nx frequency converters

# asfiff12

## high speed application

## NXS

## user's manual

Vacon High Speed Application manual

# INDEX

Document code: ud00735
Software code: ASFIFF12V251
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# 1. GENERAL

The High Speed Application, ASFIFF12, is based on the Standard Application of the All-In-One package.

This application requires licence key if it mend to be used above 1900 Hz. When above 1900 Hz is going to be used contact factory and give description about need. Note that some situations need NXP drive to be used. NXP drive can reach higher frequency than NXS drive.

# 2. APPLICATION SPECIFIC

## 2.1 **High speed**

The maximum frequency for the application is 7200 Hz (default is 50 Hz). The frequency is displayed without decimal. However license code is needed to run above 1900 Hz.
The unit for the motor speed is either rpm or krpm depending on the selected Frequency Scale (P2.1.17). The maximum frequency (7200Hz) is corresponding to the maximum nominal speed of the motor of 432 000 rpm (1 pole pair).

### *2.1.1 7200Hz*

By entering a licence code to parameter P2.9.14 is it possible to run over 1900 Hz.
This code is different for every drive and has to be ordered from Vacon. When ordering the drive with this feature, the code will be calculated before delivery. If the user wants to activate the feature afterwards, he has to inform Vacon about the **serial number of the power unit(s)** for the drive(s) where the feature is wanted.

### *2.1.2 Fine tuning*

It is possible to tune the motor controller for smoother run, especially in high-speed mode, and for PMS motors
See parameter group 9.
And separate parameters: 2.1.17, 2.1.18, 2.4.14, 2.4.15, 2.4.16, 2.6.14,

### *2.1.3 Trial Time*

It is possible to run the drive over 1900Hz, without license key, for 2 weeks. When these 2 weeks has expired will the drive trip and it is not longer possible to run the drive over 1900Hz. Time left can be see from monitoring variable V1.17 Trial Time Left. When in Trial Time mode, the drive will give warning message each time the start command is given.

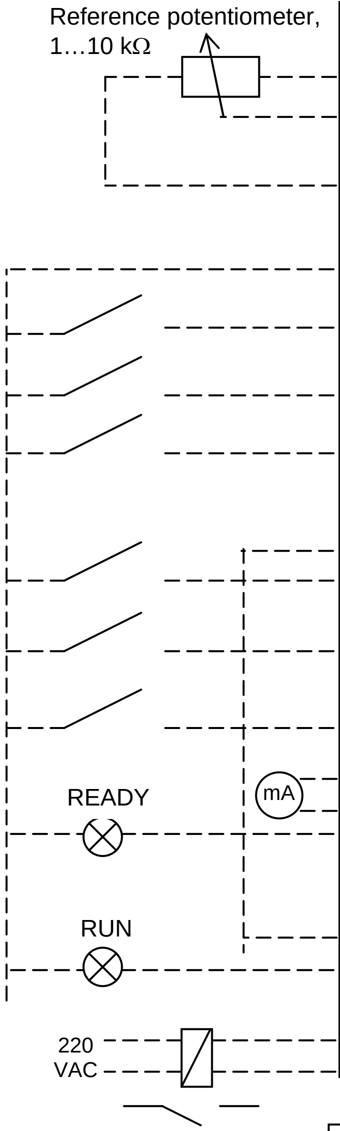
## 2.2 **Long ramp times**

By setting parameter P.2.1.16, Long Ramps, to YES, is it possible to set the acceleration and deceleration -times between 1-30 000s (8h 20min) with one-second resolution.
If No is selected (default) is the max acceleration/deceleration time 0,1-3000s.

## 2.3 **Fieldbus**

In this application is it also possible to separately program the ProcessData Output 1-8 for the fieldbus. This is done by setting the ID number of the parameter or value that you want to monitor to Process Data Ouput 1-8.
See parameter group 10

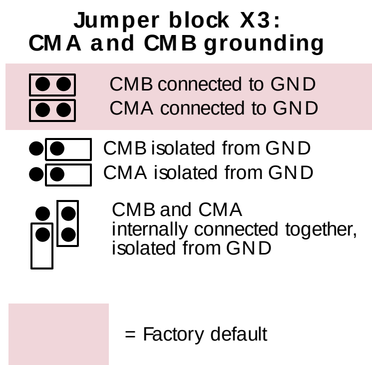
# 3. CONTROL I/O




| NXOPTA1 | | | |
|---|---|---|---|
| Terminal | | Signal | Description |
| 1 | +10V$_{ref}$ | Reference output | Voltage for potentiometer, etc. |
| 2 | AI1+ | Analogue input, voltage range 0—10V DC | Voltage input frequency reference |
| 3 | AI1- | I/O Ground | Ground for reference and controls |
| 4 | AI2+ | Analogue input, current range 0—20mA | Current input frequency reference |
| 5 | AI2- | | |
| 6 | +24V | Control voltage output | Voltage for switches, etc. max 0.1 A |
| 7 | GND | I/O ground | Ground for reference and controls |
| 8 | DIN1 | Start forward (programmable) | Contact closed = start forward |
| 9 | DIN2 | Start reverse (programmable) | Contact closed = start reverse |
| 10 | DIN3 | External fault input (programmable) | Contact open = no fault<br>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 | Multi-step speed select 1 | DIN4 / DIN5 / Frequency ref. |
| 15 | DIN5 | Multi-step speed select 2 | Open / Open / Ref.U$_{in}$<br>Closed / Open / Multi-step ref.1<br>Open / Closed / Multi-step ref.2<br>Closed / Closed / Ref.I$_{in}$ |
| 16 | DIN6 | Fault reset | Contact open = no action<br>Contact closed = fault reset |
| 17 | CMB | Common for DIN4—DIN6 | Connect to GND or +24V |
| 18 | AO1+ | Output frequency | Programmable |
| 19 | AO1- | Analogue output | Range 0—20 mA/R$_L$, max. 500Ω |
| 20 | DO1 | Digital output READY | Programmable<br>Open collector, I≤50mA, U≤48 VDC |
| **NXOPTA2** | | | |
| 21 | RO1 | Relay output 1 RUN | Programmable |
| 22 | RO1 | | |
| 23 | RO1 | | |
| 24 | RO2 | Relay output 2 FAULT | Programmable |
| 25 | RO2 | | |
| 26 | RO2 | | |

*Table 3-1. Standard application default I/O configuration.*

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



## 3.1 Control signal logic in High Speed Application

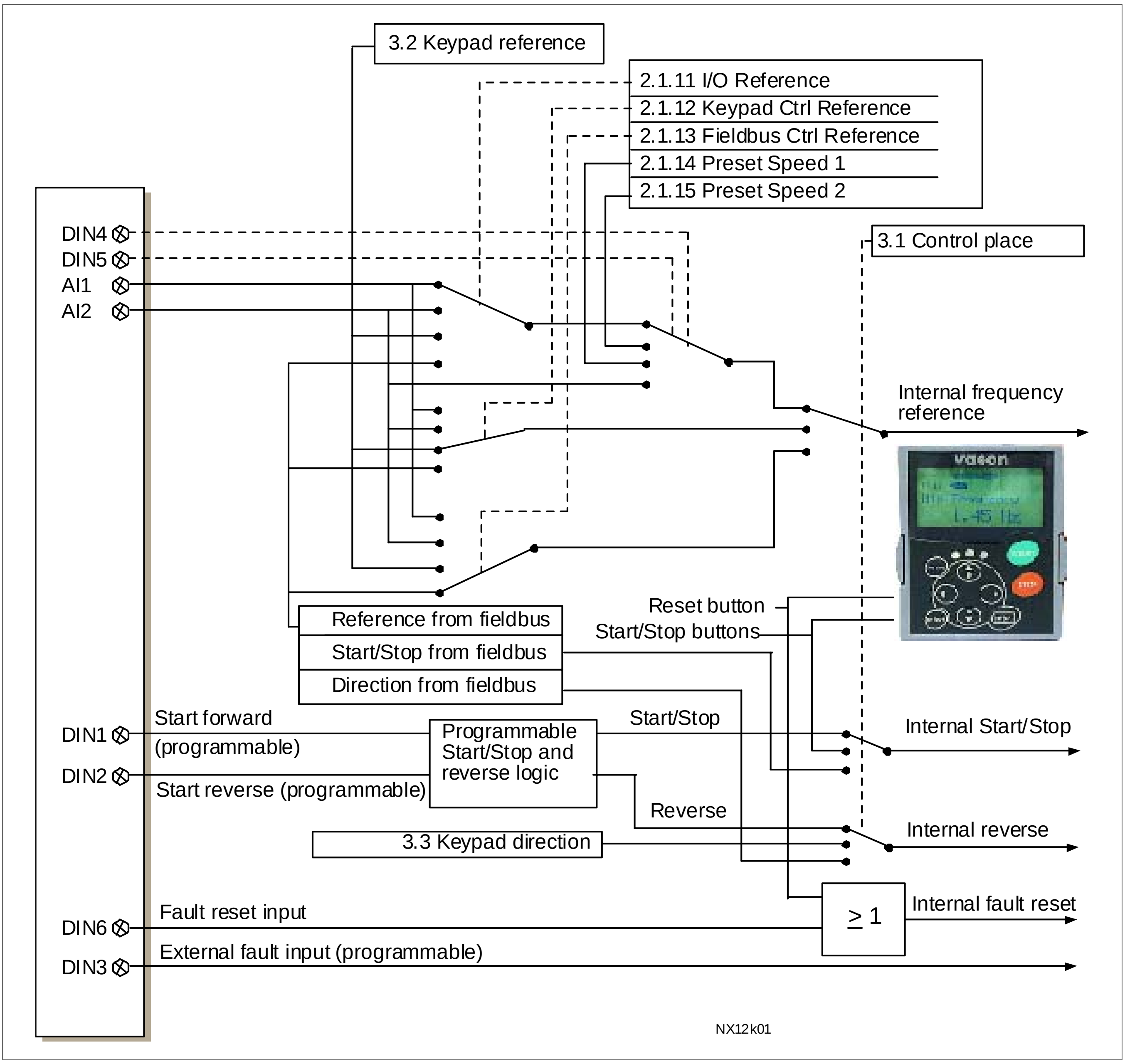



*Figure 3-1. Control signal logic of the High Speed Application*

# 4. HIGH SPEED 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 21 to 56. The descriptions are arranged according to the **ID number** of the parameter.

**Column explanations:**

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

## 4.1 **Monitoring values (Control keypad: menu M1)**

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the procut's User's Manual for more information.

| Code | Parameter | Unit | ID | Description |
|---|---|---|---|---|
| V1.1 | Output frequency | Hz | 1 | Output frequency to motor |
| V1.2 | Frequency reference | Hz | 25 | Frequency reference to motor control |
| V1.3 | Motor speed | Rpm / krpm | 2 | The unit for motor speed is depending on Frequency Scale (P2.1.17) |
| V1.4 | Motor current | A | 3 | |
| V1.5 | Motor torque | % | 4 | Calculated shaft torque |
| V1.6 | Motor power | % | 5 | Motor shaft power |
| V1.7 | Motor voltage | V | 6 | |
| V1.8 | DC link voltage | V | 7 | |
| V1.9 | Unit temperature | °C | 8 | Heatsink temperature |
| V1.10 | Motor temperature | % | 9 | Calculated motor temperature |
| V1.11 | Analogue input 1 | V | 13 | AI1 |
| V1.12 | Analogue input 2 | mA | 14 | AI2 |
| V1.13 | DIN1, DIN2, DIN3 | | 15 | Digital input statuses |
| V1.14 | DIN4, DIN5, DIN6 | | 16 | Digital input statuses |
| V1.15 | DO1, RO1, RO2 | | 17 | Digital and relay output statuses |
| V1.16 | Analogue $I_{out}$ | mA | 26 | AO1 |
| V1.17 | Trial time left | H | 67 | When zero application can not be used without licence key |
| V1.18 | PT100 Temperature | °C | 42 | Highest temperature of used PT100 inputs |
| M1.19 | Multi Monitoring items | | | Displays three selectable monitoring values |

*Table 4-1. Monitoring values*

### 4.1.1 Monitoring values 2 (Control keypad: menu M1.23)

| Code | Parameter | Unit | ID | Description |
|---|---|---|---|---|
| G1.20 | Monitor 2 | | | |
| V1.20.1 | Current | A | 1113 | Unfiltered motor current |
| V1.20.2 | Torque | % | 1125 | Unfiltered motor torque |
| V1.20.3 | DC Voltage | V | 44 | Unfiltered DC link voltage |
| V1.20.4 | Status Word | | 43 | |

*Table 4-2. Monitoring values 2*

### 4.1.2 Fieldbus monitoring values (Control keypad: menu M1.23)

| Code | Parameter | Unit | ID | Description |
|---|---|---|---|---|
| G1.21 | Fieldbus | | | |
| V1.20.1 | Motor Current 1D | A | 45 | Motor current (drive independ-ent) given with one decimal point |
| V1.24.5 | Last Active Fault | | 37 | |

