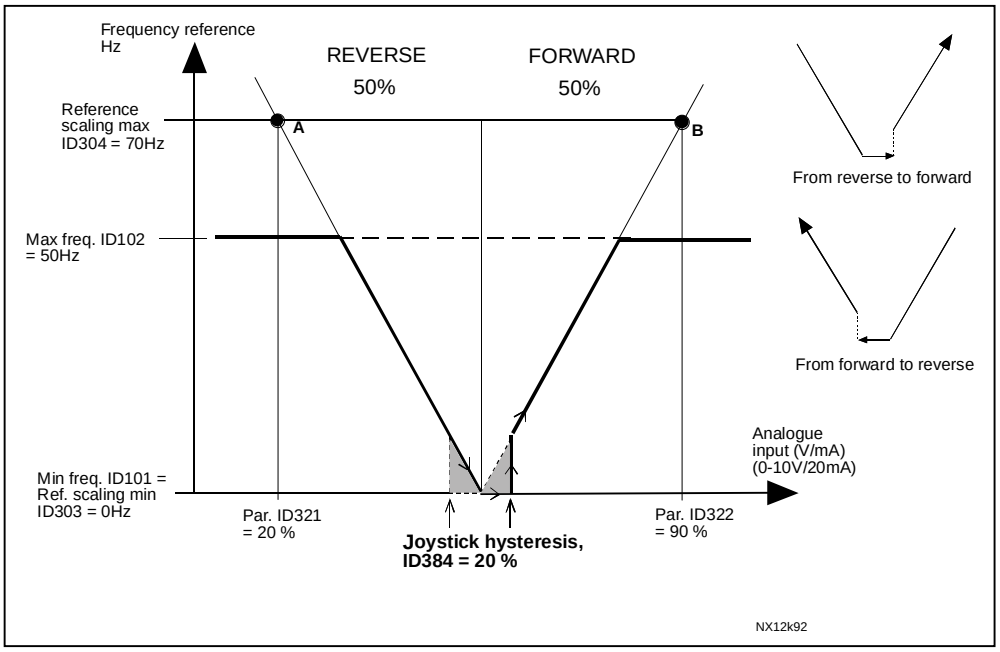


Figure 7-14. An example of joystick hysteresis. In this example, the value of par. ID385 (Sleep limit) = 0

385 AI1 sleep limit *(2.2.2.9)*

The frequency converter is stopped automatically if the AI signal level falls below the S*leep limit* defined with this parameter. See Figure 7-15.

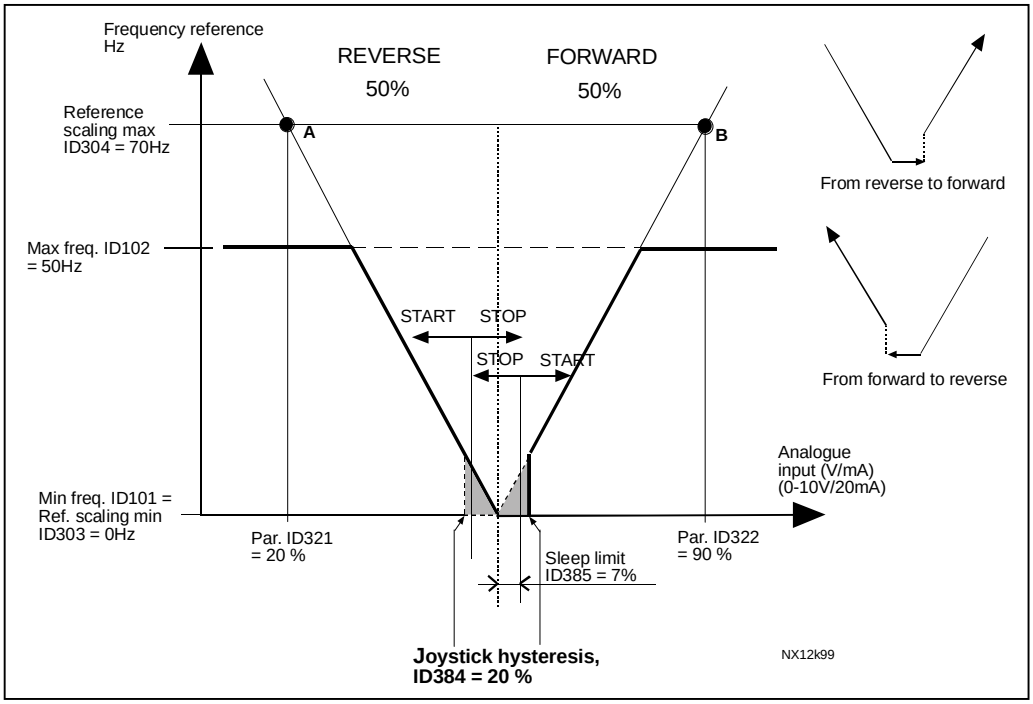


Figure 7-15. Example of sleep limit function

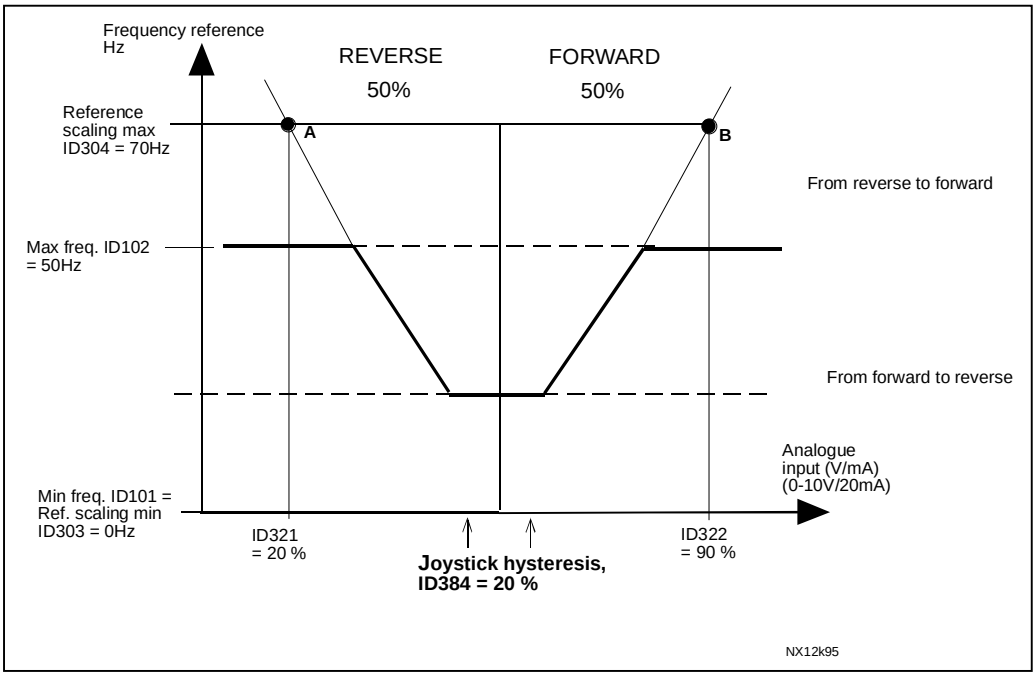


Figure 7-16. Joystick hysteresis with minimum frequency at 35Hz

386 ***AI1 sleep delay*** *(2.2.2.10)*

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

388 ***AI2 signal selection*** *(22.2.3.1)*

Connect the AI2 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

393 ***AI2 reference scaling, minimum value*** *(2.2.3.6)*
394 ***AI2 reference scaling, maximum value*** *(2.2.3.7)*

Additional reference scaling. If both ID393 and ID394 are zero scaling is set off. The minimum and maximum frequencies are used for scaling.
See figure from parameter reference scaling (ID303).

395 ***AI2 joystick hysteresis*** *(2.2.3.8)*

This parameter defines the joystick dead zone between 0 and 20 %.
See AI1 Joystick hysteresis figure (ID384).

396 ***AI2 sleep limit*** *(2.2.3.9)*

The frequency converter is stopped if the AI signal level falls below the S*leep limit* defined with this parameter. See also Sleep Delay (ID397).
See Figure 7-15 from AI1 sleep limit (ID3859.

397 ***AI2 sleep delay*** *(2.2.3.10)*

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

399 ***Scaling of current limit*** *(2.2.6.1)*

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FB Limit Scaling ID46 Monitoring value

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

400 Scaling of DC-braking current *(2.2.6.2)*

See parameter Scaling of Torque limits (ID399) for the selections.

DC-braking current can be reduced with the free analogue input signal between zero current and the current set with parameter DC Braking Current (ID507)
See Figure 7-17.

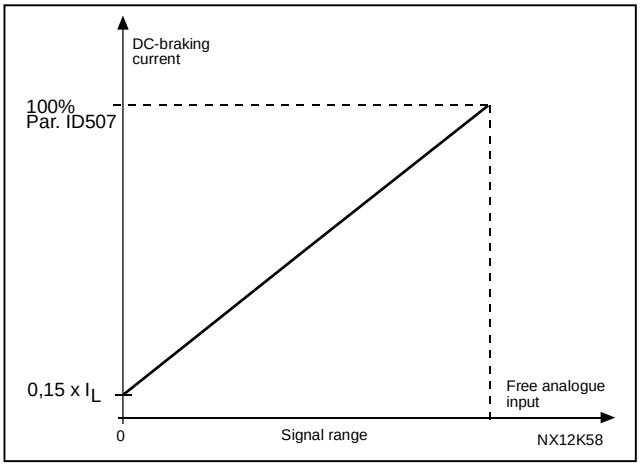


Figure 7-17. Scaling of DC-braking current

401 Reducing of acceleration and deceleration times *(2.2.6.3)*

See par. ID399.

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

Reduced time = set acc./deceler. time (par. ID103, 104; ID502, ID503) divided by the factor R from Figure 7-18.

Analogue input level zero means ramp times set by parameters. Maximum level means tenth of set by parameter.

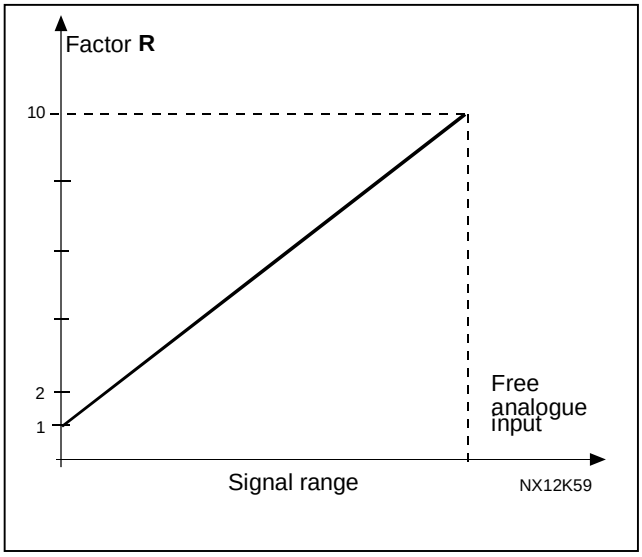


Figure 7-18. Reducing of acceleration and deceleration times

402 ***Reducing of torque supervision limit*** *(2.2.6.4)*

See ID399.

The set torque supervision limit can be reduced with the free analogue input signal between 0 and the set supervision limit, ID349. See Figure 7-19.

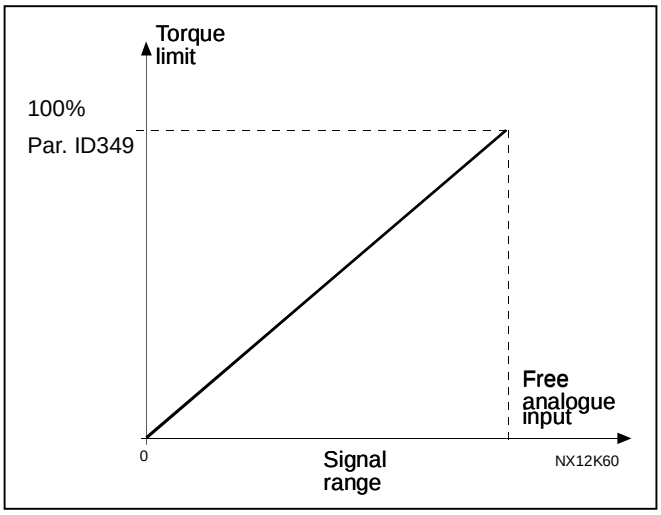


Figure 7-19. Reducing torque supervision limit

403 ***Start signal 1*** *(2.2.7.1)*

Signal selection 1 for the start/stop logic.
Default programming A.1.Default Forward start.

404 ***Start signal 2*** *(2.2.7.2)*

Signal selection 2 for the start/stop logic.
Default programming A.2. Default Reverse start.

405 ***External fault (close)*** *(2.2.7.11)*

Contact closed: Fault is displayed and motor stopped. Fault 51
If fault response selection 4 is used drive will open all DOL contactors and lock these to open state until rest command has been given. This will prevent DOL start if NET is interrupted.

406 ***External fault (open)*** *(2.2.7.12)*

Contact open: Fault is displayed and motor stopped. Fault 51
If fault response selection 4 is used drive will open all DOL contactors and lock these to open state until rest command has been given. This will prevent DOL start if NET is interrupted.

407 ***Run enable*** *(2.2.7.3)*

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

Stop is made accordingly stop function ID596. Follower Drive will make always coasting stop.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

408 ***Acceleration/Deceleration time selection*** *(2.2.7.13)*

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

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

409 ***Control from I/O terminal*** *(2.2.7.18)*

Contact closed: Force control place to I/O terminal
This input have priority order 1 comparing to ID409, ID410 and ID411.

410 ***Control from keypad*** *(2.2.7.19)*

Contact closed: Force control place to keypad
This input have priority order 2 comparing to ID409, ID410 and ID411.

411 ***Control from fieldbus*** *(2.2.7.20)*

Contact closed: Force control place to fieldbus
This input have priority order 3 comparing to ID409, ID410 and ID411.

> **NOTE:** When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used. The value of parameter ID125 (Keypad Control Place) does not change. When the input opens the control place is selected according to keypad control parameter ID125.

412 ***Reverse*** *(2.2.7.4)*

Contact open: Direction forward
Contact closed: Direction reverse
This reverse command is active when Start signal 2 is used for other purpose.

413 ***Jogging speed*** *(2.2.7.16)*

Contact closed: Jogging speed selected for frequency reference
See parameter Jogging Speed Reference (ID124).
Default programming: A.4.

414 ***Fault reset*** *(2.2.7.10)*

Contact closed: All faults are reset.
Rising edge.

415 ***Acceleration/Deceleration prohibited*** *(2.2.7.14)*

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

416 ***DC-braking*** *(2.2.7.15)*

Contact closed: In STOP mode, the DC braking operates until the contact is opened.
See ID 1080 DC Brake current in stop state.

417 ***Motor potentiometer DOWN*** *(2.2.7.8)*

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

418 ***Motor potentiometer UP*** *(2.2.7.9,)*

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

419 ***Preset speed 1*** *(2.2.7.5)*
420 ***Preset speed 2*** *(2.2.7.6)*
421 ***Preset speed 3*** *(2.2.7.7)*

Digital input selections for activating preset speeds.

422 ***AI1/AI2 selection***

With this parameter you can select either AI1 or AI2 signal for frequency reference if I/O reference selection is 14. If different than 14 see I/O Reference 2 (ID1505).
.

432 ***Ready*** *(2.3.3.1)*

The frequency converter is ready to operate.

433 ***Run*** *(2.3.3.2)*

The frequency converter operates (the motor is running).

434 ***Fault*** *(2.3.3.3)*

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

435 ***Inverted fault*** *(2.3.3.4)*

No fault trip has occurred.

436 ***Warning*** *(2.3.3.5)*

General warning signal.

437 ***External fault or warning*** *(2.3.3.6)*

Fault or warning depending on parameter Response to external fault (ID701).

438 ***Reference fault or warning (4mA)*** *(2.3.3.7)*

Fault or warning depending on parameter Response to the 4mA reference fault (ID700).

439 ***Drive Over temperature warning*** *(2.3.3.8)*

The heatsink temperature exceeds +70°C.

440 ***Reverse*** *(2.3.3.9)*

The Reverse command has been selected.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

441 ***Unrequested direction*** *(2.3.3.10)*

Motor rotation direction is different from the requested one.

442 ***At speed*** *(2.3.3.11)*

The output frequency has reached the set reference.

443 ***Jogging speed*** *(2.3.3.12)*

Jogging speed selected.

444 ***External control place*** *(2.3.3.13)*

Control from I/O terminal selected (Menu **M3**; par. ID125).

447 ***Output frequency limit 1 supervision*** *(2.3.3.16)*

The output frequency goes outside the set supervision low limit/high limit (see parameters Output frequency 1 supervision function (ID315) and Output frequency supervision value (ID316).

448 ***Output frequency limit 2 supervision*** *(2.3.3.17)*

The output frequency goes outside the set supervision low limit/high limit (see parameters Output frequency 2 supervision function (ID346) and Output frequency 2 supervision value (ID347)

449 ***Reference limit supervision*** *(2.3.3.18)*

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

450 ***Temperature limit supervision*** *(2.3.3.19)*

Frequency converter heatsink temperature goes beyond the set supervision limits (see parameters FC temperature function (ID354) and FC Temperature limit (ID355).

451 ***Torque limit supervision*** *(2.3.3.20)*

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

452 ***Motor thermal protection*** *(2.3.3.21)*

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.

454 ***Motor regulator activation*** *(2.3.3.23)*

One of the limit regulator has been activated.

455	*Fieldbus input data 1 (FBFixedControlWord, bit 3)*	*(2.3.3.24)*
456	*Fieldbus input data 2 (FBFixedControlWord, bit 4)*	*(2.3.3.25)*
457	*Fieldbus input data 3 (FBFixedControlWord, bit 5)*	*(2.3.3.26)*

The data from the fieldbus (FBFixedControlWord) can be led to frequency converter digital outputs. See details from used fieldbus board manual.

463 ***Analogue input supervision limit*** *(2.3.3.)*

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

464 ***Analogue output 1 signal selection*** *(2.3.1, 2.3.5.1, 2.3.3.1)*

Connect the AO1 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

471 ***Analogue output 2 signal selection*** *(2.3.6.1)*

Connect the AO2 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

472	*Analogue output 2 function*	*(2.3.6.2)*
473	*Analogue output 2 filter time*	*(2.3.6.3)*
474	*Analogue output 2 inversion*	*(2.3.6.4)*
475	*Analogue output 2 minimum*	*(2.3.6.5)*
476	*Analogue output 2 scaling*	*(2.3.6.6)*

For more information on these five parameters, see the corresponding parameters for the analogue output 1 on pages 55 to 57.

477 ***Analogue output 2 offset*** *(2.3.6.7, 2.3.4.7)*

Add –100.0 to 100.0% to the analogue output.

478 ***Analogue output 3, signal selection*** *(2.3.7.1)*

Connect the AO1 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

479 ***Analogue output 3, function*** *(2.3.7.2)*

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

Selection	Function
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	AI1
10	AI2
11	Output freq. (f_{min} - f_{max})
12	Motor torque
13	Motor power
14	PT100 temperature
15	FB analogue output ID48 Monitoring signal

480 ***Analogue output 3, filter time*** *(2.3.7.3)*

Defines the filtering time of the analogue output signal.
Setting this parameter value **0** will deactivate filtering.
See figure from Analogue filtering time (ID308).

481 ***Analogue output 3 inversion*** *(2.3.7.4)*

Inverts the analogue output signal.
See figure from Analogue output inversion (ID309).

482 ***Analogue output 3 minimum*** *(2.3.7.5)*

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

483 ***Analogue output 3 scaling*** *(2.3.7.6)*

Scaling factor for analogue output. Value of 200 % will double the output .
See figure from Analogue output scale (ID311).

484 ***Analogue output 3 offset*** *(2.3.7.7)*

Add –100.0 to 100.0% to the analogue output signal.
E.g. 50 % adds 10 mA or 5 V to basic signal.

485 ***Torque limit*** *(2.2.6.5)*

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FB Limit Scaling ID46 Monitoring value

This signal will adjust the motoring torque limit between 0 and Parameter Motoring Torque Limit (UD1287).

486 ***Digital output 1 signal selection*** *(2.3.1.1)*

Connect the delayed digital output signal to the digital output of your choice with this parameter. For more information about the TTF programming method, see chapter 5. Digital output function can be inverted by Inversion command word (ID1091).

487 ***Digital output 1 on-delay*** *(2.3.1.3)*
488 ***Digital output 1 off-delay*** *(2.3.1.4)*

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

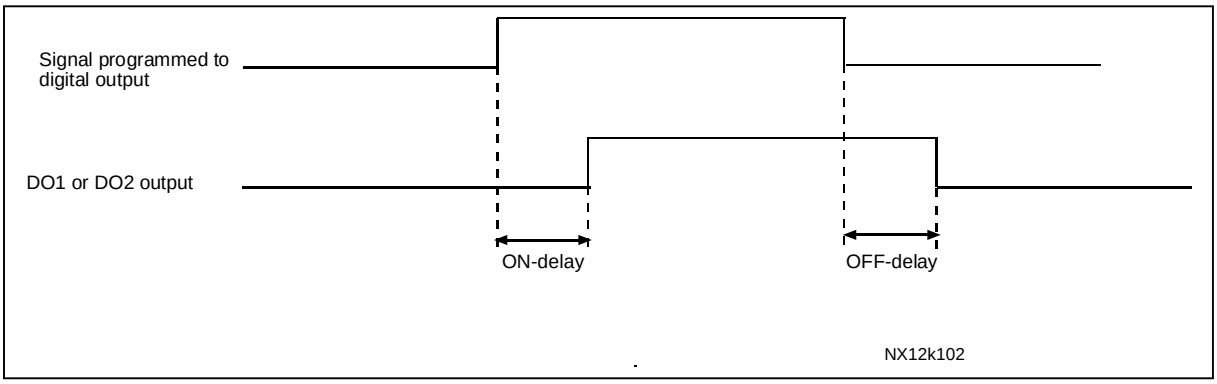


Figure 7-20. Digital outputs 1 and 2, on- and off-delays

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

489 ***Digital output 2 signal selection*** *(2.3.2.1)*

Connect the delayed DO2 signal to the digital output of your choice with this parameter. See ID486.

490 ***Digital output 2 function*** *(2.3.2.2)*

See table from Digital Output 1 function (ID312).

491 ***Digital output 2 on-delay*** *(2.3.2.3)*

492 ***Digital output 2 off-delay*** *(2.3.1.4)*

With these parameters you can set on- and off-delays to digital outputs. See ID487 and ID488.

493 ***Adjust input*** *(2.2.1.4)*

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

0 Not used
1 Analogue input 1
2 Analogue input 2
3 Analogue input 3
4 Analogue input 4
5 FB Adjust Reference ID47 Monitoring Signal

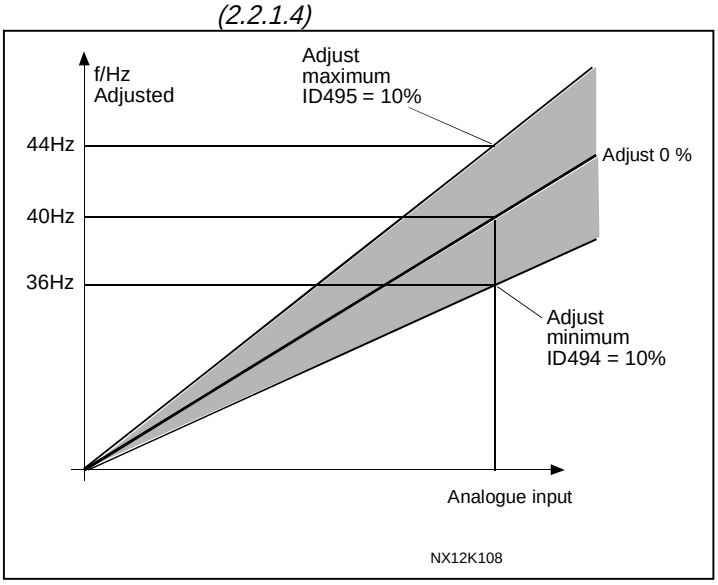


Figure 7-21. An example of adjust input

494 ***Adjust minimum*** *(2.2.1.5)*
495 ***Adjust maximum*** *(2.2.1.6)*

These parameters define the minimum and maximum of adjusted signals. See Figure 7-21. Adjust is made to main reference.