*Table 4-3. Fieldbus monitoring values*

### 4.1.3 Application Status Word

Application Status Word combains different drive statuses to one data word. See monitoring value V1.20.4 Status Word.

| | Application Status Word | |
|---|---|---|
| | FALSE | TRUE |
| b0 | - | - |
| b1 | Not in Ready state | Ready |
| b2 | Not Running | Running |
| b3 | No Fault | Fault |
| b4 | - | - |
| b5 | - | - |
| b6 | Run Disabled | Run Enable |
| b7 | No Warning | Warning |
| b8 | | |
| b9 | | |
| b10 | | |
| b11 | No DC brake | DC Brake is active |
| b12 | No Run Request | Run Request |
| b13 | No Limit Controls Active | Limit control Active |
| b14 | - | - |
| b15 | | |

*Table 4-4. Application Status Word Content.*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.1.1 | Min frequency | | P2.1.2 | Hz | | | 101 | |
| P2.1.2 | Max frequency | P2.1.1 | | Hz | | | 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 | See also P2.1.16 |
| P2.1.4 | Deceleration time 1 | 0,1 | 3000,0 | s | 3,0 | | 104 | See also P2.1.16 |
| P2.1.5 | Current limit | 0,00 | 2 x $I_H$ | A | $I_L$ | | 107 | Limit will lower frequency |
| P2.1.6 | Nominal voltage of the motor | 180 | 690 | V | NX2: 230V<br>NX5: 400V<br>NX6: 690V | | 110 | Check the rating plate of the motor. Note also used connegtion Delta/Star |
| P2.1.7 | Nominal frequency of the motor | | | Hz | | | 111 | Check the rating plate of the motor |
| P2.1.8 | Nominal speed of the motor | | | rpm / krpm | | | 112 | The default applies for a 4-pole motor and a nominal size frequency converter. The unit for motor speed is depending on Frequency Scale (P2.1.17) |
| P2.1.9 | Nominal current of the motor | 0,1x $I_H$ | 2 x $I_H$ | A | $I_H$ | | 113 | Check the rating plate of the motor. |
| 2.1.10 | Motor cosφ | 0,30 | 1,00 | | 0,85 | | 120 | Check the rating plate of the motor |
| 2.1.11 | I/O reference | 0 | 3 | | 0 | | 117 | **0**=AI1<br>**1**=AI2<br>**2**=Keypad<br>**3**=Fieldbus<br>**4**=AI3 |
| 2.1.12 | Keypad control reference | 0 | 3 | | 2 | | 121 | **0**=AI1<br>**1**=AI2<br>**2**=Keypad<br>**3**=Fieldbus<br>**4**=AI3 |
| 2.1.13 | Fieldbus control reference | 0 | 3 | | 3 | | 122 | **0**=AI1<br>**1**=AI2<br>**2**=Keypad<br>**3**=Fieldbus<br>**4**=AI3 |
| 2.1.14 | Preset speed 1 | | P2.1.2 | Hz | | | 105 | Speeds preset by operator |
| 2.1.15 | Preset speed 2 | | P2.1.2 | Hz | | | 106 | |
| 2.1.16 | Long ramp times | 0 | 1 | | 0 | | 1500 | **0** = 0,1 s – 3000,0 s<br>**1** = 0 s – 30000 s |
| 2.1.17 | Frequency Scale | 0 | 5 | | 1 | | 523 | **0** = 0-32,000 Hz<br>**1** = 0-320,00 Hz<br>**2** = 0-1900,0 Hz<br>**3** = 0-3200,0 Hz<br>**4** = 0-5200 Hz<br>**5** = 0-7200 Hz |
| 2.1.18 | Motor Type | 0 | 1 | | 0 | | 650 | 0 = Induction Motor<br>1 = PMS motor |

*Table 4-5. Basic parameters G2.1*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.2.1 | Start/Stop logic | 0 | 6 | | 0 | | 300 | Start signal **1** / Start signal **2**<br>**0** Start fwd / Start rvs<br>**1** Start/Stop / Reverse<br>**2** Start/Stop / Run enable<br>**3** Start pulse / Stop pulse<br>**4** Start / Mot.Pot UP<br>**5** Start fwd* / Start rvs*<br>**6** Start*/Stop / Reverse |
| P2.2.2 | DIN3 function | 0 | 8 | | 1 | | 301 | **0**=Not used<br>**1**=Ext. fault, closing cont.<br>**2**=Ext. fault, opening cont.<br>**3**=Run enable<br>**4**=Acc./Dec. time select.<br>**5**=Force cp. to IO<br>**6**=Force cp. to keypad<br>**7**=Force cp. to fieldbus<br>**8**=Rvs (if P2.2.1=3) |
| P2.2.3 | Current reference offset | 0 | 1 | | 1 | | 302 | **0**=0—20mA<br>**1**=4—20mA |
| P2.2.4 | Reference scaling minimum value | | P2.2.5 | Hz | | | 303 | Selects the frequency that corresponds to the min. reference signal<br>0,00 = No scaling |
| P2.2.5 | Reference scaling maximum value | | | Hz | | | 304 | Selects the frequency that corresponds to the max. reference signal<br>0,00 = No scaling |
| P2.2.6 | Reference inversion | 0 | 1 | | 0 | | 305 | **0** = Not inverted<br>**1** = Inverted |
| P2.2.7 | Reference filter time | 0,00 | 10,00 | s | 0,10 | | 306 | **0** = No filtering |
| P2.2.8 | AI1 signal selection | 0.1 | E.10 | | A.1 | | 377 | TTF programming method used. |
| P2.2.9 | AI2 signal selection | 0.1 | E.10 | | A.2 | | 388 | TTF programming method used. |
| P2.2.10 | AI3 signal selection | 0.1 | E.10 | | 0.1 | | 389 | TTF programming method used. |

*Table 4-6. Input signals, G2.2*

* = Rising edge required to start

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.3.1 | Analogue output 1 signal selection | 0 | | | A.1 | | 464 | TTF programming method used. |
| P2.3.2 | Analogue output function | 0 | 8 | | 1 | | 307 | **0**=Not used<br>**1**=Output freq. (0—$f_{max}$)<br>**2**=Freq. reference (0—$f_{max}$)<br>**3**=Motor speed (0—Motor nominal speed)<br>**4**=Motor current (0—$I_{nMotor}$)<br>**5**=Motor torque (0—$T_{nMotor}$)<br>**6**=Motor power (0—$P_{nMotor}$)<br>**7**=Motor voltage (0-$U_{nMotor}$)<br>**8**=DC-link volt (0—1000V) |
| P2.3.3 | Analogue output filter time | 0,00 | 10,00 | s | 1,00 | | 308 | **0**=No filtering |
| P2.3.4 | Analogue output inversion | 0 | 1 | | 0 | | 309 | **0** = Not inverted<br>**1** = Inverted |
| P2.3.5 | Analogue output minimum | 0 | 1 | | 0 | | 310 | **0** = 0 mA<br>**1** = 4 mA |
| P2.3.6 | Analogue output scale | 10 | 1000 | % | 100 | | 311 | |
| P2.3.7 | Digital output 1 function | 0 | 16 | | 1 | | 312 | **0**=Not used<br>**1**=Ready<br>**2**=Run<br>**3**=Fault<br>**4**=Fault inverted<br>**5**=FC overheat warning<br>**6**=Ext. fault or warning<br>**7**=Ref. fault or warning<br>**8**=Warning<br>**9**=Reversed<br>**10**=Preset speed 1<br>**11**=At speed<br>**12**=Mot. regulator active<br>**13**=OP freq. limit 1 superv.<br>**14**=Control place: IO<br>**15**=Thermistor fault/warng<br>**16**=Fieldbus input data |
| P2.3.8 | Relay output 1 function | 0 | 16 | | 2 | | 313 | As parameter 2.3.7 |
| P2.3.9 | Relay output 2 function | 0 | 16 | | 3 | | 314 | As parameter 2.3.7 |
| P2.3.10 | Output frequency limit 1 supervision | 0 | 2 | | 0 | | 315 | **0**=No limit<br>**1**=Low limit supervision<br>**2**=High limit supervision |
| P2.3.11 | Output freq. limit 1; Supervised value | | | Hz | | | 316 | |
| P2.3.12 | Analogue output 2 signal selection | 0.1 | E.10 | | 0.1 | | 471 | TTF programming method used. |
| P2.3.13 | Analogue output 2 function | 0 | 8 | | 4 | | 472 | As parameter 2.3.2 |
| P2.3.14 | Analogue output 2 filter time | 0,00 | 10,00 | s | 1,00 | | 473 | **0**=No filtering |
| P2.3.15 | Analogue output 2 inversion | 0 | 1 | | 0 | | 474 | **0**=Not inverted<br>**1**=Inverted |
| P2.3.16 | Analogue output 2 minimum | 0 | 1 | | 0 | | 475 | **0**=0 mA<br>**1**=4 mA |
| P2.3.17 | Analogue output 2 scaling | 10 | 1000 | % | 100 | | 476 | |
| P2.3.18 | Analogue output 3 signal selection | 0.1 | E.10 | | 0.1 | | 478 | TTF programming method used. |
| P2.3.19 | Analogue output 3 function | 0 | 8 | | 4 | | 479 | As parameter 2.3.2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P2.3.20 | Analogue output 3 filter time | 0,00 | 10,00 | s | 1,00 | | 480 | **0**=No filtering |
| P2.3.21 | Analogue output 3 inversion | 0 | 1 | | 0 | | 481 | **0**=Not inverted<br>**1**=Inverted |
| P2.3.22 | Analogue output 3 minimum | 0 | 1 | | 0 | | 482 | **0**=0 mA<br>**1**=4 mA |
| P2.3.23 | Analogue output 3 scaling | 10 | 1000 | % | 100 | | 483 | |
| P2.3.24 | Analogue output 4 signal selection | 0.1 | E.10 | | 0.1 | | 484 | TTF programming method used. |
| P2.3.25 | Analogue output 4 function | 0 | 8 | | 4 | | 485 | As parameter 2.3.2 |
| P2.3.26 | Analogue output 4 filter time | 0,00 | 10,00 | s | 1,00 | | 486 | **0**=No filtering |
| P2.3.27 | Analogue output 4 inversion | 0 | 1 | | 0 | | 487 | **0**=Not inverted<br>**1**=Inverted |
| P2.3.28 | Analogue output 4 minimum | 0 | 1 | | 0 | | 488 | **0**=0 mA<br>**1**=4 mA |
| P2.3.29 | Analogue output 4 scaling | 10 | 1000 | % | 100 | | 489 | |

*Table 4-7. Output signals, G2.3*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.4.1 | Ramp 1 shape | 0,0 | 10,0 | s | 0,0 | | 500 | **0** = Linear<br>**>0** = S-curve ramp time |
| P2.4.2 | Ramp 2 shape | 0,0 | 10,0 | s | 0,0 | | 501 | **0** = Linear<br>**>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<br>**1**=Used when running<br>**2**=External brake chopper<br>**3**=Used when stopped/running<br>**4**=Used when running (no testing) |
| P2.4.6 | Start function | 0 | 1 | | 0 | | 505 | **0**=Ramp<br>**1**=Flying start |
| P2.4.7 | Stop function | 0 | 3 | | 0 | | 506 | **0**=Coasting<br>**1**=Ramp<br>**2**=Ramp+Run enable coast<br>**3**=Coast+Run enable ramp |
| P2.4.8 | DC braking current | 0,4 x $I_H$ | 2 x $I_H$ | A | $I_H$ | | 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<br>**1**=On |
| P2.4.13 | Flux braking current | 0,4 x $I_H$ | 2 x $I_H$ | A | $I_H$ | | 519 | |
| P2.4.14 | Advanced Options 1 | 0 | 65536 | | 1 | | 1511 | Bitwise settings |
| P2.4.15 | Advanced Options 2 | 0 | 65536 | | 1 | | 1516 | Bitwise settings |
| P2.4.16 | Advanced Options 4 | 0 | 65536 | | 1 | | 1517 | Bitwise settings |

*Table 4-8. Drive control parameters, G2.4*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.5.1 | Prohibit frequency range 1 low limit | | P2.5.2 | Hz | | | 509 | |
| P2.5.2 | Prohibit frequency range 1 high limit | | | Hz | | | 510 | |
| P2.5.3 | Prohibit acc./dec. ramp | 0,1 | 10,0 | | 1,0 | | 518 | |