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

With this parameter you can select between Parameter Set 1 and Set 2. The input for this function can be selected from any slot. The procedure of selecting between the sets is explained in Vacon NX User's Manual, Chapter 7.3.6.3.
Digital input = FALSE:
- Set 1 is loaded as the active set

Digital input = TRUE:
- The active set is saved to set 1

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

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

The start and end of acceleration and deceleration ramps can be smoothed with these parameters. Setting value **0** gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal. Setting value 0.1...10 seconds for this parameter produces an S-shaped acceleration/deceleration. The acceleration time is determined with parameters ID103/ID104 (ID502/ID503).

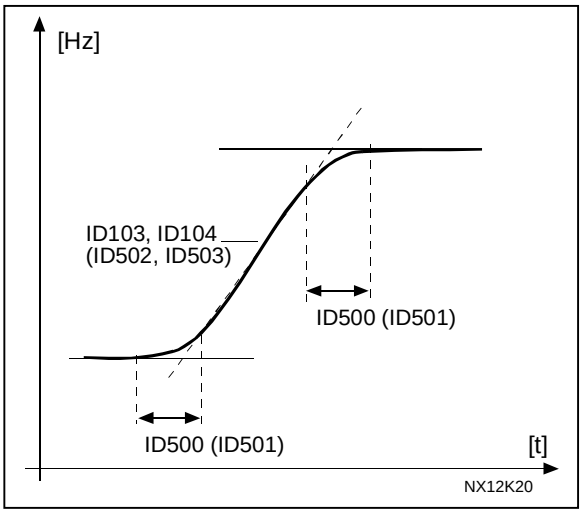


Figure 7-22. Acceleration/Deceleration (S-shaped)

Used to reduce mechanical erosion and current spikes when reference is changed.

502 ***Acceleration time 2*** *(2.4.3)*
503 ***Deceleration time 2*** *(2.4.4)*

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

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

0 = No brake chopper used
1 = Brake chopper in use and tested when running. Can be tested also in READY state
2 = External brake chopper (no testing)
3 = Used and tested in READY state and when running
4 = Used when running (no testing)

When the frequency converter is decelerating the motor, the inertia of the motor and the load are fed into an external brake resistor. This enables the frequency converter to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected). See separate Brake resistor installation manual. Brake chopper test mode generates pulse to resistor every second, if pulse feedback is wrong (resistor or chopper is missing) fault F12 is generated.

505 ***Start function*** *(2.4.6)*

Ramp:

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

Flying start:

1 The frequency converter is able to start into a running motor by applying a small current pulses to motor and searching for the frequency corresponding to the speed the motor is running at. Searching starts from the maximum frequency towards the actual frequency until the correct value is detected.

Use this mode if the motor is coasting when the start command is given. With the flying start it is possible to start motor form actual speed without forcing the speed to zero before ramping to reference.

Conditional flying start:

2 With this mode it is possible to disconnect and connect the motor from the frequency converter even when the Start command is active. On re-connecting the motor, the drive will operate as described in selection 1.

506 ***Stop function*** *(2.4.7)*

Coasting:

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

Ramp:

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

Normal stop: Ramp/ Run Enable stop: coasting

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

Normal stop: Coasting/ Run Enable stop: ramping

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

507 ***DC-braking current*** *(2.4.8)*

Defines the current injected into the motor during DC-braking. On start this parameter is used together with DC Brake time on start (ID516) to decrease time when motor is able to produce maximum torque. See ID516.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

508 ***DC-braking time at stop*** *(2.4.9)*

Determines if braking is ON or OFF and the braking time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, parameter ID506.

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

Par. ID506 = 0; Stop function = Coasting:
After the stop command, the motor coasts to a stop without control of the frequency converter.

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

The braking time is scaled according to the frequency when the DC-braking starts. If the frequency is ≥ the nominal frequency of the motor, the set value of parameter ID508 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter ID508.

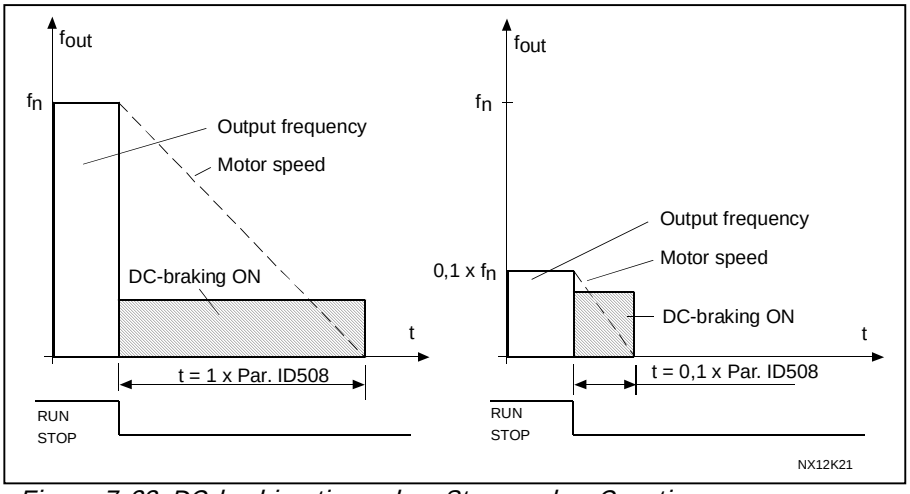


Figure 7-23. DC-braking time when Stop mode = Coasting.

Par. ID506 = 1; Stop function = Ramp:

After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with parameter ID515, where the DC-braking starts.
The braking time is defined with parameter ID508. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See Figure 7-24.

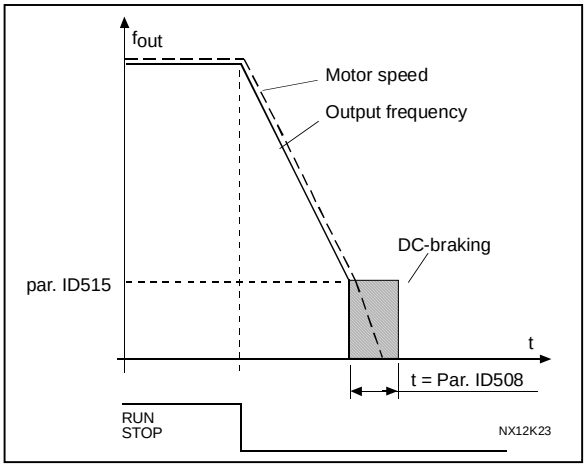


Figure 7-24. DC-braking time when Stop mode = Ramp

509	***Prohibit frequency area 1; Low limit***	*(2.5.1)*
510	***Prohibit frequency area 1; High limit***	*(2.5.2)*
511	***Prohibit frequency area 2; Low limit***	*(2.5.3)*
512	***Prohibit frequency area 2; High limit***	*(2.5.4)*
513	***Prohibit frequency area 3; Low limit***	*(2.5.5)*
514	***Prohibit frequency area 3; High limit***	*(2.5.6)*

In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems. With these parameters it is possible to set limits for the "skip frequency" region. See Figure 7-25.

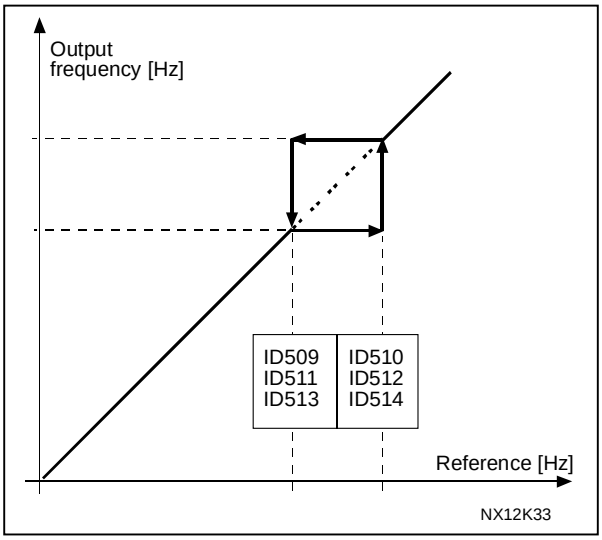


Figure 7-25. Example of prohibit frequency area setting.

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

The output frequency at which the DC-braking is applied. See Figure 7-25.

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

DC-brake is activated when the start command is given. This parameter defines the time how long DC current is given to motor before acceleration starts. DC brake curren at start is used in order to premagnetize motor before running. This will improve torque performance at start. Needed time is depending on motor size, value varies between 100 ms to 3 second. Bigger motor needs more time. Default setting 0,00 s will means 0,20 second. See ID507

Note: When flying start is used, DC Brake on start is disabled

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

518 *Acceleration/deceleration ramp speed scaling ratio between prohibit frequency limits* *(2.5.3, 2.5.7)*

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits (parameter group G2.5). 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.

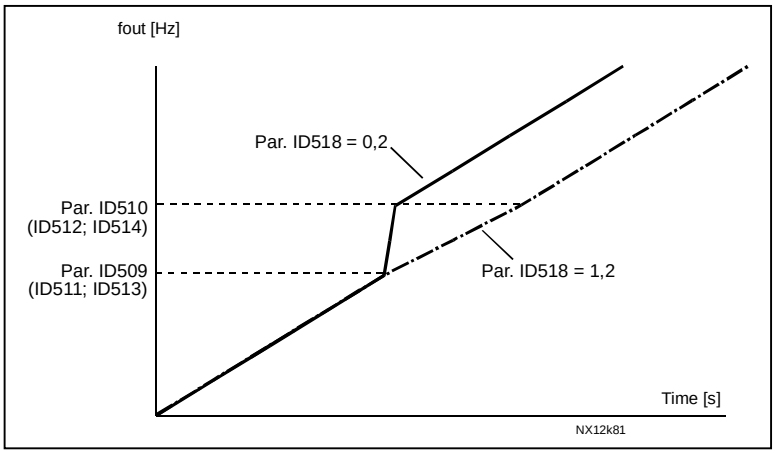


Figure 7-26. Ramp speed scaling between prohibit frequencies

519 *Flux braking current* *(2.4.13)*

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

520 *Flux brake* *(2.4.12)*

Instead of DC braking, flux braking is a useful way to raise the braking capacity in cases where additional brake resistors are not needed.
When braking is needed, the frequency is reduced and the flux in the motor is increased, which in turn increases the motor's capability to brake. Unlike DC braking, the motor speed remains controlled during braking.

The flux braking can be set ON or OFF.

0 = Flux braking OFF
1 = Flux braking ON

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

521 *Motor control mode 2* *(2.6.12)*

With this parameter you can set another motor control mode. Which mode is used is determined with parameter ID164.
For the selections, see parameter ID600.

Note: Control mode can not be changed between open loop and closed loop while drive is in run state.

530 *Inching reference 1*

531 *Inching reference 2*

These inputs activate inching reference if inching is enabled. These inputs also start the drive if activated and if there is no Run Request command from anywhere else.

532 *Enable inching*

If you are using inching function give input must be TRUE by digital signal or by setting parameter to 0.2.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

600 ***Motor control mode*** *(2.6.1)*

0	Frequency control:	Drive frequency reference is set to output frequency without slip compensation. Motor speed is defined by motor load.
1	Speed control:	Drive frequency reference is set to motor speed reference. So motor speed stays same regardless of motor load.
2	Torque control	Speed reference is used as maximum speed limit and motor produces torque within speed limit to achieve torque reference.

601 ***Switching frequency*** *(2.6.9)*

Motor noise can be minimised using a high switching frequency. Increasing the switching frequency incerases losses of the frequency converter unit. Lower frequencies are used when motor cable is long and motor is small.
The range of this parameter depends on the size of the frequency converter:

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

Table 7-9. Size-dependent switching frequencies

"Note !
The actual switching frequency might be reduced down to 1,5kHz by thermal management functions. This has to be considered when using sine wave filters or other output filters with a low resonance frequency." See Control Option and Over modulation limit.

602 ***Field weakening point*** *(2.6.4)*

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

603 ***Voltage at field weakening point*** *(2.6.5)*

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the U/f curve parameters. See parameters U/f Optimization (ID109), U/f ratio (ID108), Mid pont frequency (ID604) and Mid point voltage (ID605). When the parameters ID110 and ID111 (nominal voltage and nominal frequency of the motor) are set, the parameters field weakening point (ID602) and field weakening voltage (ID603) are automatically given the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters **after** setting the parameters nominal voltage (ID110) and nominal frequency (ID111).

604 ***U/f curve, middle point frequency*** *(2.6.6)*

If the programmable U/f curve has been selected with parameter U/f ratio (ID108) this parameter defines the middle point frequency of the curve. See also Mid point voltage (ID605) **Error! Reference source not found.**.

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

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

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

This parameter defines the zero frequency voltage of the U/f curve. Default value is unit size dependent
NOTE: If the value of parameter U/f Ratio Select (ID108) is changed this parameter is set to zero.

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

These parameters allow the under-/overvoltage controllers to be switched out of operation. This may be useful, for example, if the mains supply voltage varies more than –15% to +10% and the application will not tolerate this over-/undervoltage. In this case, the regulator controls the output frequency taking the supply fluctuations into account.
0 Controller switched off
1 Controller switched on (no ramping) = Minor adjustments of OP frequency are made
2 Controller switched on (with ramping) = Controller adjusts OP freq. up to max.freq.

608 ***Undervoltage controller*** *(2.6.11)*

See par. ID607.
Note: Over-/undervoltage trips may occur when controllers are switched out of operation.

0 Controller switched off
1 Controller switched on (no ramping) = Minor adjustments of OP frequency are made
2 Controller switched on (with ramping) = Controller adjusts OP freq. up to zero speed.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

609 ***Torque limit*** *(2.10.1)*

With this parameter you can set the torque limit control between 0.0 – 400.0 %.

610 ***Torque limit control P-gain*** *(2.10.2)*

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

611 ***Torque limit control I-gain*** *(2.10.3)*

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

620 ***Load drooping*** *(2.6.15.4)*

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

E.g. If load drooping is set to 10 % with motor that have nominal frequency of 50 Hz and motor is loaded with nominal load (100 % of torque) output frequency is allowed to decrease 5 Hz from the frequency reference. Used for e.g. when load is needed to balanced with motors that have mechanically connected.

631 Identification (2.6.16)

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

0 = No action

No identification requested.

1 = Identification without motor run

The drive is run without speed to identify the motor parameters. The motor is supplied with current and voltage but with zero frequency. U/f ratio is identified.

2 = Identification with motor run

The drive is run with speed to identify the motor parameters. U/f ratio and magnetization current is identified.

Note: It is required to do the this identification run with no load on the motor shaft for accurate results.

3 = No action

4 = Indent All

5 = Identification failed

This value is stored if identification has faild

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

ID110 Nominal voltage of the motor (par. 2.1.6)
ID111 Nominal frequency of the motor (par. 2.1.7)
ID112 Nominal speed of the motor (par. 2.1.8)
ID113 Nominal current of the motor (par. 2.1.9)
ID120 Motor cos phi (par. 2.1.10)

When in closed loop and with an encoder installed, also the parameter for pulses / revolutions (in Menu M7) has to be set.
The automatic identification is activated by setting this parameter to the appropriate value followed by a start command in the requested direction. The start command to the drive has to be given within 20 s. If no start command is given within 20 s the identification run is cancelled and the parameter will be reset to its default setting. The identification run can be stopped any time with normal stop command and the parameter is reset to its default setting. In case identification run detects fault or other problems, the identification run is completed if possible. After the identification is finished, the application checks the status of the identification and generates fault/ warning if any.
During Identification Run, the brake control is disabled (see chapter **Error! Reference source not found.**).

Note: After identification is made drive requires rising edge of start command.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

636 ***Minimum frequency for Open Loop torque control*** *(2.10.8)*

Defines the frequency limit below which the frequency converter operates in *frequency control mode*.
Because of the nominal slip of the motor, the internal torque calculation is inaccurate at low speeds where is it recommended to use the frequency control mode.

637 ***Speed controller P gain, Open Loop*** *(2.6.13)*

Defines the P gain for the speed controlled in Open Loop control mode.

638 ***Speed controller I gain, Open Loop*** *(2.6.14)*

Defines the I gain for the speed controlled in Open Loop control mode.

639 ***Torque controller P gain*** *(2.10.9)*

Defines the Integration gain of the torque controller. When motor control mode is open loop torque control.

640 ***Torque controller I gain*** *(2.10.10)*

Defines the Integration gain of the torque controller on open loop control mode.

641 ***Torque reference selection*** *(2.10.4)*

Defines the source for torque reference.
0 Not used
1 Analogue input 1
2 Analogue input 2
3 Analogue input 3
4 Analogue input 4
5 Analogue input 1 (joystick)
6 Analogue input 2 (joystick)
7 From keypad, parameter R3.5
8 Fieldbus

642 ***Torque reference scaling, maximum value*** *(2.10.5)*
643 ***Torque reference scaling, minimum value*** *(2.10.6)*

Scale the custom minimum and maximum levels for analogue inputs within -300,0...300,0%.

644 ***Torque speed limit in Open Loop Control*** *(2.10.7)*

With this parameter the maximum frequency for the torque control can be selected.

0 Maximum frequency (ID102).
1 Selected frequency reference
2 Preset speed 7 (ID130).

NXP drives have more selections for this parameter in Closed Loop control.
See page **Error! Bookmark not defined.**.

650 ***Motor Type*** *(2.1.16)*

Select used motor type with this parameter

0 Induction motor
1 Permanent magnet synchronous motor

NOTE: DC Brake current and times are set by default for induction motor, set these values to zero if needed.

651 ***Flux Current Kp***

Defines gain for flux current controller when using PMS motor

652 ***Flux Current Ti***

Defines integration time for flux current controller when using PMS motor

654 ***Enable Rs identification*** *(2.6.4.4)*

With this parameter it's possible to disable Rs identification during DC brake start.

655 ***Modulator Index Limit*** *(2.6.4.5)*

This parameter can be used to control how the drive modulates the output voltage. Reducing this value limits the maximum output voltage. If a sinusoidal filter is used set this parameter to 96%.

656 ***Load Drooping Time***

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

658 ***Torque Generator Scale***

This parameter defines calculation correction for generator side operation. Keep this in 100 % with normal motors.

662 ***Measured voltage drop*** *(2.6.6.18)*

The measured voltage drop at stator resistance between two phases with the nominal current of the motor. This parameter is identified durin ID run. Adjust this value to gain optimum torque calculation for open loop low frequencies.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

664 ***Ir: Add zero point voltage*** *(2.6.5.20)*

Defines how much voltage is applied to motor in zero speed when torque boost is used.

665 ***Ir: Add generator scale*** *(2.6.5.21)*

Defines scaling factor for generator side IR-compensation when torque boost is used

667 ***Ir: Add motoring scale*** *(2.6.5.22)*

Defines scaling factor for motoring side IR-compensation when torque boost is used

668 ***IU Offset*** *(2.6.6.23)*
669 ***IV Offset*** *(2.6.6.24)*
670 ***IW Offset*** *(2.6.6.25)*

Offsets value for phase current measurement. , identified during identification run.

672 ***Restart Delay Closed Loop & Flying Start*** *(2.6.3.35)*

The delay time within which the drive can not be restarted if flying start is used or in closed loop control mode. The time can be set up to 60.000 seconds.

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

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset Frequency (Par. ID728) is set as reference
4 = Fault, stop mode after fault according to ID506
5 = Fault, stop mode after fault always by coasting
A warning or a fault action and message is generated if the 4...20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2.

701 ***Response to external fault*** *(2.7.3)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
4 = Fault, Open all DOL contactor and Lock
Normal start can be made after all DOL control has been reset.

A warning or a fault action and message is generated from the external fault signal in the programmable digital inputs DIN3 or with ID405 and ID406.. The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

702 ***Output phase supervision*** *(2.7.6)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

Output phase supervision of the motor ensures that the motor phases have an approximately equal current.

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

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
Earth fault protection ensures that the sum of the motor phase currents is zero. The overcurrent protection is always working and protects the frequency converter from earth faults with high currents.

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

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

If tripping is selected the drive will stop and activate the fault stage.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Deactivating the protection, i.e. setting parameter to 0, will reset the thermal stage of the motor to 0%. See chapter 8.1.

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

The factor can be set between -100.0%—100.0%. See chapter 8.1.
-100.0 % = 0°C, 0.0 % = 40°C, 100.0 % = 80°C

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

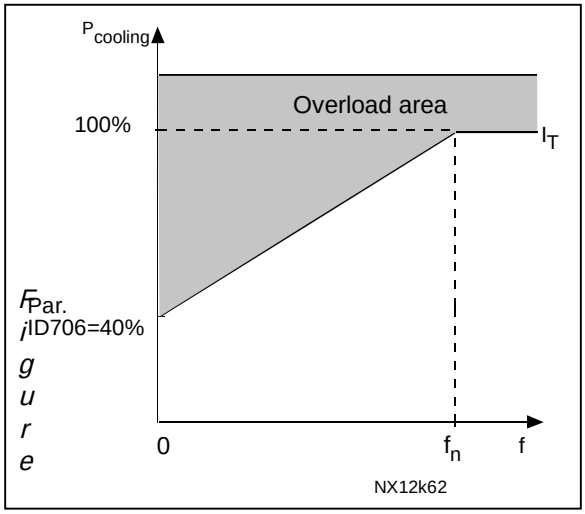
Defines cooling factor in zero speed related to point where motors in running nominal speed without external cooling. See Figure 7-27.

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

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

If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value.
Setting this parameter does not affect the maximum output current of the drive which is determined by parameter ID107 alone. See chapter 8.1.

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 Current Limit (ID107) alone.



7
-27. Motor thermal current I_T curve

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

This time can be set between 1 and 200 minutes.

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

The motor thermal time is specific to the motor design and it varies between different motor manufacturers. Default value changes between unit sizes.

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 7-28.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

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

The value can be set to 0%...150%. See chapter 8.1.
Setting value to 130 % motor calculated temperature will reach nominal temperature with 130 % of motor nominal current.

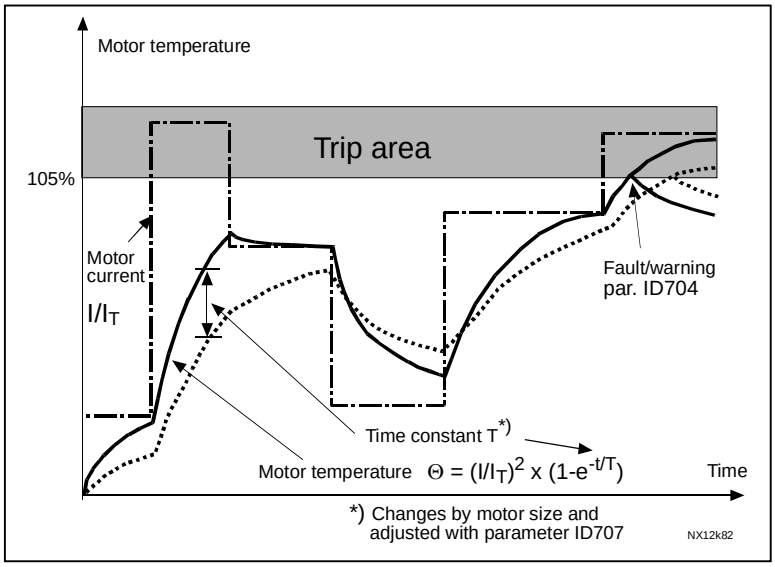


Figure 7-28. Motor temperature calculation

709 *Stall protection* *(2.7.13)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

Setting the parameter to **0** will deactivate the protection and reset the stall time counter. See chapter 8.2.