*Table 4-9. Prohibit frequency parameters, G2.5*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.6.1 | Motor control mode | 0 | 1/4 | | 0 | | 600 | **NXS:**<br>**0**=Frequency control<br>**1**=Speed control<br>**Additionally for NXP:**<br>**2**=Not used<br>**3**=Closed loop speed ctrl<br>**4**=Closed loop torque ctrl |
| P2.6.2 | U/f optimisation | 0 | 1 | | 0 | | 109 | **0**=Not used<br>**1**=Automatic torque boost |
| P2.6.3 | U/f ratio selection | 0 | 3 | | 0 | | 108 | **0**=Linear<br>**1**=Squared<br>**2**=Programmable<br>**3**=Linear with flux optim. |
| P2.6.4 | Field weakening point | | | Hz | | | 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 | | P2.6.4 | Hz | | | 604 | |
| P2.6.7 | U/f curve midpoint voltage | 0,00 | 100,00 | % | 100,00 | | 605 | n% x $U_{nmot}$<br>Parameter max. value = P 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 5-6 for exact values |
| P2.6.10 | Overvoltage controller | 0 | 2 | | 1 | | 607 | **0**=Not used<br>**1**=Used (no ramping)<br>**2**=Used (ramping) |
| P2.6.11 | Undervoltage controller | 0 | 1 | | 1 | | 608 | **0**=Not used<br>**1**=Used |
| P2.6.12 | Load drooping | 0,00 | 100,00 | % | 0,00 | | 620 | |
| P2.6.13 | Identification | 0 | 2 | | 0 | | 631 | **0**=No action<br>**1**=Identification w/o run<br>**2**=Identification with run |
| P2.6.14 | Modulator Type | 0 | 1 | | 0 | | 1518 | **0** = Default PWM<br>**1** = Space Vector PWM. |

*Table 4-10. Motor control parameters, G2.6*

*Closed Loop parameters (Control keypad: Menu M2→ G2.6.13)*

| Closed Loop parameter group 2.6.13 (NXP only) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P2.6.15.1 | Magnetizing current | 0,00 | 100,00 | A | 0,00 | | 612 | |
| P2.6.15.2 | Speed control P gain | 0 | 1000 | | 30 | | 613 | |
| P2.6.15.3 | Speed control I time | 0,0 | 500,0 | ms | 30,0 | | 614 | |
| P2.6.15.5 | Acceleration compensation | 0,00 | 300,00 | s | 0,00 | | 626 | |
| P2.6.15.6 | Slip adjust | 0 | 500 | % | 100 | | 619 | |
| P2.6.15.7 | Magnetizing current at start | MotCurr Min | MotCurr Max | A | 0,00 | | 627 | |
| P2.6.15.8 | Magnetizing time at start | 0,0 | 600,0 | s | 0,0 | | 628 | |
| P2.6.15.9 | 0-speed time at start | 0 | 32000 | ms | 100 | | 615 | |
| P2.6.15.10 | 0-speed time at stop | 0 | 32000 | ms | 100 | | 616 | |
| P2.6.15.11 | Start-up torque | 0 | 3 | | 0 | | 621 | **0**=Not used<br>**1**=Torque memory<br>**2**=Torque reference<br>**3**=Start-up torque fwd/rev |
| P2.6.15.12 | Start-up torque FWD | –300,0 | 300,0 | s | 0,0 | | 633 | |
| P2.6.15.13 | Start-up torque REV | –300,0 | 300,0 | s | 0,0 | | 634 | |
| P2.6.15.15 | Encoder filter time | 0 | 1000 | ms | 0 | | 618 | |
| P2.6.15.17 | Current control P gain | 0,00 | 100,00 | % | 40,00 | | 617 | |
| P2.6.15.18 | Current control I gain | 0,00 | 100,00 | % | 40,00 | | 657 | |

*Table 4-11. Closed Loop parameters, G2.6.13*

### *4.7.1 Advanced Open Loop parameters (Control keypad: Menu M2→ G2.6.1)*

| Advanced Open Loop parameter group 2.6.14 (NXP only) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P2.6.16.1 | Zero speed current | 0,0 | 250,0 | % | 120,0 | | 625 | |
| P2.6.16.2 | Minimum current | 0,0 | 100,0 | % | 80,0 | | 622 | |
| P2.6.16.3 | Flux reference | 0,0 | 100,0 | % | 80,0 | | 623 | |
| P2.6.16.4 | Frequency limit | 0,0 | 100,0 | % | 20,0 | | 635 | |
| P2.6.16.5 | U/f boost | 0 | 1 | | 0 | | 632 | |

*Table 4-12. Advanced Open Loop parameters, G2.6.14.*

### 4.7.2 Identification parameters (Control keypad: Menu M2 → G2.6.6)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.6.17.1 | Flux 10 % | 0 | 2500 | % | 10 | | 1355 | |
| P2.6.17.2 | Flux 20 % | 0 | 2500 | % | 20 | | 1356 | |
| P2.6.17.3 | Flux 30 % | 0 | 2500 | % | 30 | | 1357 | |
| P2.6.17.4 | Flux 40 % | 0 | 2500 | % | 40 | | 1358 | |
| P2.6.17.5 | Flux 50 % | 0 | 2500 | % | 50 | | 1359 | |
| P2.6.17.6 | Flux 60 % | 0 | 2500 | % | 60 | | 1360 | |
| P2.6.17.7 | Flux 70 % | 0 | 2500 | % | 70 | | 1361 | |
| P2.6.17.8 | Flux 80 % | 0 | 2500 | % | 80 | | 1362 | |
| P2.6.17.9 | Flux 90 % | 0 | 2500 | % | 90 | | 1363 | |
| P2.6.17.10 | Flux 100 % | 0 | 2500 | % | 100 | | 1364 | |
| P2.6.17.11 | Flux 110 % | 0 | 2500 | % | 110 | | 1365 | |
| P2.6.17.12 | Flux 120 % | 0 | 2500 | % | 120 | | 1366 | |
| P2.6.16.13 | Flux 130 % | 0 | 2500 | % | 130 | | 1367 | |
| P2.6.17.14 | Flux 140 % | 0 | 2500 | % | 140 | | 1368 | |
| P2.6.17.15 | Flux 150 % | 0 | 2500 | % | 150 | | 1369 | |
| P2.6.17.16 | Rs voltage drop | 0 | 30000 | | Varies | | 662 | Used for torque calculation in open loop |
| P2.6.17.17 | Ir add zero point voltage | 0 | 30000 | | Varies | | 664 | |
| P2.6.17.18 | Ir add generator scale | 0 | 30000 | | Varies | | 665 | |
| P2.6.17.19 | Ir add motoring scale | 0 | 30000 | | Varies | | 667 | |
| P2.6.17.20 | Iu Offset | -32000 | 32000 | | 0 | | 668 | |
| P2.6.17.21 | Iv Offset | -32000 | 32000 | | 0 | | 669 | |
| P2.6.17.22 | Iw Offset | -32000 | 32000 | | 0 | | 670 | |
| P2.6.17.23 | Speed step | -50,0 | 50,0 | 0,0 | 0,0 | | 1252 | NCDrive speed tuning |

*Table 4-13. Identification parameters, G2.6.4*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.7.1 | Response to 4mA reference fault | 0 | 5 | | 0 | | 700 | **0**=No response<br>**1**=Warning<br>**2**=Warning+Previous Freq.<br>**3**=Wrng+PresetFreq 2.7.2<br>**4**=Fault,stop acc. to 2.4.7<br>**5**=Fault,stop by coasting |
| P2.7.2 | 4mA reference fault frequency | | P2.1.2 | Hz | | | 728 | |
| P2.7.3 | Response to external fault | 0 | 3 | | 2 | | 701 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**3**=Fault,stop by coasting |
| P2.7.4 | Input phase supervision | 0 | 3 | | 0 | | 730 | |
| P2.7.5 | Response to undervoltage fault | 0 | 1 | | 0 | | 727 | **0**=Fault stored in history<br>**1**=Fault not stored |
| P2.7.6 | Output phase supervision | 0 | 3 | | 2 | | 702 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**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 | 100 | % | 100 | | 708 | |
| P2.7.13 | Stall protection | 0 | 3 | | 0 | | 709 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**3**=Fault,stop by coasting |
| P2.7.14 | Stall current | 0,1 | $I_{nMotor}$ x 2 | A | $I_L$ | | 710 | |
| P2.7.15 | Stall time limit | 1,00 | 120,00 | s | 15,00 | | 711 | |
| P2.7.16 | Stall frequency limit | | P2.1.2 | Hz | | | 712 | |
| P2.7.17 | Underload protection | 0 | 3 | | 0 | | 713 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**3**=Fault,stop by coasting |
| P2.7.18 | Field weakening area load | 10 | 150 | % | 50 | | 714 | |
| P2.7.19 | Zero frequency load | 5,0 | 150,0 | % | 10,0 | | 715 | |
| P2.7.20 | Underload protection time limit | 2 | 600 | s | 20 | | 716 | |
| P2.7.21 | Response to thermistor fault | 0 | 3 | | 2 | | 732 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**3**=Fault,stop by coasting |
| P2.7.22 | Response to fieldbus fault | 0 | 3 | | 2 | | 733 | See P2.7.21 |
| P2.7.23 | Response to slot fault | 0 | 3 | | 2 | | 734 | See P2.7.21 |
| P2.7.24 | No. of PT100 inputs | 0 | 5 | | 0 | | 739 | **0**=Not used<br>**1**=PT100 input 1<br>**2**= PT100 input 1 & 2<br>**3**= PT100 input 1 & 2 & 3<br>**4**= PT100 input 2 & 3<br>**5**= PT100 input 3 |
| P2.7.25 | Response to PT100 fault | 0 | 3 | | 2 | | 740 | **0**=No response<br>**1**=Warning<br>**2**=Fault,stop acc. to 2.4.7<br>**3**=Fault,stop by coasting |

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| 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 | Disable Run Lock | 0 | 1 | | 0 | | 1086 | |

*Table 4-14. Protections, G2.7*

## 4.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.8.1 | Wait time | 0,10 | 10,00 | s | 0,50 | | 717 | |
| P2.8.2 | Trial time | 0,00 | 60,00 | s | 30,00 | | 718 | |
| P2.8.3 | Start function | 0 | 2 | | 0 | | 719 | **0**=Ramp<br>**1**=Flying start<br>**2**=According to P 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 | | 1 | | 738 | |

*Table 4-15. Autorestart parameters, G2.8*

## 4.10 High Speed Special parameters (Control keypad: Menu M2 → G2.9)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.9.1 | Torque Stabilizer Damping | 0 | 1000 | | 900 | | 1504 | |
| P2.9.2 | Torque Stabilizer Gain | 0 | 1000 | | 100 | | 1505 | |
| P2.9.3 | Torque Stabilizer Gain in FWP | 0 | 1000 | | 50 | | 1506 | |
| P2.9.4 | Flux Stabilizer Gain | 0 | 32000 | | 500 | | 1507 | |
| P2.9.5 | Voltage Stabilizer Damping | 0 | 1000 | | 900 | | 1508 | |
| P2.8.6 | Voltage Stabilizer Gain | 0 | 1000 | | 100 | | 1509 | |
| P2.9.7 | Voltage Stabilizer Limit | 0 | 1000 | | 150 | | 1510 | |
| P2.9.8 | RS Voltage Drop | 0 | 1000 | | 0 | | 662 | |
| P2.9.9 | Synchronous / Asynchronous Modulator | 0 | 1 | | 1 | | 1512 | **0** = Syncronous modulation<br>**1** = Asyncronous Modulation |
| P2.9.10 | Symmetrical / Asymmetrical Modulation | 0 | 1 | | 0 | | 1513 | 0 = Asymetrical<br>1 = Symmetrical |
| P2.9.11 | Max Voltage Index | 50 | 113 | % | 105 | | 1503 | |
| P2.9.12 | Low speed option | -1 | 5000 | | -1 | | 1514 | **-1** = Disabled |
| P2.9.13 | Disable enable HW Low speed option | 0 | 1 | | 1 | | 1515 | **0** = Enabled<br>**1** = Disabled |
| P2.9.14 | Licence | 0 | 65535 | | 0 | | 1502 | License key needed if >1900Hz is required |
| P2.9.15 | FluxCircStabGain | 0 | 30000 | | 10000 | | 1519 | Gain for Flux Circle Stabilizer |

*Table 1-11. Autorestart parameters, G2.8*

## 4.11 Field bus parameters (Control keypad: Menu M2 → G2.10)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.10.1 | Fieldbus min scale | | | Hz | | | 850 | |
| P2. 10.2 | Fieldbus max scale | | | Hz | | | 851 | |
| P2.10.3 | Fieldbus process data out 1 selection | 0 | 10000 | | 1 | | 852 | Choose monitoring data with parameter ID<br>Def: Output Frequency |
| P2.10.4 | Fieldbus process data out 2 selection | 0 | 10000 | | 2 | | 853 | Choose monitoring data with parameter ID<br>Def:Motor Speed |
| P2.10.5 | Fieldbus process data out 3 selection | 0 | 10000 | | 45 | | 854 | Choose monitoring data with parameter ID<br>Def:Motor Current to FB |
| P2.10.6 | Fieldbus process data out 4 selection | 0 | 10000 | | 4 | | 855 | Choose monitoring data with parameter ID<br>Def: Motor Torqye |
| P2.10.7 | Fieldbus process data out 5 selection | 0 | 10000 | | 5 | | 856 | Choose monitoring data with parameter ID<br>Def: Motor Power |
| P2.10.8 | Fieldbus process data out 6 selection | 0 | 10000 | | 6 | | 857 | Choose monitoring data with parameter ID<br>Def: Motor Voltage |
| P2.10.9 | Fieldbus process data out 7 selection | 0 | 10000 | | 7 | | 858 | Choose monitoring data with parameter ID<br>Def: DC-Link Voltage |
| P2.10.10 | Fieldbus process data out 8 selection | 0 | 10000 | | 37 | | 859 | Choose monitoring data with parameter ID<br>Def: Last Active Fault |

*Table 4-16. Field bus parameters, G2.10*

## 4.12 Keypad control (Control keypad: Menu M3)

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

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

*Table 4-17. Keypad control parameters, M3*

## 4.13 System menu (Control keypad: M6)

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

## 4.14 Expander boards (Control keypad: Menu M7)

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

# 5. 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. ***377 AI1 Signal SelectionP***) indicates that the *TTF programming method* shall be applied to this parameter.