710 *Stall current limit* *(2.7.14)*

The current can be set to 0 ...2*I_H. For a stall stage to occur, the current must have exceeded this limit. See Figure 7-29. The software does not allow entering a greater value than 2*I_H. If parameter ID197 current limit of motor is changed, this parameter is automatically recalculated to the value 90 % of current limit. See chapter 8.2.

Note: This limit must be set below current limit that this function can operate.

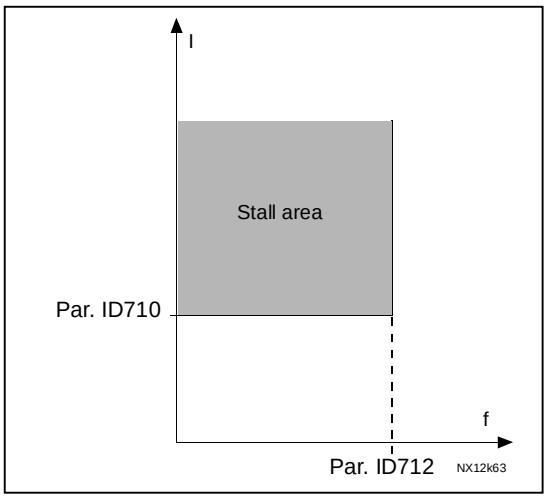


Figure 7-29. Stall characteristics settings

711 *Stall time* *(2.7.15)*

This time can be set between 1.0 and 120.0s.
This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter.
If the stall time counter value goes above this limit the protection will cause a trip (see ID709). See chapter 8.2.

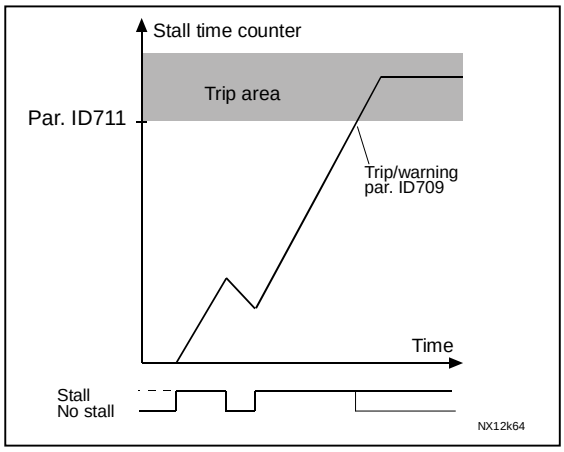


Figure 7-30. Stall time count

712 *Stall frequency limit* *(2.7.16)*

The frequency can be set between 1-f_{max} (ID102).
For a stall state to occur, the output frequency must have remained below this limit. See chapter 8.2. Function requires that output frequency is 1 Hz below frequency reference before stall time starts to calculate.

713 *Underload protection* *(2.7.17)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

If tripping is set active the drive will stop and activate the fault stage.
Deactivating the protection by setting the parameter to 0 will reset the underload time counter to zero. See chapter 8.3.

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

The torque limit can be set between 10.0—150.0 % x T_{nMotor}.
This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point. See Figure 7-31.

If you change parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 8.3.

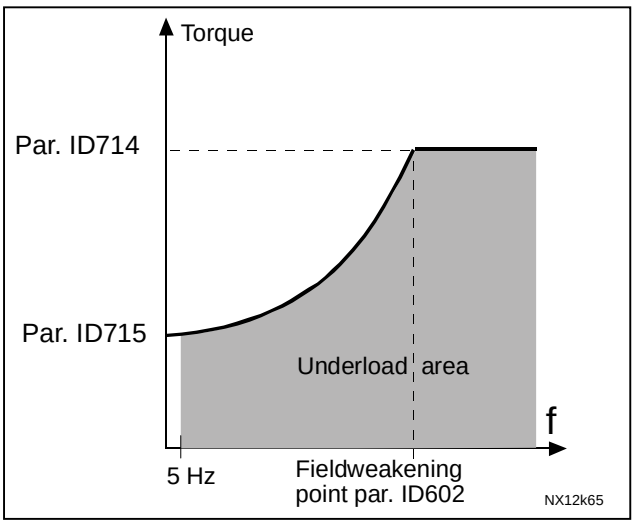


Figure 7-31. Setting of minimum load

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

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

The torque limit can be set between 5.0—150.0 % x TnMotor.
This parameter gives value for the minimum torque allowed with zero frequency. See Figure 7-31.

If you change the value of parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 8.3.

716 Underload time *(2.7.20)*

This time can be set between 2.0 and 600.0 s.
This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to parameter ID713). If the drive is stopped the underload counter is reset to zero. See Figure 7-32 and chapter 8.3.

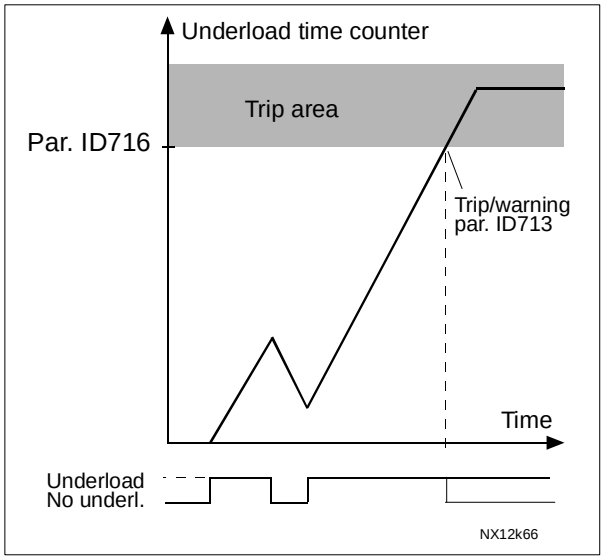


Figure 7-32. Underload time counter function

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

Defines the time before the frequency converter tries to automatically restart the motor after the fault trig has been appeared inside trial time.

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

If the fault trig appears more than defines by parameters ID720 to ID725 inside trial time permanent fault is generated.

.

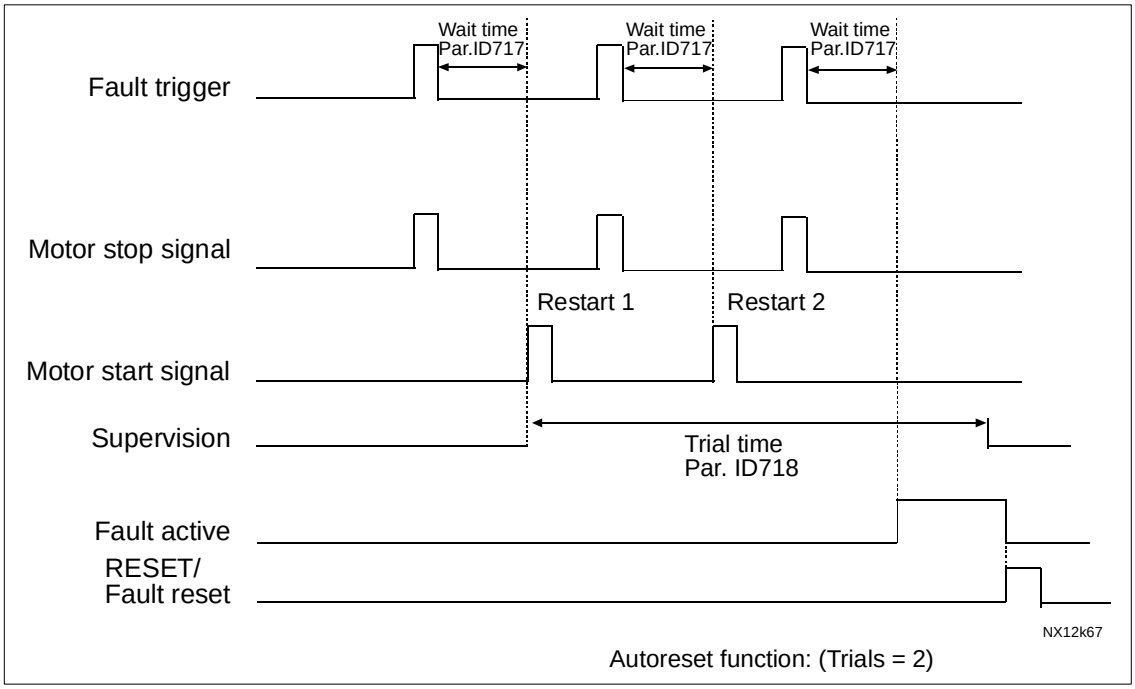


Figure 7-33. Example of Automatic restarts with two restarts

Parameters ID720 to ID725 determine the maximum number of automatic restarts during the trial time set by parameter ID718. The time count starts from the first autofault reset . If the number of faults occurring during the trial time exceeds the values of parameters ID720 to ID725 the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault start the trial time count again.

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

719 ***Automatic restart: Start function*** *(2.8.3)*

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

0 = Start with ramp
1 = Flying start
2 = Start according to ID505

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

720 ***Automatic restart: Number of tries after undervoltage fault trip*** *(2.8.4)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after and undervoltage trip.

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

721 ***Automatic restart: Number of tries after overvoltage trip*** *(2.8.5)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after an overvoltage trip.

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

722 ***Automatic restart: Number of tries after overcurrent trip*** *(2.8.6)*

(NOTE! IGBT temp fault also included)
This parameter determines how many automatics restarts can be made during the trial time set by ID718.

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

723 ***Automatic restart: Number of tries after reference trip*** *(2.8.7)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

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

725 ***Automatic restart: Number of tries after external fault trip*** *(2.8.9)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

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

726 ***Automatic restart: Number of tries after motor temperature fault trip*** *(2.8.8)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

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

727 ***Response to undervoltage fault*** *(2.7.5)*

0 = Fault stored in fault history
1 = Fault not stored in fault history

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

728 ***4mA reference fault: preset frequency reference*** *(2.7.2)*

If the value of parameter ID700 is set to 3 and the 4mA fault occurs then the frequency reference to the motor is the value of this parameter.

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

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

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

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

The Automatic restart is taken into use with this parameter.

0 = Disabled
1 = Enabled

The function resets the following faults (max. three times) (see Vacon NX User's Manual, Chapter 9):

- Overcurrent (F1)
- Overvoltage (F2)
- Undervoltage (F9)
- Frequency converter overtemperature (F14)
- Motor overtemperature (F16)
- Reference fault (F50)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

732 ***Response to thermistor fault*** *(2.7.21)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

Setting the parameter to **0** will deactivate the protection.

733 ***Response to fieldbus fault*** *(2.7.22)*

Set here the response mode for the fieldbus fault if active control place is fieldbus. For more information, see the respective Fieldbus Board Manual.

See parameter ID732.

734 ***Response to slot fault*** *(2.7.23)*

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

See parameter ID732.

738 ***Automatic restart: Number of tries after underload fault trip*** *(2.8.10)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718.

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

739 ***Number of PT100 inputs in use*** *(2.7.24)*

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

0 = Not used (ID Write, value of maximum temperature can be written from fieldbus)
1 = PT100 input 1
2 = PT100 input 1 & 2
3 = PT100 input 1 & 2 & 3
4 = PT100 input 2 & 3
5 = PT100 input 3

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

740 ***Response to PT100 fault*** *(2.7.25)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
4 = Fault, Open all DOL contactor and Lock
Normal start can be made after all DOL control has been reset.

741 ***PT100 warning limit*** *(2.7.26)*

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

742 ***PT100 fault limit*** *(2.7.27)*

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

743 ***Number of PT100 2 inputs in use*** *(2.7.34)*

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

745 ***PT100 2 warning limit*** *(2.7.35)*

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

746 ***PT100 2 fault limit*** *(2.7.36)*

Set here the limit at which the second PT100 fault (F61) will be activated.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

750 *Cooling monitor*

When using a liquid-cooled drive, connect this input to the *Cooling OK* signal from Vacon flow control application or any input that shows state of used cooling unit. Fault is generated if input is low when drive is in run state, while drive is in stop state only warning is generated. See product user manual of liquid-cooled drive.

751 *Cooling fault delay*

This parameter defines delay after the drive goes to fault state when cooling OK signal is missing. If drive is in Stop state this is only warning, In Run state drive will make fault with coast stop.

756 *Safe disable active* *(2.3.3.30)*

Select digital output that will show status of safe disable.

850 ***Fieldbus reference minimum scaling*** *(2.9.1)*
851 ***Fieldbus reference maximum scaling*** *(2.9.2)*

Use these two parameters to scale the fieldbus reference signal.
If ID850 = ID851 then custom scaling is not used and the minimum and maximum frequencies are used for scaling.
The scaling takes place as presented in Figure 7-6. See also chapter 8.4.

Note: Using this custom scaling function also affects the scaling of the actual value.

852 to
859 ***Fieldbus data out selections 1 to 8*** *(2.9.3 to 2.9.10)*

Using these parameters, you can monitor any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to monitor for the value of these parameters. See chapter 8.4.

See monitoring signals for full detail of ID numbers

Some typical values:

1	Output frequency	15	Digital inputs 1,2,3 statuses
2	Motor speed	16	Digital inputs 4,5,6 statuses
3	Motor current	17	Digital and relay output statuses
4	Motor torque	25	Frequency reference
5	Motor power	26	Analogue output current
6	Motor voltage	27	AI3
7	DC link voltage	28	AI4
8	Unit temperature	31	AO1 (expander board)
9	Motor temperature	32	AO2 (expander board)
13	AI1	37	Active fault 1
14	AI2	45	Motor current (drive independent) given with one decimal point

Table 7-10.

876 to
833 ***Fieldbus data IN selections 1 to 8***

Using these parameters, you can control any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters. Monitoring signals that can be controlled from fieldbus are marked as yellow.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

891 to

895 Fieldbus digital input parameter

With these parameters you can define what parameter is controlled by using FB Digital input.

Example:
All option boards inputs are in use and you want to still give DC Brake Command (ID416) and you have fieldbus board also in the drive.
Set ID891 Fieldbus digital input 1 parameter to 416
Now you are able to control DC Braking command from fieldbus by Profibus control word bit 11. See table 2-10.

Its possible to control any parameter same way if values 0=FALSE and 1=TRUE have meaning for that parameter. E.g. All digital input by help of virtual slot See chapter 1.4.3 Defining unused inputs/Outputs.

896 Fieldbus profile

With this parameter it's possible to select what FB profile is used in application.
1 = ProfiDrive
2 = ByPass See table 5-11
***3** = Reserved*

Bit	Description	
	Value = 0	Value = 1
0	OFF	ON, Reset after Fault or b1 and b2
1	Emergency stop by coast	ON, On normal operation: Keep TRUE
2	Emergency stop by ramp	ON, On normal operation: Keep TRUE
3	STOP REQUEST	RUN REQUST
4	Force ramp to Zero	Enable Ramp,
5	Freeze Ramp	Enable Ramp,
6	Force Ref to Zero	Enable Ramp,
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	Fieldbus DIN1=OFF	Fieldbus DIN1=ON (Watchdog pulse)
12	Fieldbus DIN2=OFF	Fieldbus DIN2=ON
13	Fieldbus DIN3=OFF	Fieldbus DIN3=ON
14	Fieldbus DIN4=OFF	Fieldbus DIN4=ON
15	No Action	No Action

Table 7-11.Profibus Control Word in ByPass Mode

897 Fieldbus General Status Word ID

With this parameter it's possible to select what data is send in FBGeneralStatusWord

898 *FB Custom Minimum Scale*

899 *FB Custom Maximum Scale*

With these parameter its possible to define what inputs levels corresponds minimum and maximum frequency references.

1037 *Analogue input 3, minimum value*
1038 *Analogue input 3, maximum value*
1039 *Analogue input 4, minimum value*
1040 *Analogue input 4, maximum value*

With these parameters it's possible to select corresponding value for custom minimum and maximum. See ID1509 & ID1510.

1080 *DC-Brake Current in stop*

Defines current injected to motor on stop state when ID 416 is active.

1084 *Control Options*

These parameters functions are dependent of Vacon LineSynch application version

b0 = Reserved
b1 = Update Ramp Generator when MotorControlMode changes from TC (4) to SC (3)
b2 = RampUp; use acceleration ramp
b3 = RampDown; use deceleration ramp
b4 = FollowActual; follow actual speed value within WindowPos/NegWidth
b5 = TC ForceRampStop; Under stop request the speed limit forces the motor to stop
b6 = Reserved
b7 = Disables switching frequency decrease
b8 = Reserved
b9 = Reserved
b10 = Reserved
b11 = Disable Drooping under zero frequency limit
b12 = Reserved
b13 = Reserved
b14 = Power Monitor Option
b15 = Reserved

1086 *Disable parameter stop lock* *(2.7.28)*

When activating this parameter it is possible to adjust parameters that are normally locked during run state. Note: For Vacon personnel only.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1087 ***Scaling of Generating torque limit***

0 = Parameter
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = Fieldbus Scaling

This signal will adjust the maximum motor generating torque between 0 and maximum limit set with parameter Generator Torque Limit (ID1288). Analogue input level zero means zero generator torque limit.

1088 ***Scaling of Generating power limit***

0 = Parameter
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = Fieldbus Scaling

This signal will adjust the maximum motor generating power between 0 and maximum limit set with parameter Generator Power Limit (ID1290). Analogue input level zero means zero generator power limit.

1091 ***Inversion Control***

With this control word it is possible to invert some input and output signals

b0=Delayed digital outputs 1 signals are inverted
b1=Delayed digital outputs 2 signals are inverted
b8=Motoring Power limit digital input inverted
b9=Generator Power limit digital input inverted

1209 ***Input switch acknowledgement*** *(2.2.7.32)*

Select the digital input to acknowledge the status of the input switch. The input switch is normally a switch fuse unit or main contactor with which the power is fed to the drive. If the input switch acknowledgement is missing, drive trips at *Input switch open* fault (F64).

1213 ***Emergency stop*** *(2.2.7.30)*

Indicates to the drive that machine has been stop by external emergency stop circuit.. When the digital input is low the drive stops as per the parameter definition of ID1276 Emergency stop mode and indicates warning code A63.

1218 Charge DC link (2.3.3.29)

Charge DC. Used to charge the inverter drive through OEVA type of input switch. When the DC link voltage is above the charging level a 2-second pulse train is generated to close the input switch. The pulse train is OFF when the input switch acknowledgement goes high.

1239 Inching reference 1
1240 Inching reference 2
These parameters define frequency reference when inching is activated.

1241 Speed share

Defines percentage ration for final speed reference from received speed reference.

1244 Torque reference filtering time

Defines filtering time for torque reference.

1248 Load Share

Defines percentage ration for final torque reference from received torque reference.

1250 Flux reference (2.6.4.32)

Defines how much magnetization current will be used.

1257 Inching ramp

This parameter defines acceleration and deceleration times when inching is active

1262 Over Voltage Reference Select

Overvoltage reference level depending on the status of the brake chopper.

0 High voltage level
1 Normal voltage level (Default)
2 Brake Chopper Level (ID1267)

ID1262	Brake chopper in use	Brake chopper is not is use
0	500 V Unit: 844 V 690 V Unit: 1164 V	500 V Unit: 797 V 690 V Unit: 1099 V
1	1.25*Estimated DC nominal voltage	1.18*Estimated DC nominal voltage
2	1.07*brake chopper level	Brake chopper level

1267 Brake Chopper Level

Brake chopper control activation level in volts.

For 400V Supply: 400*1.35*1.18 = 638V
For 500V Supply: 500*1.35*1.18 = 808V
For 690V Supply: 690*1.35*1.18 = 1100V

Please note that when brake chopper is used the overvoltage controller can be switched OFF or the overevoltage reference level can be set above the brake chopper level.

1276 ***Emergency stop mode*** ***6*** *(2.4.21)*

Defines the action after the IO emergency input goes low.

0 Coasting stop
1 Ramping stop

1285 ***Positive frequency limit***

Maximum frequency limit for the drive. Speed is limted here recardles of limit functions.

1286 ***Negative frequency limit***

Minimum frequency limit for the drive. Speed is limted here recardles of limit functions.

1288 ***Generator Torque limit***

Defines maximum generating side torque limit

1287 ***Motoring Torque limit***

Defines maximum motoring side torque limit

1290 ***Generator power limit***

Defines maximum generating side power limit. Only for Closed Loop control.

1289 ***Motoring power limit***

Defines maximum motoring side power limit. Can be activated for Open Loop with Control Options parameter ID1084.

1316 ***Brake fault response***

Defines action when brake fault is detected
0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

1317 ***Brake fault delay***

The delay before the brake fault is activated F58. Used when there is mechanical delay in the brake. See External Brake acknowledge (ID1210).

Contact factory before using mode 3 and 4,

1412 Torque Stabilator Gain

1413 Torque Stabilator Damping

If PMS motor is used in open loop control mode it is rcomended to use value of 980 in this parameter insted of 1000.

1414 Torque Stabilator Gain in Fieldwerakening area.

1420 Prevent of StartUp

This parameter is enabled when “Prevention of Start” circuit is used to inhibit the gate pulses.

1424 Restart Delay

The delay time within which the drive can not be restarted after the coast stop and flying start is not in use. Closed Loop control mode and flying start uses different delay see ID672 The time can be set up to 60.000 seconds.

1506 Generator Power limit Digital input 1

1507 Generator Power limit Digital input 2

With these parameter you can select desired digital input for controlling generator side power limit. ID 1506 activates generator power limit 1 ID 1513 and ID 1507 activates power limit ID 1514. If both input are activated then power limit is zero.

1515 Over Modulation Limit

Output Voltage Limit for partial modulation in 1%. 100% means maximum sinusoidal modulation. 113% is full six step.
If you have sini filter in use set this to 96 %

1516 Modulator Normal

Parameter for changing modulator type when induction motor is used.

1517 Modulator PM Inc

Parameter for changing modulator type when PMS motor is used with ncremental encoder.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1527 ***Analogue output 4, signal selection*** *(2.3.8.1)*

Connect the AO4 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

1520 ***Analogue output 4, function*** *(2.3.8.2)*

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

Selection	Function
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	AI1
10	AI2
11	Output freq. (f_{min} - f_{max})
12	Motor torque
13	Motor power
14	PT100 temperature
15	FB analogue output ProcessData4 (NXS)

1521 ***Analogue output 3, filter time*** *(2.3.8.3)*

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

1522 ***Analogue output 4 inversion*** *(2.3.8.4)*

Inverts the analogue output signal.

1523 ***Analogue output 4 minimum*** *(2.3.8.5)*

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

1525 ***Analogue output 4 scaling*** *(2.3.8.6)*

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

1524 ***Analogue output 4 offset*** *(2.3.8.7)*

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

7.1 Synchronization Control Parameters

1600 Active synchronization

This parameter defines what input is used to activate synchronization. When input is activated drive uses line frequency as frequency reference and will adjust voltage angle to correspond line voltage angle with given hysteresis.

1601 Active direct

This parameter defines what input is used to activate change to direct in line contactor. When synchronization is ready and active direct input is active drive will make change to net. See operation details from chapter 2. When using single motor control mode this input low signal will open the net contactor. For multi-motor control see ID1612.

1602 Motor 1 FC Contactor control

1603 Motor 1 NET Contactor control

1604 Motor 2 FC Contactor control

1605 Motor 2 NET Contactor control

1606 Motor 3 FC Contactor control

1607 Motor 3 NET Contactor control

These parameters define what digital outputs are used to control FC and NET contactors.

1608 Phase offset to NET

This parameter defines the FC voltage angle advance to net voltage angle when the synchronization command is on. This parameter is adjusted depending on the motor load and the delay when the motor does not have current.

1611 Controlled motor

This parameter defines what motor is controlled from the drive when using multi-motor control mode. Use of digital inputs for selection will bypass this parameter selection. The drive can control three motors with own digital outputs and seven motors when using external relay control.