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

Defines the frequency limits of the frequency converter.
The maximum value for these parameters is 5200 Hz.
The software will automatically check the values of parameters ID105, ID106, ID315 and ID728.

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

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

***105 Preset speed 1*** *(2.1.14)*
***106 Preset speed 2*** *(2.1.15)*

Parameter values are automatically limited between the minimum and maximum frequencies (P ID101, ID102).
Note the use of TTF-programming method in the Multi-purpose Control Application. See parameters ID419, ID420 and ID421.

| Speed | Multi-step speed sel. 1 (DIN4) | Multi-step speed sel. 2 (DIN5) |
|---|---|---|
| Basic speed | 0 | 0 |
| ID105 | 1 | 0 |
| ID106 | 0 | 1 |

*Table 5-1. 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.

*NOTE! The Max value for this parameter might differ for FR9 and bigger and for NXLC.*

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

Linear: **0** The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. Linear U/f ration should be used in constant torque applications. **This default setting should be used if there is no special need for another setting**.

Squared: **1** The voltage of the motor changes followiing a squared curve form with the frequency in the area from 0 Hz to the field weakening point where the nominal voltage is also supplied to the motor. The motor runs undermagnetised below the field weakening point and produces less torque and electromechanical noise. Squared U/f ratio can be used in applications where torque demand of the load is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

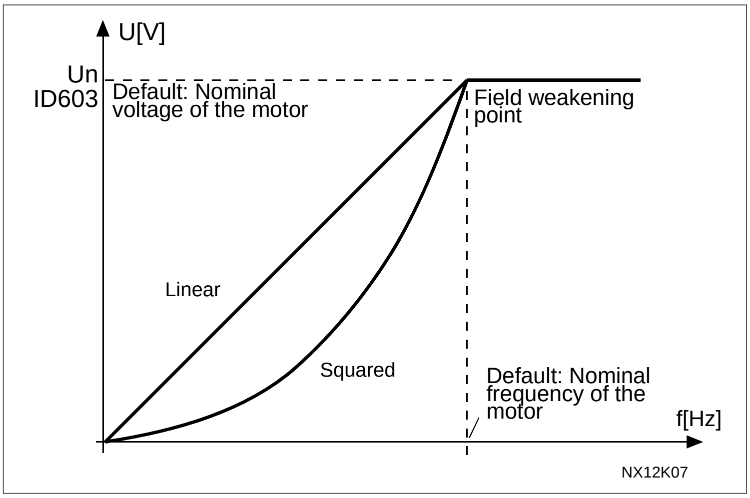



*Figure 5-1. Linear and squared change of motor voltage*

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

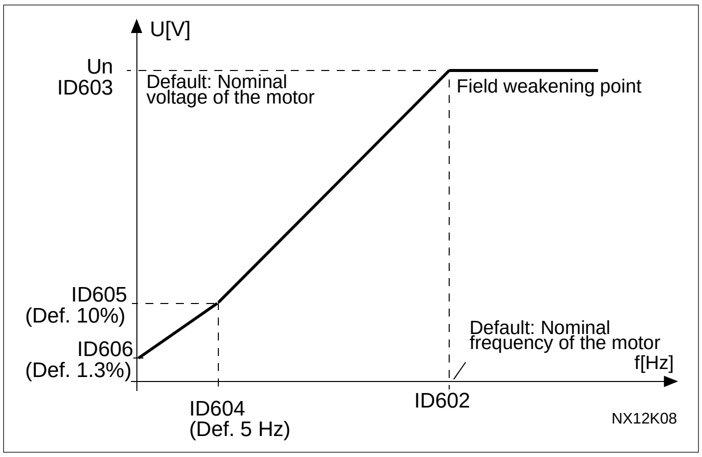



*Figure 5-2. Programmable U/f curve*

Linear with flux optimisation:

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

***109*** ***U/f optimisation*** *(2.6.2)*

**Automatic torque boost** The voltage to the motor changes automatically which makes the motor produce sufficient torque to start and run at low frequencies. The voltage increase depends on the motor type and power. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors.
**NOTE**! This feature is not usable if ID662 = 0.

**EXAMPLE:**

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

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

Option 1: Activate the Automatic torque boost.

Option 2: Programmable U/f curve
To get torque you need to set the zero point voltage and midpoint voltage/frequency (in parameter group 2.6) so that the motor takes enough current at low frequencies.
First set ID108 to *Programmable U/f curve* (value **2**). Increase zero point voltage (ID606) to get enough current at zero speed. Set then the midpoint voltage (ID605) to 1.4142*ID606 and midpoint frequency (ID604) to value ID606/100%*ID111.

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

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

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

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

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

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

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

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

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

*NOTE! The Max value for this parameter might differ for FR9 and bigger, and for NXW.*

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

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

| Applic. / Sel. | ASFIFF12 |
|---|---|
| 0 | Analogue volt.ref.<br>Terminals 2-3 |
| 1 | Analogue curr.ref.<br>Terminals 4-5 |
| 2 | Keypad reference (Menu M3) |
| 3 | Fieldbus reference |
| 4 | AI3 |

*Table 5-2. Selections for parameter ID117*

***120*** ***Motor cos phi*** *(2.1.10)*

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

***121*** ***Keypad frequency reference selection*** *(2.1.12)*

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

| Applic. / Sel. | ASFIFF12 |
|---|---|
| 0 | Analogue volt.ref.<br>Terminals 2–3 |
| 1 | Analogue curr.ref.<br>Terminals 4–5 |
| 2 | Keypad reference (Menu M3) |
| 3 | Fieldbus reference* |
| 4 | AI3 |

*Table 5-3. Selections for parameter ID121*

*FBSpeedReference

***122*** ***Fieldbus frequency reference selection*** *(2.1.13)*

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

**300** ***Start/Stop logic selection*** *(2.2.1)*

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

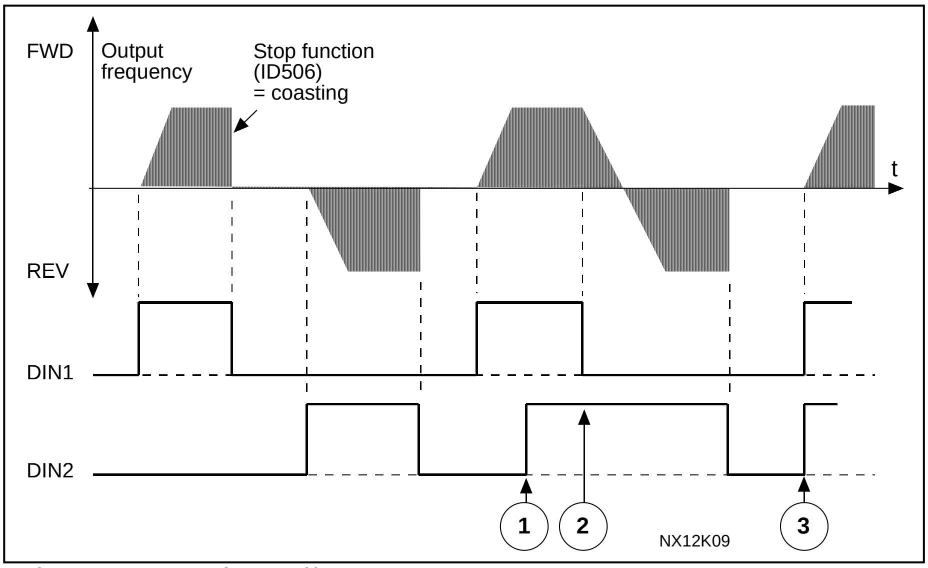



*Figure 5-3. Start forward/Start reverse*

① The first selected direction has the highest priority.

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

③ If Start forward (DIN1) and Start reverse (DIN2) signals are active simultaneously the Start forward signal (DIN1) has priority.

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

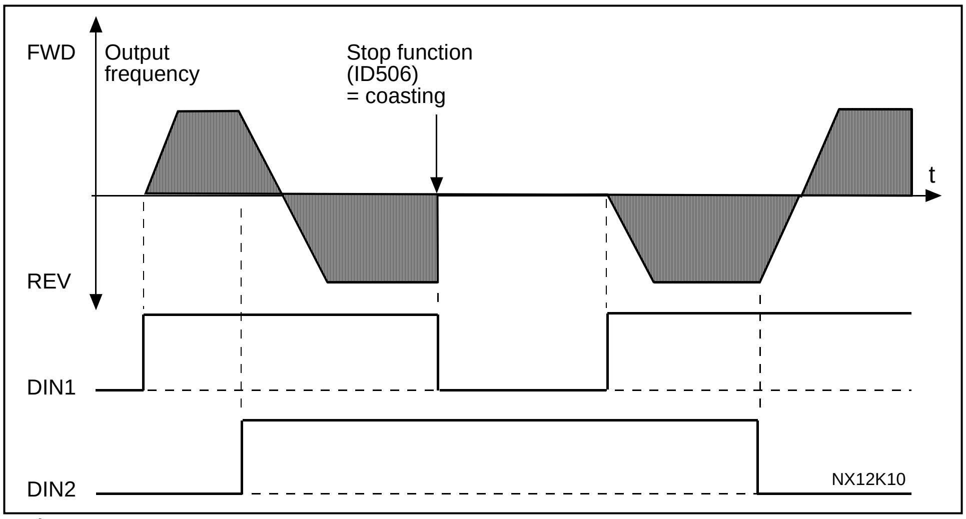



*Figure 5-4. Start, Stop, Reverse*

**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
(DIN3 can be programmed for reverse command)
See Figure 5-5.

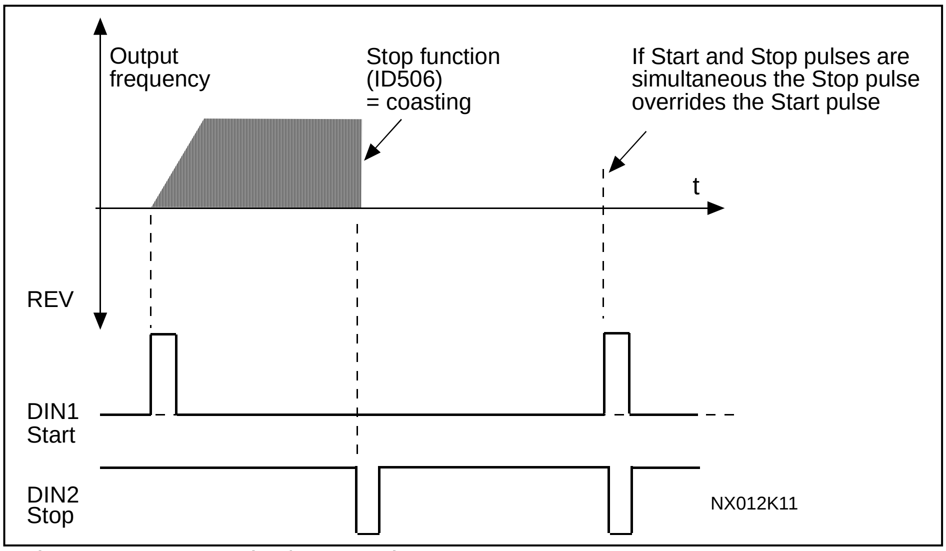



*Figure 5-5. Start pulse/ Stop pulse.*

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

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

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

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

***301 DIN3 function*** *(2.2.2)*

**0** Not used
**1** External fault, closing contact = Fault is shown and motor is stopped when the input is active.
**2** External fault, opening contact = Fault is shown and motor is stopped when the input is not active.
**3** Run enable, contact open = Motor start disabled and the motor is stopped
contact closed = Motor start enabled
**4** Acc./Dec time select. contact open = Acceleration/deceleration time 1 selected
contact closed = Acceleration/deceleration time 2 selected

**5** Closing contact: Force control place to I/O terminal
**6** Closing contact: Force control place to keypad
**7** Closing contact: Force control place to fieldbus
When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used (reference according to parameters ID117, ID121 and ID122).
**Note:** The value of parameter ID125 Keypad Control Place does not change.
When DIN3 opens the control place is selected according to parameter 3.1.

**8** Reverse contact open = Forward
contact closed = Reverse

Can be used for reversing if parameter ID300 has value 3.

***302 Reference offset for current input*** *(2.2.3)*

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

***303 Reference scaling, minimum value*** *(2.2.4)*
***304 Reference scaling, maximum value*** *(2.2.5)*

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

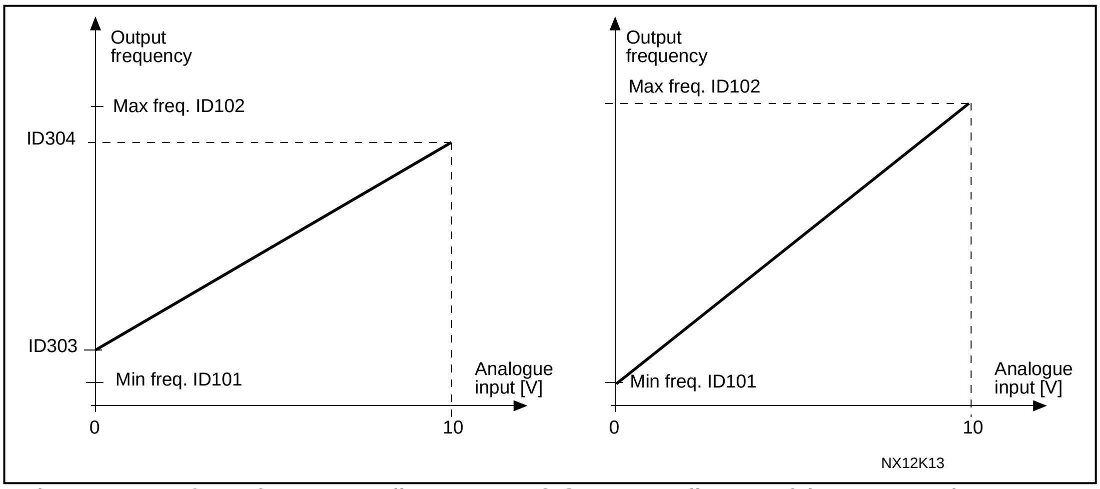



*Figure 5-6. **Left**: Reference scaling; **Right**: No scaling used (P ID303 = 0).*

### 305 Reference inversion (2.2.6)

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

**0** No inversion
**1** Reference inverted

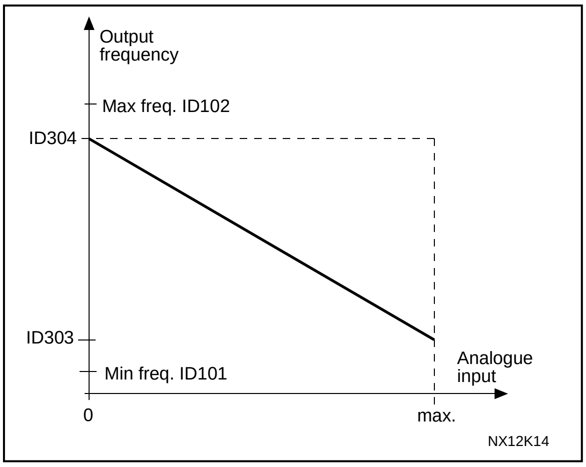



*Figure 5-7. Reference invert.*

### 306 Reference filter time (2.2.7)

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

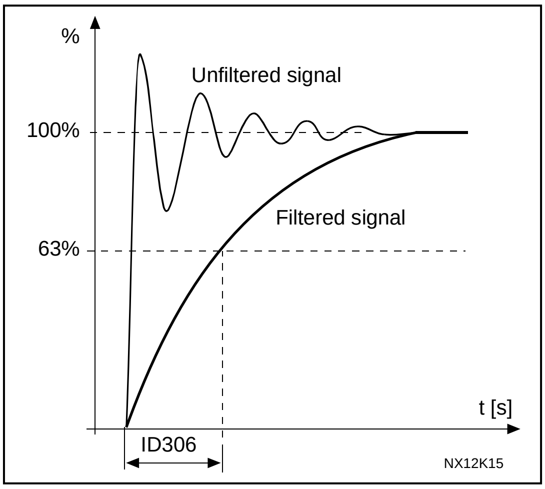



*Figure 5-8. Reference filtering*

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

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

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

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

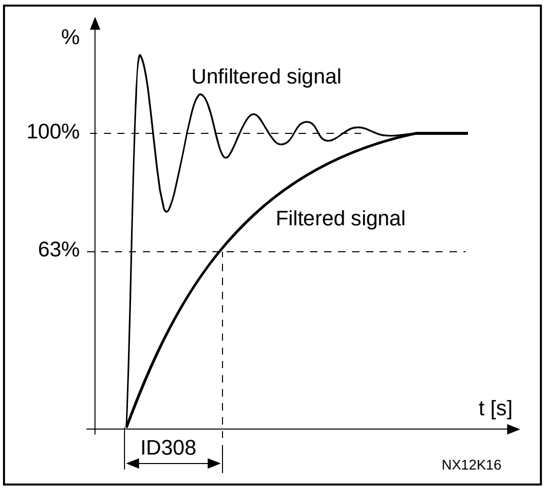



*Figure 5-9. Analogue output filtering*

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

Inverts the analogue output signal:

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

See parameter ID311 below.

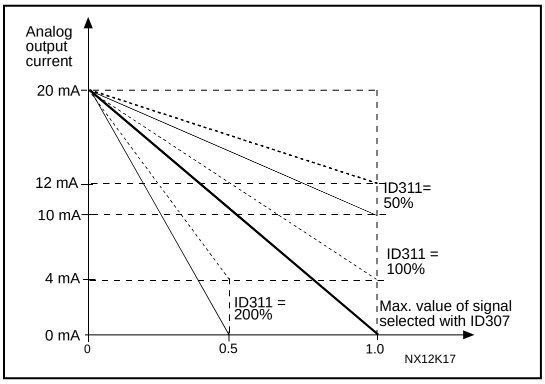



*Figure 5-10. Analogue output invert*

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

Defines the signal minimum to either 0 mA or 4 mA (living zero). Note the difference in analogue output scaling in parameter ID311 (Figure -11).

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

### *311 Analogue output scale 234567 (2.3.6)*

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 5-4. Analogue output scaling*

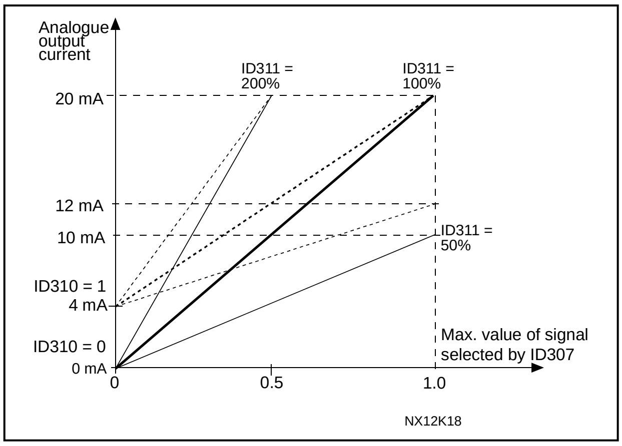



*Figure 5-11. Analogue output scaling*

### *312 Digital output function (2.3.7)*
### *313 Relay output 1 function (2.3.83)*
### *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 = Vacon overheat warning | The heat-sink temperature exceeds +70°C |
| 6 = External fault or warning | Fault or warning depending on P ID701 |
| 7 = 4mA reference fault or warning | Fault or warning depending on P ID700<br>- if analogue reference is 4—20 mA and signal is <4mA |
| 8 = Warning | Always if a warning exists |
| 9 = Reversed | The reverse command has been selected |
| 10 = Preset speed 1 (Applications 2)<br>10 = Jogging speed (Applications 3456) | The preset speed has been selected with digital input<br>The jogging speed has been selected with digital input |
| 11 = At speed | The output frequency has reached the set reference |
| 12 = Motor regulator activated | Overvoltage or overcurrent regulator was activated |
| 13 = Output frequency limit supervision | The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 315 and 316 below) |
| 14 = Control from I/O terminals (Appl. 2) | I/O control mode selected (in menu M3) |
| 15 = Thermistor fault or warning (Appl.2) | The thermistor input of option board indicates overtemperature. Fault or warning depending on par ID732. |
| 16 = Fieldbus input data | Fieldbus input data (FBFixedControlWord) to DO/RO. |

*Table 5-5. Output signals via DO1 and output relays RO1 and RO2.*

***315*** ***Output frequency limit supervision function*** *(2.3.101)*

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

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

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

Selects the frequency value supervised by parameter ID315. See Figure 5-12

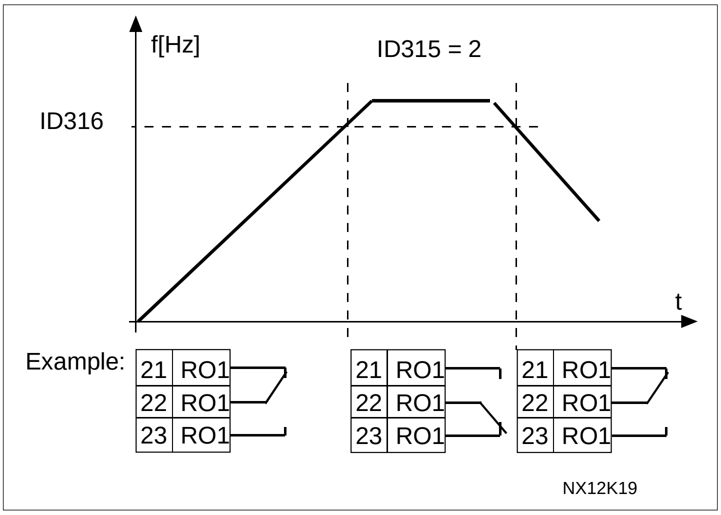



*Figure 5-12. Output frequency supervision*

***377*** ***AI1 signal selection*** *(2.2.8)*

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

***388*** ***AI2 signal selection*** *(2.2.9)*

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

***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).

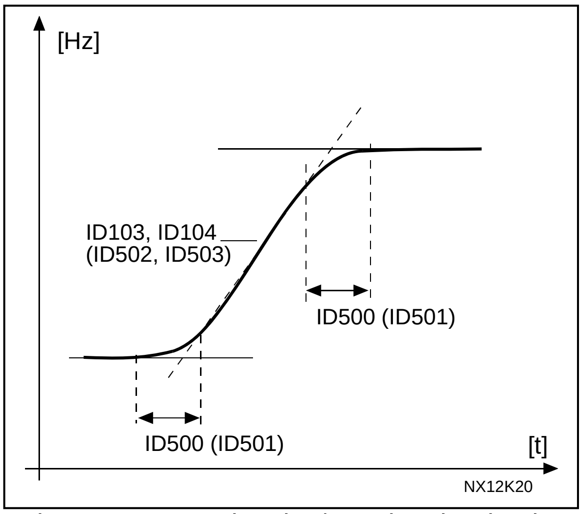



*Figure 5-13. Acceleration/Deceleration (S-shaped)*

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

These values correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (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 (ID301).

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

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

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

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

Ramp:

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

Flying start:

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

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

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

Coasting:

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

Ramp:

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

Normal stop: Ramp/ Run Enable stop: coasting

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

Normal stop: Coasting/ Run Enable stop: ramping

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

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

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

*NOTE! The Max value for this parameter might differ for FR9 and bigger, and for NXLC.*

***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.

**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.

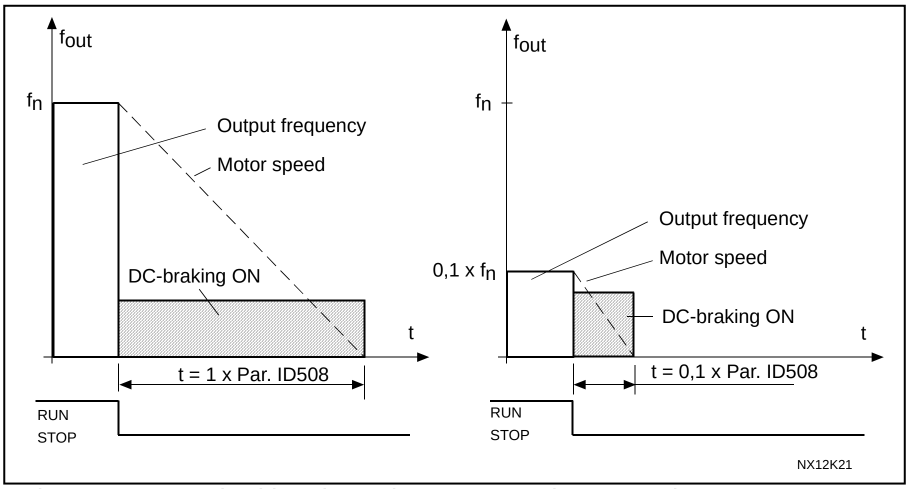



*Figure 5-14. DC-braking time when Stop mode = Coasting.*

**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 5-15.

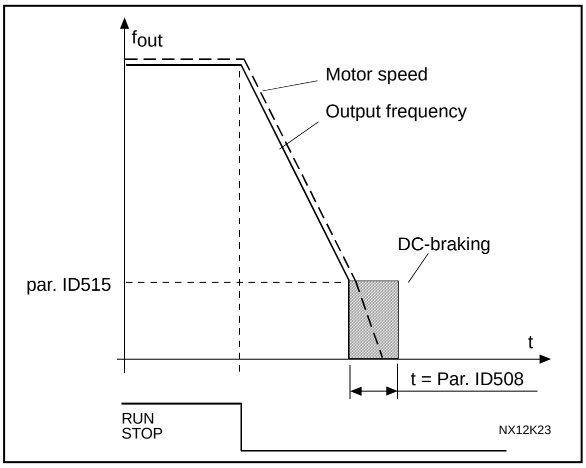



*Figure 5-15. DC-braking time when Stop mode = Ramp*

***509 Prohibit frequency area 1; Low limit 234567*** *(2.5.1)*
***510 Prohibit frequency area 1; High limit 234567*** *(2.5.2)*

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 5-16.

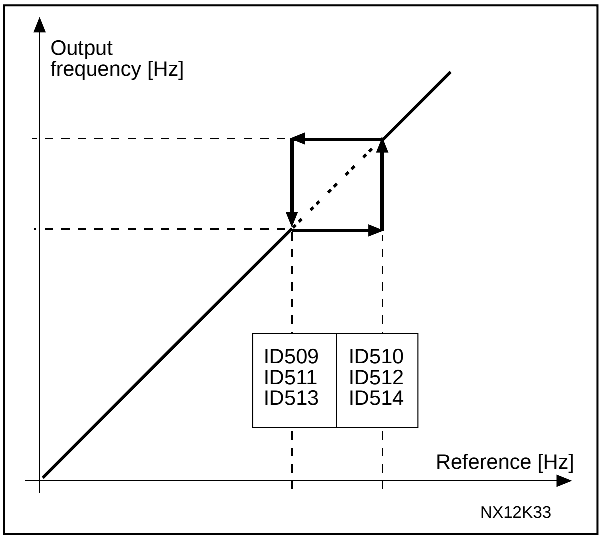



*Figure 5-16. Example of prohibit frequency area setting.*

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

The output frequency at which the DC-braking is applied. See Figure 5-16.

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

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

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

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

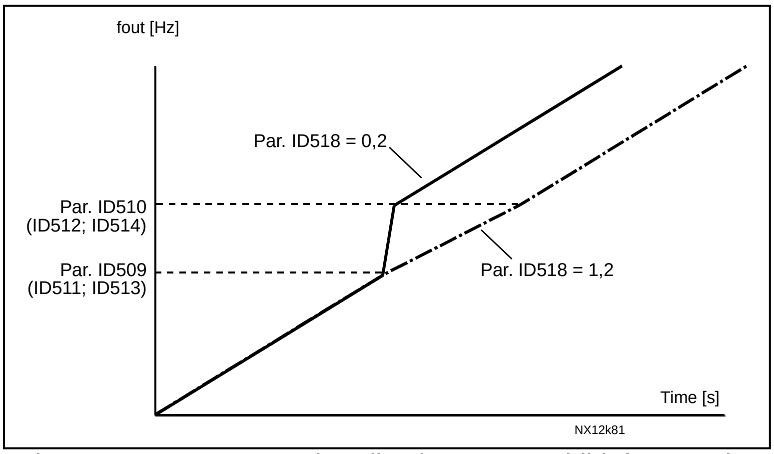



*Figure 5-17. Ramp speed scaling between prohibit frequencies*

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

Defines the flux braking current value. This value can be set between 0.4*$I_H$ and the Current limit.

*NOTE! The Max value for this parameter might differ for FR9 and bigger, and for NXLC.*

### *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.

### *523 Frequency Scale* *(2.1.17)*

By changing the Frequency Scale will the internal variables for setting the decimals, and max values for eg MaxFreq, Motor Nominal Freq/Speed, be set automatically.

| Freq Scale Sel. | Frequency Area |
|---|---|
| **0** | 0-32,000 Hz |
| **1** | 0-320,00 Hz |
| **2** | 0-1900,0 Hz |
| **3** | 0-3200,0 Hz |
| **4** | 0-5200 Hz |
| **5** | 0-7200 Hz |

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

**NXS:**

**0** Frequency control: The I/O terminal and keypad references are frequency references and the frequency converter controls the output frequency (output frequency resolution = 0.01 Hz)

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

The following selections are available for Vacon NXP drives only, except for selection **2** which is available in the Multi-Purpose Control Application for NXS drives also.

**2** Torque control In torque control mode, the references are used to control the motor torque.

**3** Speed crtl (closed loop) The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed very accurately comparing the actual speed received from the tachometer to the speed reference (accuracy ±0.01%).

**4** Torque crtl (closed loop) The I/O terminal and keypad references are torque references and the frequency converter controls the motor torque.

**5** Frequency control (advanced open loop)

Frequency control with better performance at lower speeds.

**6** Speed control (advanced open loop)

Speed control with better performance at lower speeds.

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

Motor noise can be minimised using a high switching frequency. Increasing the switching frequency reduces the capacity of the frequency converter unit.
The range of this parameter depends on the size of the frequency converter:

| Type | Min. [kHz] | Max. [kHz] | Default [kHz] |
|---|---|---|---|
| 0003—0061 NX_2<br>0003—0061 NX_5 | 1.0 | 16,0 | 10.0 |
| 0075—0205 NX_2 | 1.0 | 10.0 | 3.6 |
| 0072—0520 NX_5 | 1.0 | 6.0 | 3.6 |
| 0004—0208 NX_6 | 1.0 | 6.0 | 1.5 |

*Table 5-6. Size-dependent switching frequencies*

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

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

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

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

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

If the programmable U/f curve has been selected with parameter ID108 this parameter defines the middle point frequency of the curve. See Figure 5-2.

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

If the programmable U/f curve has been selected with the parameter ID108 this parameter defines the middle point voltage of the curve. See Figure 5-2.

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

If the programmable U/f curve has been selected with the parameter ID108 this parameter defines the zero frequency voltage of the curve. NOTE: If the value of parameter ID108 is changed this parameter is set to zero. See Figure 5-2.

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

**0** Controller switched off
**1** Controller switched on

***612 CL: Magnetizing current*** *(2.6.14.1)*

Set here the motor magnetizing current (no-load current). See chapter 6.1.

***613 CL: Speed control P gain*** *(2.6.14.2)*

Sets the gain for the speed controller in % per Hz. See chapter 6.1.

***614 CL: Speed control I time*** *(2.6.14.3)*

Sets the integral time constant for the speed controller. Increasing the I-time increases stability but lengthens the speed response time. See chapter 6.1.

***615 CL: Zero speed time at start*** *(2.6.14.9)*

After giving the start command the drive will remain at zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time has elapsed from the instant where the command is given. See chapter 6.1.

***616 CL: Zero speed time at stop*** *(2.6.14.10)*

The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed when a stop command is given. This parameter has no effect if the selected stop function (ID506) is *Coasting*. See chapter 6.1.

***617 CL: Current control P gain*** *(2.6.14.17)*

Sets the gain for the current controller. This controller is active only in closed loop and advanced open loop modes. The controller generates the voltage vector reference to the modulator. See chapter 6.1.

***618 CL: Encoder filter time*** *(2.6.14.15)*

Sets the filter time constant for speed measurement.
The parameter can be used to eliminate encoder signal noise. Too high a filter time reduces speed control stability. See chapter 6.1.

***619 CL: Slip adjust*** *(2.6.14.6)*

The motor name plate speed is used to calculate the nominal slip. This value is used to adjust the voltage of motor when loaded. The name plate speed is sometimes a little inaccurate and this parameter can therefore be used to trim the slip. Reducing the slip adjust value increases the motor voltage when the motor is loaded. See chapter 6.1.

***620 Load drooping*** *(2.6.12)*

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

***621*** ***CL: Startup torque*** *(2.6.14.11)*

Choose here the startup torque.
Torque Memory is used in crane applications. Startup Torque FWD/REV can be used in other applications to help the speed controller. See chapter 6.1.
**0** = Not Used
**1** = TorqMemory
**2** = Torque Ref
**3** = Torq.Fwd/Rev

***622*** ***AOL: Minimum current*** *(2.6.15.2)*

Minimum current to the motor in the current control frequency region. Larger value gives more torque, but increases losses. See chapter 6.2.

***623*** ***AOL: Flux reference*** *(2.6.15.3)*

Reference for flux below the frequency limit. Larger value gives more torque, but increases losses. See chapter 6.2.

***625*** ***AOL: Zero speed current*** *(2.6.15.1)*

At very low frequencies, this parameter defines the constant current reference to the motor. See chapter 6.2.

***626*** ***CL: Acceleration compensation*** *(2.6.14.5)*

Sets the inertia compensation to improve speed response during acceleration and deceleration. The time is defined as acceleration time to nominal speed with nominal torque. This parameter is active also in advanced open loop mode.

***627*** ***CL: Magnetizing current at start*** *(2.6.14.7)*

***628*** ***CL: Magnetizing time at start*** *(2.6.14.8)*

Set here the rise time of magnetizing current.

***631*** ***Identification*** *(2.6.2)*

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.

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.

***632*** ***AOL: U/f boost*** *(2.6.15.5)*

Boost voltage at Frequency Limit to increase flux and torque. See chapter 6.2.

***633*** ***CL: Start-up torque, forward*** *(2.6.14.12)*

Sets the start-up torque for forward direction if selected with P ID621.

***634*** ***CL: Start-up torque, reverse*** *(2.6.14.13)*

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

***635*** ***AOL: Frequency limit*** *(2.6.15.4)*

Corner frequency for transition to standard U/f control. The value is given in % of motor nominal frequency. See chapter 6.2.

***650*** ***Motor Type*** *(2.1.18)*

Select used motor type with this parameter.
0 = Induction motor
1 = Permanent magnet synchronous motor

***657*** ***Current control Ti***

Current controller integrator time constant (0 ... 1000) = 0...100.0 ms

***662*** ***RS Voltage Drop***

This parameter defines the motor stator resistance as a voltage drop at the nominal current. Parameter value is defined according to motor nominal voltage and the current and the actual stator resistance as

$$RsVoltageDrop = 2560 \frac{I_n}{U_n} R_s .$$

***662*** ***Measured voltage drop*** *(2.6.5.18)*

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.

***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*** *(2.6.5.23)*
***669*** ***IV Offset*** *(2.6.5.24)*
***670*** ***IW Offset*** *(2.6.5.25)*

Offsets value for phase current measurement.

***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 (P ID728) is set as reference
**4** = Fault, stop mode after fault according to ID506
**5** = Fault, stop mode after fault always by coasting
A warning or a fault action and message is generated if the 4…20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2.

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

**0** = No response
**1** = Warning
**2** = Fault, stop mode after fault according to ID506
**3** = Fault, stop mode after fault always by coasting
A warning or a fault action and message is generated from the external fault signal in the programmable digital inputs DIN3. The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

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

**0** = No response
**1** = Warning
**2** = Fault, stop mode after fault according to ID506
**3** = Fault, stop mode after fault always by coasting
Output phase supervision of the motor ensures that the motor phases have an approximately equal current.

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

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

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

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

If tripping is selected the drive will stop and activate the fault stage.
Deactivating the protection, i.e. setting parameter to **0**, will reset the thermal stage of the motor to 0%. See chapter 6.3.

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

The factor can be set between -100.0%—100.0%. See chapter 6.3.

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

The current can be set between 0—150.0% x $I_{nMotor}$. This parameter sets the value for thermal current at zero frequency. See Figure 5-18.

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, P 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 6.3.

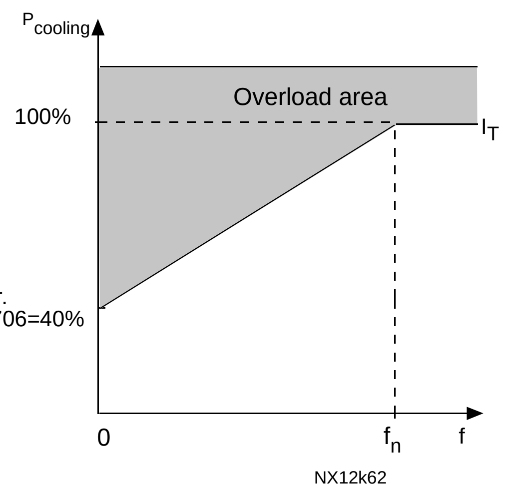



*Figure 5-18. Motor thermal current $I_T$ curve*

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

This time can be set between 1 and 200 minutes.

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

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

If the motor's t6–time (t6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set basing on it. As a rule of thumb, the motor thermal time constant in minutes equals to 2xt6. If the drive is in stop stage the time constant is internally increased to three times the set parameter value. The cooling in the stop stage is based on convection and the time constant is increased. See also Figure 5-19.

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

Defines how much of the nominal motor load is applied.
The value can be set to 0%…100%. See chapter 6.3.

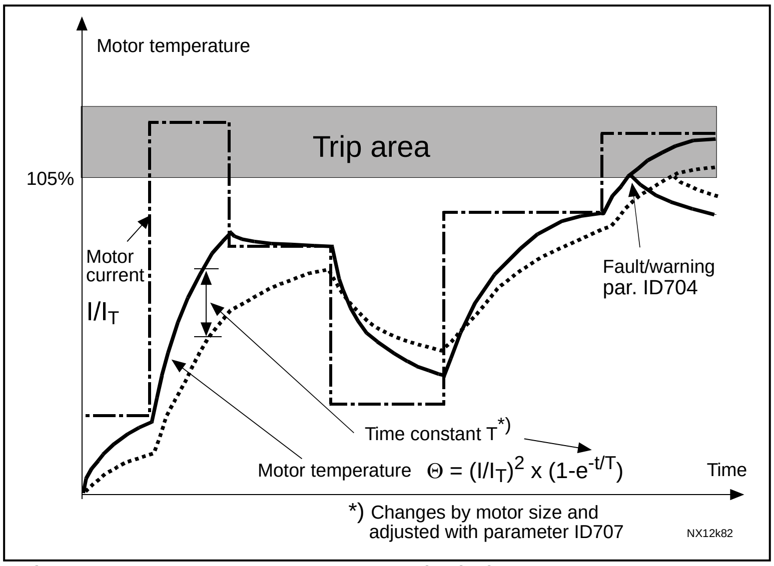



*Figure 5-19. Motor temperature calculation*

**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 6.4.

**710** ***Stall current limit*** *(2.7.14)*

The current can be set to 0.1…$I_{nMotor}$*2. For a stall stage to occur, the current must have exceeded this limit. See Figure 5-20. The software does not allow entering a greater value than $I_{nMotor}$*2. If parameter ID113 *Nominal current of motor* is changed, this parameter is automatically restored to the default value ($I_L$). See chapter 6.4.

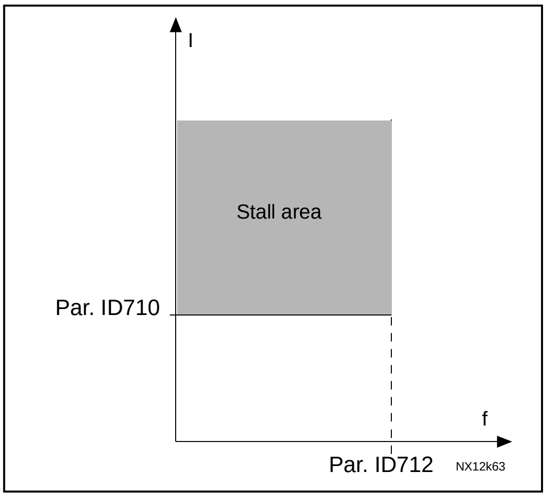



*Figure 5-20. Stall characteristics settings*

### *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 6.4.

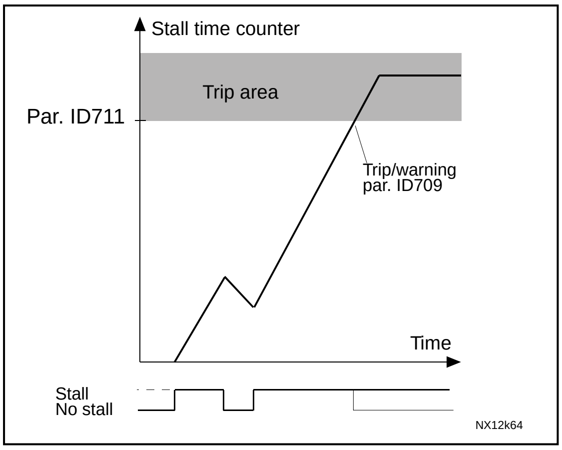



*Figure 5-21. Stall time count*

### *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 6.4.

### *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 6.5.

### *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 5-22.

If you change parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 6.5.

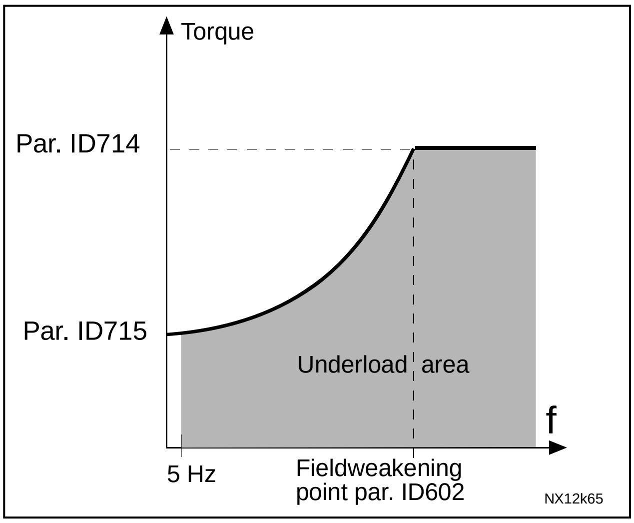



*Figure 5-22. Setting of minimum load*

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

The torque limit can be set between 5.0—150.0 % x TnMotor.
This parameter gives value for the minimum torque allowed with zero frequency. See Figure 5-22.

If you change the value of parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 6.5.

### 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 5-23 and chapter 6.5.

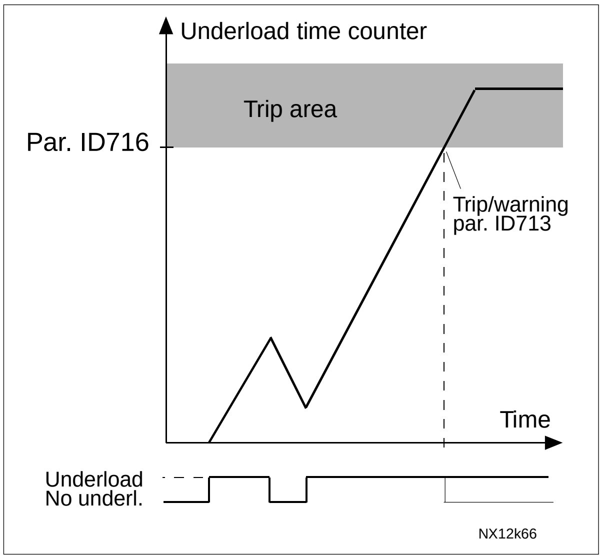



*Figure 5-23. Underload time counter function*

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

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

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

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

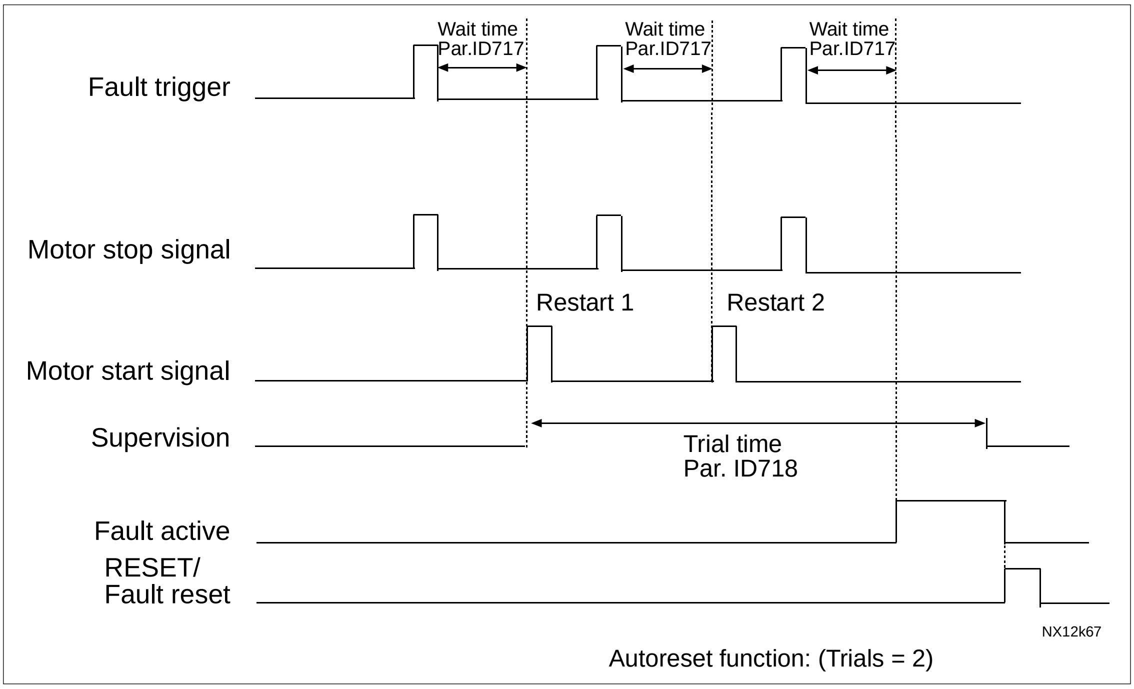



*Figure 5-24. Example of Automatic restarts with two restarts*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

***723*** ***Automatic restart: Number of tries after 4mA reference trip*** *(2.8.7)*

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

**0** = No automatic restart after 4mA 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 the product's 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.

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

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

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

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

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

See parameter ID732.

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

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

See parameter ID732.

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

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

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

***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
**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 F56*** *(2.7.25)*

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

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

Set here the limit at which the PT100 warning (W56) will be activated.

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

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

***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 5-6. See also chapter 6.6.

**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 6.6.
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 5-7.*

***1355 to 1369 Flux 10…150%***

Motor voltage corresponding to 10%….150%c of flux as a percentage of Nominal Flux voltage. Measured during identification.

***1500 Long ramp times***

By setting parameter P.2.1.16, Long Ramps, to YES, is it possible to set the acceleration and deceleration -times between 1-30 000s (8h 20min) with one-second resolution.
If No is selected (default) is the max acceleration/deceleration time 0,1-3000s.

***1502 Licence***

By entering a license code to parameter P2.9.14 is it possible to run up to 7200Hz.
This code is different for every drive and has to be purchased from Vacon. When ordering the drive with this feature, the code will be calculated before delivery. If the user wants to activate the feature afterwards, he has to inform Vacon about the serial number of the power unit(s) for the drive(s) where the feature is wanted.

***1503 Max Voltage Index***

This parameter can be used to limit the drive operating point not to exceed the linear modulation range in which case the over modulation range is not allowed. 100% is the limit for the linear modulation. Six-step modulation requires the set value
minimum of 113%

***1504 Torque Stabilizer Damping Coefficient***

The function of the torque stabilizer is to damp the speed oscillations, which occur especially at light loads, by damping the torque oscillations. This parameter defines the damping coefficient for the torque stabilizer. In general, the higher the inertia of the system with respect the motor torque, the lower the oscillations are in frequency and the closer the value should be 1000. The torque stabilizer affects directly the output frequency of the drive.

***1505 Torque Stabilizer Gain At Aero Frequency***

This parameter defines the additional gain of the torque stabilizer at the zero frequency
The actual gain at zero frequency is (P2.9.2 + P2.9.3)
The higher the gain, the stronger effect the stabilizer has at zero frequency. Too high gain may result in problems with stability.

***1506 Torque Stabilizer Gain in FWP***

This parameter defines the gain of the torque stabilizer at the field weakening point frequency. The gain changes linearly with the frequency between zero and the field weakening point frequency.

***1507 Flux Stabilizer Gain***

The flux stabilizer is used to damp the oscillations in motor magnetizing current part. This parameter defines the gain of the flux stabilizer. The flux stabilizer works like the torque stabilizer but affects directly the output voltage instead of the frequency. The higher the gain the stronger effect the stabilizer has. Too high gain may result in problems with stability.

### 1508 *Voltage Stabilizer Damping Coefficient*

Voltage stabilizer acts like the torque stabilizer preventing the speed from oscillating at light loads. The voltage stabilizer prevents speed oscillations by damping especially the DC-link voltage oscillations. The damping coefficient affects like the damping coefficient in a torque stabilizer. The voltage stabilizer affects also directly the output frequency of the drive.

### 1509 *Voltage Stabilizer Gain*

This parameter defines the voltage stabilizer gain at the light load. The gain is internally reduced when the torque increases. The higher the gain the stronger effect the stabilizer has. Too high gain may result in problems with stability.
The actual gain is zero if the motor torque is higher than 50% of motor nominal torque.

### 1510 *Voltage Stabilizer Limit*

This parameter sets the limit for the voltage stabilizer output frequency.

### 1511 *Advanced Options 1*

By changing the value of this WORD -type variable is it possible to activate different bits of the Advanced Options1 variable.

| Sel. | Advanced options 1 |
|---|---|
| B0 | Disable synchronous modulation |
| B1 | Use encoder speed for slip compensation |
| B2 | Disable encoder supervision |
| B3 | Disable slip compensation for reverse direction |
| B4 | Increase output frequency range up to 3900Hz |
| B5 | Increment |

### 1512 *Synchronous / Asynchronous Modulation*

In a synchronous modulation mode the ratio of the switching frequency and the drive output frequency i.e. the pulse number is an integer.

### 1513 *Symmetrical / Asymmetrical Modulation*

In a synchronous modulation mode it is also possible to use the symmetrical modulation. In this case, the ratio of the switching frequency and the drive output frequency i.e. the pulse number is restricted to certain values so that the motor voltages are more symmetrical and balanced. The actual switching frequency depends on the drive frequency and may change in steps and drop much below the switching frequency set value. Hence, there may be problems with motors having a sinus-filter, if too low switching frequency set value is used.

### 1514 *Low Speed Option*

This parameter has to be connected off (= value -1) when running over 100-150Hz otherwise may the motor operation go unstable. When running the motor under this frequency, the value can be changed between 2000 and 3000.
In drives with internal optical communication link (Fr9 -> or Ch61 ->) it is recommended to use 3000 and with other units value 2000
Both ID1514 and ID1515 have to be switched off when not in use.

### *1515 Low Speed Option HW*

Hardware based Low Speed Option, 0 = enabled, 1 = disabled
The intention is to improve operation in low frequencies (<100Hz)
The parameter is only usable with Fr10 and bigger, and CH61 and bigger.
*Both ID1514 and ID1515 have to be switched off when not in use.*

### *1516 Advanced Options 2*

By changing the value of this WORD -type variable is it possible to activate different bits of the Advanced Options 2 variable.

| Sel. | Advanced options 2 |
|---|---|
| B0 | Sensor less control = 1 |
| B1 | 1 = Master controlled Id-control in sync. master/follower. applications<br>0 = independent Id-control in master and followers |
| B2 | Reserved |
| B3 | Reserved |
| B4 | PM motor; 1 = enable start-positioning damping |
| B5 | Enable |

### *1517 Advanced Options 4*

By changing the value of this WORD -type variable is it possible to activate different bits of the Advanced Options 4 variable.

| Sel. | Advanced options 4 |
|---|---|
| B0 | 1 = activate roll-back prevention control |
| B1 | 1= do PMSM start angle ID only once after power up |
| B2 | 1 = enable sin/cos interpolation (for sin/cos encoder testing) |
| B3 | 1 = enable dc-compensation (fast OL) |

### *1518 Modulator Type*

| Sel. | Advanced options 4 |
|---|---|
| 0 | Default PWM |
| 1 | Space Vector PWM |

## 5.1 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 the product’s User's Manual.

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

***123*** ***Keypad Direction*** *(3.3)*

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

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

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

***R3.2*** ***Keypad Reference*** *(3.2)*

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

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

# 6. APPENDICES

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

- *Closed Loop parameters (Chapter 6.1)*
- *Advanced Open Loop parameters (Chapter 6.2)*
- *Parameters of Motor thermal protection (Chapter 6.3)*
- *Parameters of Stall protection (Chapter 6.4)*
- *Parameters of Underload protection (Chapter 6.5)*
- *Fieldbus control parameters (Chapter 6.6)*

## 6.1 Closed loop parameters (ID's 612 to 621)

**Note:** It is not possible to run >320Hz in Close Loop.

Select the Closed loop control mode by setting value **3** or **4** for parameter ID600.
Closed loop control mode (see page 37) is used when enhanced performance near zero speed and better static speed accuracy with higher speeds are needed. Closed loop control mode is based on "rotor flux oriented current vector control". With this controlling principle, the phase currents are divided into a torque producing current portion and a magnetizing current portion. Thus, the squirrel cage induction machine can be controlled in a fashion of a separately excited DC motor.

**Note:** These parameters can be used with Vacon NXP drive only.

**EXAMPLE:**

Motor Control Mode = 3 (Closed loop speed control)

This is the usual operation mode when fast response times, high accuracy or controlled run at zero frequencies are needed. Encoder board should be connected to slot C of the control unit. Set the encoder P/R-parameter (P7.3.1.1). Run in open loop and check the encoder speed and direction (V7.3.2.2). Change the direction parameter (P7.3.1.2) or switch the phases of motor cables if necessary. Do not run if encoder speed is wrong. Program the no-load current to parameter ID612 and set parameter ID619 (Slip Adjust) to get the voltage slightly above the linear U/f-curve with the motor frequency at about 66% of the nominal motor frequency. The Motor Nominal Speed parameter (ID112) is critical. The Current Limit parameter (ID107) controls the available torque linearly in relative to motor nominal current.

## 6.2 Advanced Open Loop parameters (ID's 622 to 625, 632, 635)

Select the Advanced Open Loop control mode by setting value **5** or **6** for parameter ID600.
The Advanced Open Loop control mode finds similar implementations as the Closed Loop control mode above. However, the control accuracy of the Closed Loop control mode is higher than that of the Advanced Open Loop control mode.

**EXAMPLE:**

Motor Control Mode = 5 Frequency control (Advanced open loop) and 6 Speed control (Advanced open loop)

The motor is running at current vector control at low frequencies. At frequencies above the frequency limit, the motor is in frequency control. The default current value is 120% at zero frequency. Use linear U/f-curve (ID108). 120% starting torque should now be possible. Sometimes increasing the frequency limit (ID635) will improve the run. The Frequency limit is the critical point. Increase the zero frequency point to get enough current at frequency limit.

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

*General*

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

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

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

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

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

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

*General*

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of motor thermal protection. The stall state is defined with two parameters, ID710 (Stall current) and ID712 (Stall frequency limit). If the current is higher than the set limit and 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.

## 6.5 Parameters of Underload protection (ID's 713 to 716):

*General*

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.
Motor underload protection can be adjusted by setting the underload curve with parameters ID714 (Field weakening area load) and ID715 (Zero frequency load), see below. The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5Hz (the underload time counter is stopped).

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

## 6.6 Fieldbus control parameters (ID's 850 to 859)

The Fieldbus control parameters are used when the frequency or the speed reference comes from the fieldbus (Modbus, Profibus, DeviceNet etc.). With the Fieldbus Data Out Selection 1…8 you can monitor values from the fieldbus.

## 7. 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:<br>– sudden heavy load increase<br>– short circuit in motor cables<br>– unsuitable motor<br>Subcode in **T.14:**<br>S1 = Hardware trip<br>S2 = reserved<br>S3 = Current controller supervision | - Check loading.<br>- Check motor.<br>- Check cables.<br>- Make Identification run |
| **2** | Overvoltage | The DC-link voltage has exceeded the drive limit. See User manual.<br>- Too short a deceleration time<br>- high overvoltage spikes in supply<br>Subcode in **T.14:**<br>S1 = Hardware trip<br>S2 = Overvoltage control supervision | - Make the deceleration time longer.<br>- Use brake chopper or brake resistor (available as options)<br>- Activate over voltage controller.<br>- Check input voltage |
| **3** | Earth fault | Current measurement has detected that the sum of motor phase current is not zero.<br>– 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.<br>– faulty operation<br>– component failure | - Reset the fault and restart.<br>- 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:<br>– defective component<br>– brake resistor short-circuit or overload | - Cannot be reset from the keypad.<br>- Switch off power.<br>- DO NOT RE-CONNECT POWER!<br>- Contact your local distributor.<br>- If this fault appears simultaneously with Fault 1, check motor cables and motor |
| **8** | System fault | - component failure<br>- faulty operation<br>Note exceptional fault data record<br>Subcode in **T.14:**<br>S1 = Reserved<br>S2 = Reserved<br>S3 = Reserved<br>S4 = Reserved<br>S5 = Reserved<br>S6 = Reserved<br>S7 = Charging switch<br>S8 = No power to driver card<br>S9 = Power unit communication (TX)<br>S10 = Power unit communication (Trip)<br>S11 = Power unit comm. (Measurement) | Reset the fault and restart.<br>Should the fault re-occur, contact your local distributor. |

| Fault code | Fault | Possible cause | Correcting measures |
|---|---|---|---|
| 9 | Undervoltage | DC-link voltage is under the drive fault voltage limit. See user manual.<br>– most probable cause: too low a supply voltage<br>– frequency converter internal fault<br>– One of input fuse is broken.<br>– External charge switch have not been closed.<br><br>Subcode in **T.14:**<br>S1 = DC-link too low during run<br>S2 = No data from power unit<br>S3 = Undervoltage control supervision | - In case of temporary supply voltage break, reset the fault and restart the frequency converter.<br>- Check the supply voltage.<br>- If it is adequate, an internal failure has occurred.<br>- Check input fuses<br>- Check DC charge function<br>- Contact your local distributor. |
| 10 | Input line supervision | Input line phase is missing.<br><br>Subcode in **T.14:**<br>S1 = Phase supervision diode supply<br>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<br>– brake resistor is broken<br>– brake chopper failure | - Check brake resistor and cabling.<br>- 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.<br>- Check the heatsink for dust.<br>- Check the ambient temperature.<br>- 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.<br>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.<br>Subcode in **T.14:**<br>S1 = Current unbalance<br>S2 = DC-Voltage unbalance | Should the fault re-occur, contact your local distributor. |
| 22 | EEPROM checksum fault | Parameter save fault<br>– faulty operation<br>– 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<br>– component failure | Reset the fault and restart.<br>Should the fault re-occur, contact your local distributor. |
| 26 | Start-up prevented | - Start-up of the drive has been prevented. | - Cancel prevention of start-up if this can be done safely. |

| Fault code | Fault | Possible cause | Correcting measures |
|---|---|---|---|
| | | - Run request is ON when new application is loaded to drive | - Remove Run Request. |
| **29** | Thermistor fault | The thermistor input of option board has detected too high a motor temperature | Check motor cooling and loading<br>Check thermistor connection<br>(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.<br>- Check motor size.<br>- 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.<br>New device of same type and rating. | Reset. Device is ready for use.<br>Old parameter settings will be used. |
| **38** | Device added (same type) | Option board added. | Reset. Device is ready for use.<br>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.<br>Subcode in **T.14:**<br>S1 = Unknown device<br>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.<br>- Check motor size.<br>- Make Identification run |
| **43** | Encoder fault | Problem detected in encoder signals.<br>Sub code in **T.14:**<br>1 =Encoder 1 channel A is missing<br>2 =Encoder 1 channel B is missing<br>3 =Both encoder 1 channels are missing<br>4 =Encoder reversed<br>5 =Encoder board missing | - Check encoder channel connections.<br>- Check the encoder board.<br>- Check encoder frequency in open loop |
| **44** | Device changed (different type) | Option board or power unit changed.<br>New device of different type or different rating than the previous one. | Reset<br>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<br>Set the option board parameters again. |
| **49** | Div by zero in application | A division by zero has occurred in the application program. | Contact your distributor if fault accrues while frequency converter is in run state. If you are application programmer check the application program. |
| **50** | Analogue input $I_{in}$ < 4mA (sel. signal range 4 to 20 mA) | Current at the analogue input is < 4mA.<br>– signal source has failed<br>– 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 | The connection between the control | Check keypad connection and possible |

| Fault code | Fault | Possible cause | Correcting measures |
|---|---|---|---|
| | communication fault | keypad or NCDrive and the frequency converter is broken. | keypad cable. |
| **53** | Fieldbus fault | The data connection between the fieldbus Master and the fieldbus board is broken | Check installation.<br>If installation is correct contact the nearest Vacon distributor. |
| **54** | Slot fault | Defective option board or slot | Check board and slot.<br>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<br>- Motor is not connected to frequency converter.<br>- 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<br>- 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. |
| **72** | Trial Time | Application is used without licence key.<br>You have given too high frequency value as maximum frequency. | Contact Vacon factory to get licence key.<br>Use application below 1700 Hz |

*Table 7-1. Fault codes*

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