1612 Reset Direct

This parameter resets the NET contactor control signal when using multi-motor control mode. In single motor control Active Direct low command will be Reset Direct command.

1620 Phase hysteresis

This parameter defines hysteresis when FC voltage angle and NET voltage angle are considered to be in synch.

1621 Delay to coasting

This parameter defines the delay when modulation will be stopped from internal decision to make the change. See operation details from chapter 2.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1623 Delay to Open

This parameter defines the delay when the FC contactor will be opened from internal decision to make the change. See operation details from chapter 2.

1624 Delay to Close

This parameter defines the delay when the NET contactor will be closed from internal decision to make the change net. See operation details from chapter 2.

1625 Drive in Synch

This digital output indicates when the drive has been synchronized to net.

1626 Control Mode

This parameter defines what kind of motor starting and stopping configuration is used.

0 = Single Drive
Only one motor is used in the system, Active direct command will also open the NET contactor when there is a LOW signal.
1 = Multi-Motor
Separate input is needed to use [Reset Direct] to open Net contactor. This parameter can also be used with one motor ID1627.
2 = In Sequence
All motors in the system are set to Net in sequence when synchronization and active direct commands are active. Use ID1700 to select if rising edge is required for these commands.

1627 Number of motors

Number of motors in the system. Used in multi-motor and In Sequence control modes.

1628 Start delay to FC

This parameter defines the delay when the drive will make a start attempt after the command to open the NET contactor have been given. FC Contactor will be closed half of this time.

1630 FC Contactor acknowledgment

With this parameter select where connected feedback from the FC contactor is.

1631 NET Contactor acknowledgment

With this parameter select where connected feedback from the NET contactor is.

1634 Commissioning; Test modes

Test modes for commissioning purposes, to activate test modes see also ID1635

0= Line synchronization mode

1= FC and NET contactor timing mode.
This mode will control motor 1 contactor without actual synchronization, only delay parameters for opening and closing are used. Change between FC and NET contactor is made with [Active Direct] command.

2= FC On, Net Off
This selection will force the FC contactor to close and the NET contactor to open.

3= FC Off, Net On
This selection will force FC contactor to open and Net contactor to close.

1635 Commissioning test activation

This DI needs to be TRUE before test modes are activated. Use virtual input 0.2 if actual digital input is not available.

1636 ByPass Inter Lock Falling Edge

Input from external monitoring device. HIGH will mean that motor DOL input is OK. This input will generate fault 87. Used e.g. when motor DOL overload protection is opening motor contactor.

1637 ByPass Inter Lock Rising Edge

Input from external net monitoring device. LOW will mean that Net is OK. This input will generate fault 87. Used e.g. when motor DOL overload protection is opening motor contactor.

1670 Motor selection B0

1671 Motor selection B1

1672 Motor selection B2

These digital inputs are used to select the controlled motor. In none of these inputs are equal or higher than DigIN: A.1 parameter ID1608 is used for motor selection.

1680 DC Low Response

Select response for DC Low fault. This function will activate Fault 85. See details in the Line Synchronization chapter on protection functions. Use selections 0 or 1 if Frequency Converter is disconnected from net when synchronization is finished.

0 = No action
1 = Warning
2 = Fault
Drive will open all contactors and wait until the reset command is given to open all contactors. After the DOL reset command the actual fault can be reset.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1681 *DC Low Limit*

DC voltage Fault limit for F85.

1685 *Line Voltage low response*

Select response for AC Low fault. This function will activate Fault 86. See details in the Line Synchronization chapter on protection functions. Use selections 0 or 1 if measurements are disconnected from net when synchronization is finished.

0 = No action
1 = Warning
2 = Fault
Drive will open all contactors and wait until the reset command is given to open all contactors. After the DOL reset command, the actual fault can be reset.

1686 *Line Voltage low limit*

AC voltage Fault limit for F86.

1690 *Smoot / Speed ratio*

This parameter is used to select speed of synchronization; there are 10 settings where selection 0 is smoothes and selection 10 fastest. Even selections (0,2,4...) will not allow motor to go generator side. To get maximum speed for synchronization brake resistor or AFE may be needed.

1700 *Synchronization options*

This parameter is used to activate certain functions

b0 = Reserved
b1 = Single to Net
The drive will monitor the rising edge of synchronization command and change to net command. In sequence mode the drive starts the next motor but follows normal frequency reference until the rising edge command is given.
b2 = Reserved
b3 = Single Reset
Only one motor is taken from Net when this is active. If not active all motors that are in Net will be disconnected when Reset DOL command is given.
b4 = Reserved
b5 = Reserved
b6 = Reserved
b7 = Reserved
b8 = Reserved
b9 = Reserved
b10 = Reserved
b11 = Reserved
b12 = Disable Current Monitoring
Motor current is not monitored for interlock
b13 = Disable Volt Monitoring
Line voltage is not monitored from interlock
b14 = Disable Freq Monitoring
Line voltage frequency is not monitored for interlock
b15 = Disable Phase Current Monitoring
Motor Phase currents are not monitored for interlock.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.2 Keypad control parameters

Unlike the parameters listed above, these parameters are located in the **M3** menu of the control keypad. The reference parameters do not have an ID number.

114 ***Stop button activated*** *(3.4, 3.6)*

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

See also parameter ID125.

125 ***Control Place*** *(3.1)*

The active control place can be changed with this parameter. For more information, see Vacon NX User's Manual, Chapter 7.3.3.1.

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

0 = PC Control, Activeted by NCDrive
1 = I/O terminal
2 = Keypad
3 = Fieldbus

123 ***Keypad Direction*** *(3.3)*

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

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

For more information, see Vacon NX User's Manual, Chapter 7.3.3.3.

R3.2 ***Keypad Reference*** *(3.2)*

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

The output frequency can be copied as the keypad reference by pushing the *Stop button* for 3 seconds when you are on any of the pages of menu ***M3***. For more information, see Vacon NX User's Manual, Chapter 7.3.3.2.

R3.5 ***Torque reference*** *(3.5)*

Define here the torque reference within 0.0...100.0%.

8. APPENDICES

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

- *Parameters of Motor thermal protection (Chapter 8.1)*
- *Parameters of Stall protection (Chapter 8.2)*
- *Parameters of Underload protection (Chapter 8.3)*
- *Fieldbus control parameters (Chapter 8.4)*
- *Line synchronization protections (Chapter 8.45)*

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

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

General

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

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

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

The thermal stage of the motor can be monitored on the control keypad display V1.10 ID9. 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.*

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

General

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of motor thermal protection. The stall state is defined with two parameters, ID710 (Stall current) and ID712 (Stall frequency limit). If the current is higher than the set limit and 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.

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

General

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.
Motor underload protection can be adjusted by setting the underload curve with parameters ID714 (Field weakening area load) and ID715 (Zero frequency load), see below. The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5Hz (the underload time counter is stopped).

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

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

8.4 Fieldbus control parameters (ID's 850 to 859)

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

Process Data OUT (Slave → Master)

The fieldbus master can read the frequency converter's actual values using process data variables. *Basic, Standard, Local/Remote, Multi-Step, PID control and Pump and fan control* applications use process data as follows:

Data	Value	Unit	Scale	ID
Process data OUT 1	Output Frequency	Hz	0,01 Hz	1
Process data OUT 2	Motor Speed	rpm	1 rpm	2
Process data OUT 3	Motor Current	A	0,1 A	45
Process data OUT 4	Motor Torque	%	0,1 %	4
Process data OUT 5	Motor Power	%	0,1 %	5
Process data OUT 6	Motor Voltage	V	0,1 V	6
Process data OUT 7	DC link voltage	V	1 V	7
Process data OUT 8	Active Fault Code	-	-	37

The *Multipurpose* application has a selector parameter for every Process Data. The monitoring values and drive parameters can be selected using the ID number. Default selections are as in the table above.

Current scaling in different size of units

Note: ID45, usually in Process data OUT 3 is scaled to be with one decimal always

Voltage	Size	Scale
208 – 240 Vac	NX0001 – NX0011	100 – 0,01A
208 – 240 Vac	NX0012 – NX0420	10 – 0,1A
208 – 240 Vac	NX0530	1 – 1A
380 – 500 Vac	NX0003 – NX0007	100 – 0,01A
380 – 500 Vac	NX0009 – NX0300	10 – 0,1A
380 – 500 Vac	NX0385 – NX2643	1 – 1A
525 – 690 Vac	NX0004 – NX0013	100 – 0,01A
525 – 690 Vac	NX0018 – NX0261	10 – 0,1A
525 – 690 Vac	NX0325 – NX1500	1 – 1A

Process Data IN (Master -> Slave)
ControlWord, Reference and Process Data are used with All-inOne applications as follows:

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

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

Multipurpose control application

Data	Value	Unit	Scale
Reference	Speed Reference	%	0.01%
ControlWord	Start/Stop Command Fault reset Command	-	-
Process Data IN1	Torque Reference	%	0.1%
Process Data IN2	Free Analogue INPUT	%	0.01%
Process Data IN3	Adjust Input	%	0.01%
PD3 – PD8	Not Used	-	-

PID control and Pump and fan control applications

Data	Value	Unit	Scale
Reference	Speed Reference	%	0.01%
ControlWord	Start/Stop Command Fault reset Command	-	-
Process Data IN1	Reference for PID controller	%	0.01%
Process Data IN2	Actual Value 1 to PID controller	%	0.01%
Process Data IN3	Actual Value 2 to PID controller	%	0.01%
PD4–PD8	Not Used	-	-

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

8.5 Line synchronization protection functions

80	Both ON	Both contactors have been closed while drive is run state.	
81	CAN Communication	Communication to externals CAN I/O has stopped.	Communication can not be started again until drive is powered down.
82	Frequency error D7	Measured frequency is not within hysteresis.	Check that drive sees correct and positive frequency.
83	Voltage error D7	Measured voltage is not within hysteresis	Check that all phases are measured.
84	Motor Current	Motor current is not within hysteresis to make synchronization to net	FC Contactor has not been closed or motor nominal current has been set too high related to used motor.
85	DC Low	Measured DC voltage was too low	
86	AC Voltage	Measured line voltage was too low	
87	ByPass interlock	External line measurement indicated that line is down	

8.5.1 Fault 80, both contactor on while running

This fault is active when feedback from the first motor contactors is being used.
This fault will appear if feedback from both contactors indicates that contactors are closed and the drive is modulating. When this happens, the drive will stop modulation immediately. Check the timing of the coasting delay, contactor opening delay and contactor closing delay.

8.5.2 Fault 81, Can communication

Communication to external CAN I/O has interrupted. When this fault happens, the drive will internally force the contactor control to off and the fault will not reset until the drive is powered down.

8.5.3 Fault 82, Frequency error D7

Measured line frequency is not within hysteresis. Measured line voltage frequency must be higher than + 25 Hz and less than + 75 Hz. If frequency is not within these hysteresis, the drive will not try to make synchronization to net.

8.5.4 Fault 83, Voltage error D7

Measured line voltage is less than 90 % of motor nominal voltage. If measured voltage is zero, two or all phase measurements are not connected to net; if some voltage is measured then probably one phase is not connected to net. Drive will not make synchronization if voltage is below 90 % of motor nominal voltage.

8.5.5 Fault 84, Motor current

Measured motor current is less than 15% of motor nominal current while in FC control. This usually means that the FC contactor has not been closed properly. Drive will not make changeover to net if the current is below 15% of motor nominal current.

8.5.6 Fault 85, DC Low

This function monitors the drive's own DC voltage. If the voltage goes below a set limit, the drive will force open all contactors. This function is used to prevent DOL start if net is lost while motors are connected to net. If the drive is separated from net when synchronization is done, set response to No Response. When the fault has occurred give command to open all NET contactors. This fault is possible to reset when internal logic sees that no DOL control is active (contactor control word is zero).

8.5.7 Fault 86, AC Voltage

This function monitors line rms voltage. If voltage goes below a set limit, the drive will force all contactors open. This function is used to prevent DOL start if net is lost while motors are connected to net. If the drive is separated from net when synchronization is done, set response to No Response. When the fault has occurred give command to open all NET contactors. This fault is possible to reset when internal logic sees that no DOL control is active (contactor control word is zero).

8.5.8 Fault 87, ByPass interlock

This function monitors DI where is connected input from any device that can indicate if three phase voltage input is interrupted to motor (NET monitor device, motor DOL thermal protection). This function is used to prevent DOL start if net is lost while motors are connected to net. When fault is activated drive will open all DO controls that are controlling DOL contactors. Normal operation can be started again when command to open all DO's has been given (contactor control word is zero).

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

	Line Synch Status Word 1 ms	
	Signal	Comment
b0	Coasting to NET	Internal coasting command is active
b1	Active Synchro	Command to make synchronization is active
b2	Active Direct	Command to change to net is active
b3	Reset Direct	Multi Motor net contactor reset command
b4	Fine tunig	Line voltage frequency within 0,10 Hz from net frequency
b5	Fine tunig OK	Voltage angle is within hysteresis
b6	Connect Direct	Internal command to close NET contactor
b7	Direct Active	Final control signals to NET relay
b8	FC Active	Final control signal to FC relay
b9	Drive Ready	Drive is in Ready state
b10	Drive Run	Drive is in Run state
b11	RunEnable	Internal RunEnable status
b12	RunRequest	Internal RunRequest status
b13	FC Contactor Ack.	Feedback from M1 FC contactor
b14	Net Contactor Ack.	Feedback from M1 NET contactor
b15	Both ON when Run	Drive was running while Net and FC contactor were closed

9. 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_H) in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor Subcode in **T.14:** S1 = Hardware trip S2 = reserved S3 = Current controller supervision	- Check loading. - Check motor. - Check cables. - Make Identification run
2	Overvoltage	The DC-link voltage has exceeded the drive limit. See User manual. - Too short a deceleration time - high overvoltage spikes in supply Subcode in **T.14:** S1 = Hardware trip S2 = Overvoltage control supervision	- Make the deceleration time longer. - Use brake chopper or brake resistor (available as options) - Activate over voltage controller. - Check input voltage
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. – insulation failure in cables or motor	- Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	- Reset the fault and restart. - Should the fault re-occur, contact your local distributor.
6	Emergency stop	Stop signal has been given from the option board.	- Check emergency stop circuit
7	Saturation trip	Various causes: – defective component – brake resistor short-circuit or overload	- Cannot be reset from the keypad. - Switch off power. - DO NOT RE-CONNECT POWER! - Contact your local distributor. - If this fault appears simultaneously with Fault 1, check motor cables and motor

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

8	System fault	- component failure - faulty operation Note exceptional fault data record Subcode in **T.14:** S1 = Reserved S2 = Reserved S3 = Reserved S4 = Reserved S5 = Reserved S6 = Reserved S7 = Charging switch S8 = No power to driver card S9 = Power unit communication (TX) S10 = Power unit communication (Trip) S11 = Power unit comm. (Measurement)	Reset the fault and restart. Should the fault re-occur, contact your local distributor.
9	Undervoltage	DC-link voltage is under the drive fault voltage limit. See user manual. – most probable cause: too low a supply voltage – frequency converter internal fault – One of input fuse is broken. – External charge switch have not been closed. Subcode in **T.14:** S1 = DC-link too low during run S2 = No data from power unit S3 = Undervoltage control supervision	- In case of temporary supply voltage break, reset the fault and restart the frequency converter. - Check the supply voltage. - If it is adequate, an internal failure has occurred. - Check input fuses - Check DC charge function - Contact your local distributor.
10	Input line supervision	Input line phase is missing. Subcode in **T.14:** S1 = Phase supervision diode supply S2 = Phase supervision active front end	Check supply voltage, fuses and cable.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	– no brake resistor installed – brake resistor is broken – brake chopper failure	- Check brake resistor and cabling. - If ok, the chopper is faulty. Contact your local distributor.
13	Frequency converter under-temperature	Heatsink temperature is under –10°C	
14	Frequency converter over-temperature	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 and load.
16	Motor over-temperature	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.	Check load.

18	Unbalance (Warning only)	Unbalance between power modules in paralleled units. Subcode in **T.14:** S1 = Current unbalance S2 = DC-Voltage unbalance	Should the fault re-occur, contact your local distributor.
22	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	Should the fault re-occur, contact your local distributor.
24	Counter fault	Values displayed on counters are incorrect	Have a critical attitude towards values shown on counters.
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault and restart. Should the fault re-occur, contact your local distributor.
26	Start-up prevented	- Start-up of the drive has been prevented. - Run request is ON when new application is loaded to drive	- Cancel prevention of start-up if this can be done safely. - Remove Run Request.
29	Thermistor fault	The thermistor input of option board has detected too high a 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)
31	IGBT temperature (hardware)	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	- Check loading. - Check motor size. - Make identification Run
32	Fan cooling	Cooling fan of the frequency converter does not start, when ON command is given	Contact your local distributor.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
35	Application	Problem in application software	Contact your distributor. If you are application programmer check the application program.
37	Device changed (same type)	Option board or power unit changed. New device of same type and rating.	Reset. Device is ready for use. Old parameter settings will be used.
38	Device added (same type)	Option board added.	Reset. Device is ready for use. Old board settings will be used.
39	Device removed	Option board removed.	Reset. Device no longer available.
40	Device unknown	Unknown option board or drive. Subcode in **T.14:** S1 = Unknown device S2 = Power1 not same type as Power2	Contact the distributor near to you.
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	- Check loading. - Check motor size. - Make Identification run
43	Encoder fault	Problem detected in encoder signals. Sub code in **T.14:** 1 =Encoder 1 channel A is missing 2 =Encoder 1 channel B is missing 3 =Both encoder 1 channels are missing 4 =Encoder reversed 5 =Encoder board missing	- Check encoder channel connections. - Check the encoder board. - Check encoder frequency in open loop

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

44	Device changed (different type)	Option board or power unit changed. New device of different type or different rating than the previous one.	Reset Set the option board parameters again if option bard changed. Set converter parameters again if power unit changed.
45	Device added (different type)	Option board of different type added.	Reset Set the option board parameters again.
50	Analogue input I_{in} < 4mA (sel. signal range 4 to 20 mA)	Current at the analogue input is < 4mA. – signal source has failed control cable is broken or loose	Check the current loop circuitry.
51	External fault	Digital input fault.	- Remove fault situation from external device.
52	Keypad communication fault	The connection between the control keypad or NCDrive and the frequency converter is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken	Check installation. If installation is correct contact the nearest Vacon distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest Vacon distributor.
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise
57	Identification (Warning only)	Identification run have been failed	- Run command was removed before identification was ready - Motor is not connected to frequency converter. - There is load on motor shaft.
58	Brake	Actual status of the brake is opposite than control signal.	Check mechanical brake condition and connections.
59	Follower Communication	SystemBus or CAN communication is broken between master and follower	Check parameters from expanderboard and optical fibre or CAN cable.
60	Cooling	Liquid cooled drive cooling circulation have been failed	Check reason for cooling failure from external system.
61	Speed Error	Motor speed is not the same than reference.	-Check encoder connegtion - PMS motor has been gone over pull out torque.
62	Run Disable	- Run Enable signal is Low	- Check reason for Run Enable signal.
63	Emergency stop (Warning only)	Digital input or fieldbus have give command to make emergency stop	New run command is accepted after emergency stop is reset.
64	Input switch open	Drive input switch is opened	Check the main power switch of the drive.
65	PT100 board two temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise
80	Both ON	Both contactors have been closed while drive is run state	
81	CAN Communication	Communication to externals CAN I/O have stopped.	Communication can not be started again until drive is powered down.
82	Frequency error D7	Measured frequency is not within hysteresis.	Check that drive sees correct and positive frequency.

83	Voltage error D7	Measured voltage is not within hysteresis	Check that all phases are measured.
84	Motor Current	Motor current is not within hysteresis to make synchronization to net	FC Contactor has not been closed or motor nominal current has been set too high related to used motor.
85	DC Low	Measured DC voltage was going too low	
86	AC Voltage	Measured line voltage was going too low	
87	Net Is Down	External line measurement indicated that line is dow	

Table 9-1. Fault codes

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Vaasa
Vacon Oyj (Headquarters and Production)
Runsorintie 7, 65380 Vaasa
firstname.lastname@vacon.com
tel. +358 (0) 201 2121
fax: +358 (0) 201 212 205

Helsinki
Vacon Oyj
Äyritie 12, 01510 Vantaa
tel. +358 (0)201 212 600
fax: +358 (0)201 212 699

Tampere
Vacon Oyj
Alasniitynkatu 30, 33700 Tampere
tel. +358 (0)201 2121
fax: +358 (0)201 212 750

Rotatek Finland Oy
Laserkatu 6, 53850 Lappeenranta
tel. +358 (0)5 6243 870
fax: +358 (0)5 6243 871

Vacon Traction Oy
Alasniitynkatu 30, 33700 Tampere
tel. +358 (0)201 2121
fax: +358 (0)201 212 710

sales companies and representative offices:

Austria
Vacon AT Antriebssysteme GmbH
Aumühlweg 21
2544 Leobersdorf
vacon.austria@vacon.com
tel. +43 2256 651 66
fax: +43 2256 651 66 66

Belgium
Vacon Benelux NV/SA
Interleuvenlaan 62
3001 Heverlee (Leuven)
info@vacon.be
tel. +32 (0)16 394 825
fax: +32 (0)16 394 827

France
Vacon France s.a.s.
Batiment le Sextant
462 rue Benjamin Delessert
ZI de Moissy Cramayel
BP 83
77 554 Moissy Cramayel
www.vacon-france.fr
tel. +33 (0)1 64 13 54 11
fax: +33 (0)1 64 13 54 21

Germany
Vacon GmbH
Gladbecker Str. 425
45329 Essen
tel. +49 (0)201/80670-0
fax: +49 (0)201/80670-93

Great Britain
Vacon Drives (UK) Ltd.
18 Maizefield
Hinckley Fields Industrial Estate
Hinckley
LE10 1YF Leicestershire
vacon.uk@vacon.com
tel. +44 (0)1455 611 515
fax: +44 (0)1455 611 517

Italy
Vacon S.p.A.
Via F.lli Guerra, 35
42100 Reggio Emilia
info@vacon.it
tel. +39 0522 276811
fax: +39 0522 276890

The Netherlands
Vacon Benelux BV
Weide 40, 4206 CJ Gorinchem
vacon.benelux@vacon.com
tel. +31 (0)183 642 970
fax: +31 (0) 183 642 971

Norway
Vacon AS
Langgata 2
3080 Holmestrand
vacon@vacon.no
tel. +47 330 96120
fax: +47 330 96130

PR China
Vacon Plc
Beijing Representative Office
A205, Grand Pacific Garden Mansion
8A Guanhua Road
Beijing 100026
www.vacon.com.cn
vacon.china@vacon.com
tel. +86 10 6581 3734
fax: +86 10 6581 3754

Russia
ZAO Vacon Drives
Bolshaja Jakimanka 31
stroenie 18
109180 Moscow
www.ru.vacon.com
tel. +7 (095) 974 1541
fax: +7 (095) 974 1554
ZAO Vacon Drives
2ya Sovetskaya 7, office 210A
191036 St. Petersburg
www.ru.vacon.com
tel. +7 (812) 332 1114
fax: +7 (812) 279 9053

Singapore
Vacon Plc
Singapore Representative Office
102F Pasir Panjang Road
#02-06 Citilink Warehouse Complex
Singapore 118530
vacon.singapore@vacon.com
tel. +65 6278 8533
fax: +65 6278 1066

Spain
Vacon Drives Ibérica S.A.
Miquel Servet, 2. P.I. Bufalvent
08240 Manresa
www.vacon.es
info@vacon.es
tel. +34 93 877 45 06
fax: +34 93 877 00 09

Sweden
Vacon AB
Torget 1
172 67 Sundbyberg
tel. +46 (0)8 293 055
fax: +46 (0)8 290 755

Vacon distributor: