VACON
NX FREQUENCY CONVERTERS

# Lift Application

# USER'S MANUAL

ASFIFF08

# Vacon Standard Lift Application (Software ASFIFF08)

## INDEX

# Standard Lift Application

## 1. Introduction

Select the Lift Application in menu M6 on page *S6.2*.

The Lift Application can be used with modern Lift systems. There are functions included that are required to achieve a smooth ride in the lift car. The I/O interface table includes the most commonly needed signals in lift applications.

In the application, constant speeds are presented in [m/s] and also in [Hz], acceleration and deceleration are presented in [m/s$^2$] and jerks are presented in [ms].

Mechanical brake control logic is designed to achieve smooth departures from and landings to floor level. The brake can be set in various ways to meet the different requirements of lift motors and lift control logic.

The used hardware can be any Vacon NXS or NXP frequency converter. In closed loop motor control mode NXP drive and encoder option board is required (NXOPTA4 or NXOPTA5).

All outputs are freely programmable. Digital input functions are freely programmable to any digital input. Start forward and reverse signals are fixed to input DIN1 and DIN2 (see next page).

## 2. Programming principle of the Input signals in the Lift application

The programming principle of the input signal in the Lift Application as well as in the Multipurpose Control Application (and partly in the other applications) is different compared to the conventional method used in other Vacon NX applications.

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

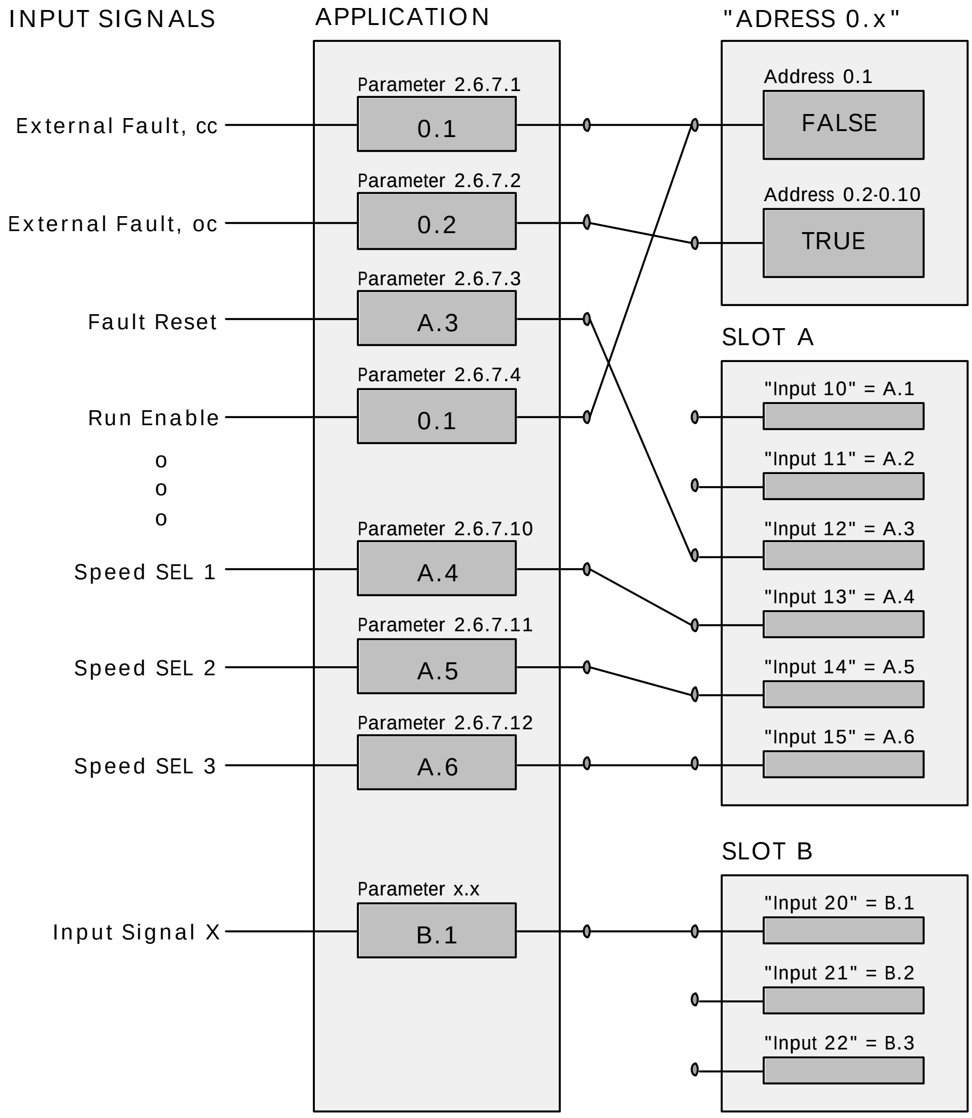


*Figure 1. Basic principle of the Terminal to Function Programming method (TTF).*

| | |
|---|---|
| *Note:* | *Constant value can be given to input signal. Value 0.1 is a constant FALSE and values from 0.2 through 0.10 are constant TRUE (see Figure 1).* |

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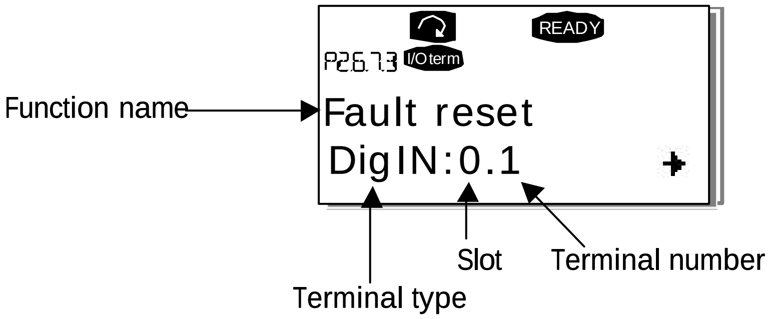
## 2.1 Defining an input for a certain function on keypad

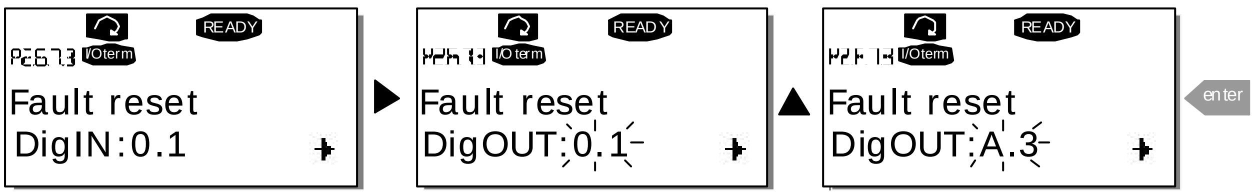
Connecting a certain function (input signal) to a certain digital input is done by giving the parameter an appropriate value. The value is formed of the *Board slot* on the Vacon NX control board (see Vacon NX User's Manual, Chapter 6.2) and the *respective signal number*, see below.




Example: You want to connect the digital input function *Fault Reset* (parameter 2.6.7.3) to a digital input A.3 on the basic board NXOPTA1, located in Slot A.

First find the parameter 2.6.7.3 on the keypad. Press the *Menu button right* once to enter the edit mode. On the *value line*, you will see the terminal type on the left (DigIN) and on the right, digital input where function is connected.

When the value is blinking, hold down the *Browser button up* or *down* to find the desired board slot and signal number. The program will scroll the board slots starting from 0 and proceeding from A to E and the I/O numbers from 1 to 10.
Once you have set the desired value, press the *Enter button* once to confirm the change.



## 2.2 Defining a terminal for a certain function with NCDrive programming tool

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

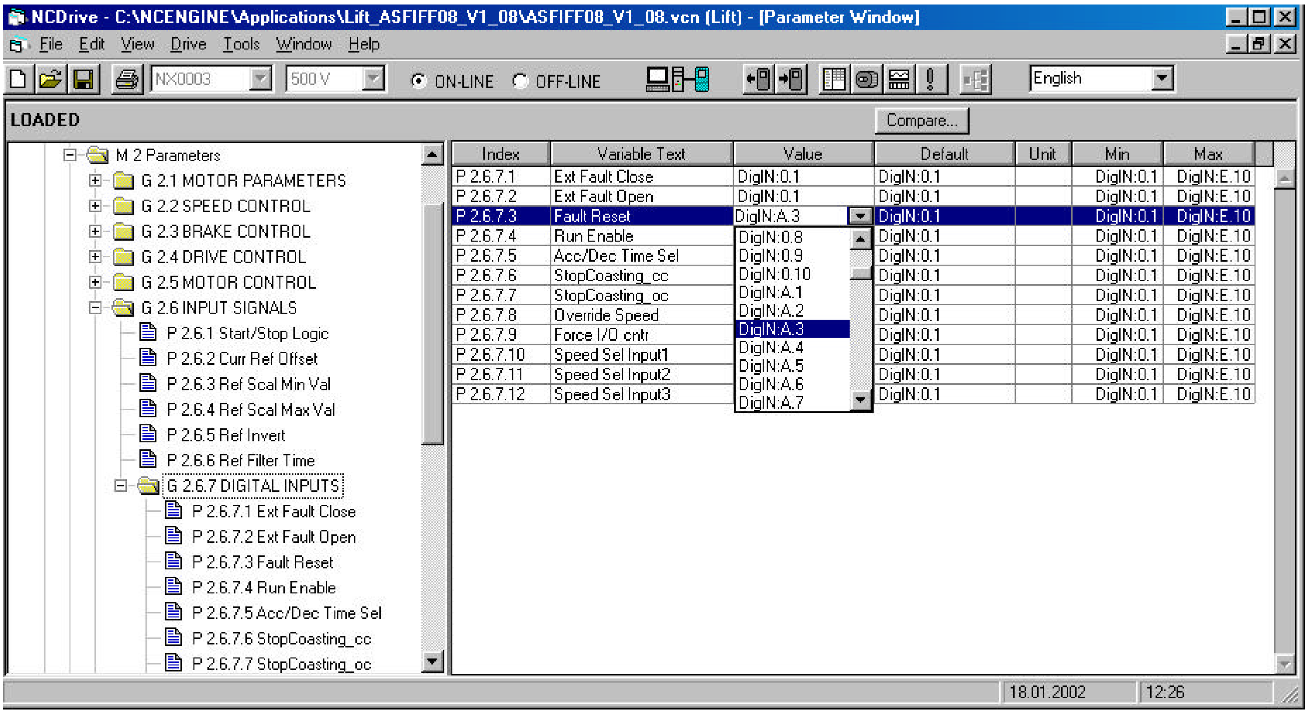
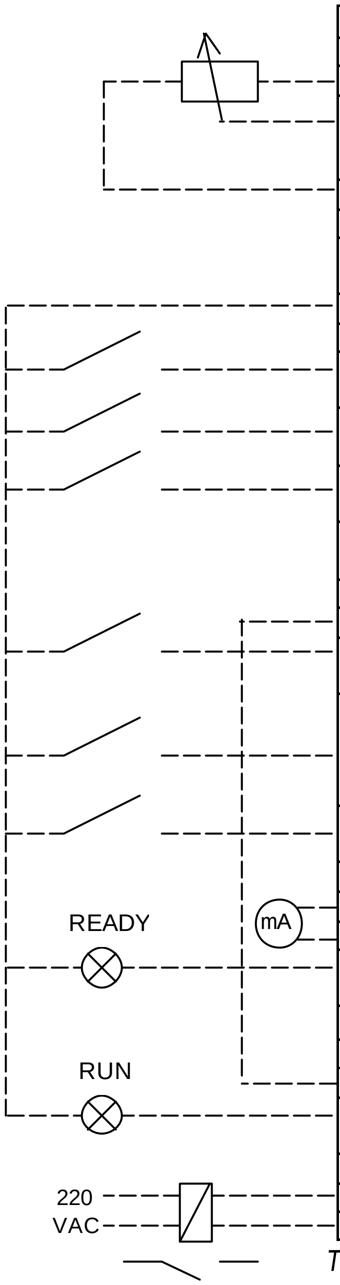


*Figure 2. Screenshot of NCDrive programming tool; Entering the address code*

> *Note: Two input signals can be connected to same digital input. However, use this feature very considerably.*

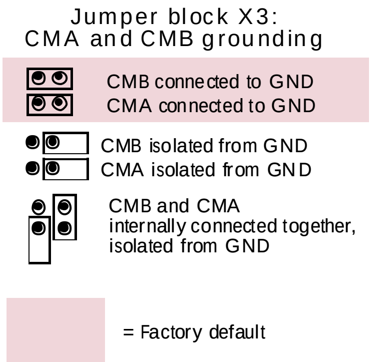
# 3. Control I/O




| 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 | Fault Reset (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 | Speed reference selection | Programmable speed reference for Inputs DIN4, DIN5, and DIN6: |
| 15 | DIN5 | Speed reference selection | Activity reference<br>Activity reference with direction<br>Binary Reference |
| 16 | DIN6 | Speed reference selection | |
| 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 FAULT | 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 Mechanical Brake | Programmable |
| 25 | RO2 | | |
| 26 | RO2 | | |

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

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



# 4. Lift 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 20 to 62.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own setting
ID = ID number of the parameter (used with PC tools)
(grey) = Apply the *Terminal to Function* method (TTF) to these parameters. See Chapter 2.
(cyan) = 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 Vacon NX User's Manual, Chapter 7 for more information.

| Code | Parameter | Unit | ID | Description |
|---|---|---|---|---|
| V1.1 | Output frequency | Hz | 1 | Output frequency to motor |
| V1.2 | Frequency reference | Hz | 25 | Frequency reference to motor control |
| V1.3 | Motor speed | rpm | 2 | Motor speed in rpm |
| V1.4 | Motor current | A | 3 | |
| V1.5 | Motor torque | % | 4 | In % of the nominal motor 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 | Voltage input | V | 13 | AI1 |
| V1.11 | Current input | mA | 14 | AI2 |
| V1.12 | DIN1, DIN2, DIN3 | | 15 | Digital input statuses |
| V1.13 | DIN4, DIN5, DIN6 | | 16 | Digital input statuses |
| V1.14 | DO1, RO1, RO2 | | 17 | Digital and relay output statuses |
| V1.15 | Analogue $I_{out}$ | mA | 26 | AO1 |
| V1.16 | Lift Speed | m/s | 1630 | Lift speed in m/s |
| V1.17 | Encoder Speed | rpm | 1631 | |
| V1.18 | UnFiltered Motor Torq | % | 1632 | |
| V1.19 | Speed ctrl out | % | 1633 | Torque reference from speed controller output |
| V1.20 | Ramp Down Distance | m | 1634 | Distance when decelerated from any speed to levelling speed (or zero speed). Value visualizes the effect of different parameters to stopping distance. |
| G1.21 | Multimonitor | | | Three different value can be monitored at the same time |

*Table 2. Monitoring values*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.1.1 | Nominal voltage of the motor | 180 | 690 | V | NX2: 230V<br>NX5: 400V<br>NX6: 690V | | 110 | |
| 2.1.2 | Nominal frequency of the motor | 30,00 | 320,00 | Hz | 50,00 | | 111 | Check the rating plate of the motor |
| P2.1.3 | Nominal speed of the motor | 300 | 20 000 | rpm | 1440 | | 112 | The default applies for a 4-pole motor and a nominal size frequency converter. |
| P2.1.4 | Nominal current of the motor | 1 x $I_L$ | 2,5 x $I_L$ | A | $I_L$ | | 113 | Check the rating plate of the motor |
| P2.1.5 | Motor cosφ | 0,30 | 1,00 | | 0,85 | | 120 | Check the rating plate of the motor |
| P2.1.6 | Current limit | 0,1 x $I_L$ | 2,5 x $I_L$ | A | 1,5 x $I_L$ | | 107 | NOTE: This applies for frequency converters up to FR7. For greater sizes, consult the factory. |

*Table 3. Basic parameters G2.1*

## 4.3 Speed Control Parameters (Control keypad: Menu M2 → G2.2)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.2.1 | Nominal Linear Speed | 0,20 | 5,00 | m/s | 1,00 | | 1500 | |
| P2.2.2 | Speed Reference Selection | 0 | 6 | s | 0 | | 117 | 0=Activity Reference<br>1=Activ ref. with direction<br>2=Binary reference<br>3=AI1 (Voltage input)<br>4=AI2 (Current input)<br>5=Fieldbus<br>6=Keypad |
| P2.2.3.x | Speed Reference [m/s] | | | | | | | |
| P2.2.3.1 | Levelling Speed | 0,00 | par2.2.1 | m/s | 0,10 | | 1501 | Parameters correspond to parameters in group 2.2.4. They will be updated automatically if parameters are changed.<br>These parametres are also updated when P2.2.1 is changed. |
| P2.2.3.2 | Full Speed | 0,00 | par2.2.1 | m/s | 1,00 | | 1502 | |
| P2.2.3.3 | Limited Speed | 0,00 | par2.2.1 | m/s | 0,25 | | 1503 | |
| P2.2.3.4 | Inspection Speed | 0,00 | 1,5xP2.2.1 | m/s | 0,50 | | 1504 | |
| P2.2.3.5 | Speed Reference 4 | 0,00 | par2.2.1 | m/s | 0,10 | | 1505 | |
| P2.2.3.6 | Speed Reference 5 | 0,00 | par2.2.1 | m/s | 1,00 | | 1506 | |
| P2.2.3.7 | Speed Reference 6 | 0,00 | par2.2.1 | m/s | 0,25 | | 1507 | |
| P2.2.3.8 | Speed Reference 7 | 0,00 | par2.2.1 | m/s | 0,50 | | 1508 | |
| P2.2.3.9 | Override speed | 0,00 | 1,5xP2.2.1 | m/s | 0,50 | | 1613 | |
| P2.2.4.x | Speed Reference [Hz] | | | | | | | |
| P2.2.4.1 | Levelling Speed | 0,00 | par2.1.2 | Hz | 5,00 | | 1604 | Parameters correspond to parameters in group 2.2.3. They will be updated automatically if parameters are changed. |
| P2.2.4.2 | Full Speed | 0,00 | par2.1.2 | Hz | 50,00 | | 1605 | |
| P2.2.4.3 | Limited Speed | 0,00 | par2.1.2 | Hz | 12,50 | | 1606 | |
| P2.2.4.4 | Inspection Speed | 0,00 | 1,5xP2.1.2 | Hz | 25,00 | | 1607 | |
| P2.2.4.5 | Speed Reference 4 | 0,00 | par2.1.2 | Hz | 5,00 | | 1608 | |
| P2.2.4.6 | Speed Reference 5 | 0,00 | par2.1.2 | Hz | 50,00 | | 1609 | |
| P2.2.4.7 | Speed Reference 6 | 0,00 | par2.1.2 | Hz | 12,50 | | 1610 | |
| P2.2.4.8 | Speed Reference 7 | 0,00 | par2.1.2 | Hz | 25,00 | | 1611 | |
| P2.2.4.9 | Override speed | 0,00 | 1,5xP2.1.2 | Hz | 5,00 | | 1612 | |

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.2.5.x | SPEED CURVE 1 | | | | | | | |
| P2.2.5.1 | Acceleration | 0,20 | 2,00 | m/s2 | 0,70 | | 103 | |
| P2.2.5.2 | Deceleration | 0,20 | 2,00 | m/s2 | 0,70 | | 104 | |
| P2.2.5.3 | Acceleration increase jerk 1 | 0,01 | 1,00 | s | 0,50 | | 1540 | |
| P2.2.5.4 | Acceleration Decrease jerk 1 | 0,01 | 1,00 | s | 0,25 | | 1541 | |
| P2.2.5.5 | Deceleration increase jerk 1 | 0,01 | 1,00 | s | 0,25 | | 1542 | |
| P2.2.5.6 | Deceleration decrease jerk 1 | 0,01 | 1,00 | s | 0,50 | | 1543 | |
| P2.2.6.x | SPEED CURVE 2 | | | | | | | |
| P2.2.6.1 | Internal Ramp Switch | 0 | par2.1.2 | Hz | 0 | | 1544 | |
| P2.2.6.2 | Acceleration 2 | 0,20 | 2,00 | m/s2 | 0,20 | | 502 | |
| P2.2.6.3 | Deceleration 2 | 0,20 | 2,00 | m/s2 | 0,20 | | 503 | |
| P2.2.6.4 | Acceleration increase jerk 2 | 0,01 | 1,00 | s | 0,50 | | 1545 | |
| P2.2.6.5 | Acceleration decrease jerk 2 | 0,01 | 1,00 | s | 0,50 | | 1546 | |
| P2.2.6.6 | Deceleration increase jerk2 | 0,01 | 1,00 | s | 0,50 | | 1547 | |
| P2.2.6.7 | Deceleration decrease jerk 2 | 0,01 | 1,00 | s | 0,50 | | 1548 | |
| P2.2.7 | Enable jerks | 0 | 1 | | 1 | | 1549 | |
| P2.2.8 | Reference hold time | 0,00 | 5,00 | s | 0,00 | | 1509 | |
| P2.2.9 | Stop State (DIN456) | 0 | 1 | | 0 | | 1614 | 0=Normal operation<br>1=Stop if DIN456 are OFF |

*Table 4. Speed control parameters G2.1*

## 4.4 Mechanical Brake control parameters (Control keypad: Menu M2 → G2.3)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.3.1.x | OPEN LOOP PARAMETERS | | | | | | | |
| P2.3.1.1 | Current limit | 0 | 1,5 x In | A | 0,2 x In | | 1551 | Value is changed when parameter 2.1.4 is set. |
| P2.3.1.2 | Torque limit | 0 | 100,0 | % | 30,0 | | 1552 | |
| P2.3.1.3 | Frequency limit | 0 | 10,00 | Hz | 1,00 | | 1553 | |
| P2.3.1.4 | Brake open delay | 0 | 1,00 | s | 0,10 | | 1554 | |
| P2.3.1.5 | Freq. limit close | 0 | 20,00 | Hz | 1,00 | | 1555 | |
| P2.3.1.6 | Brake close delay | 0 | 5,00 | s | 0,00 | | 1556 | |
| P2.3.1.7 | Max. Freq. brake closed | 0 | 10,00 | Hz | 4,00 | | 1557 | |
| P2.3.1.8 | Mechanical brake reaction time | 0 | 1,00 | s | 0,05 | | 1558 | |
| P2.3.1.9 | DC braking current | 0,15 x $I_n$ | 1,5 x $I_n$ | A | Varies | | 507 | |
| P2.3.1.10 | DC braking time at start | 0,00 | 60,00 | s | 0,500 | | 1559 | 0=DC brake is off at start |
| P2.3.1.11 | DC braking time at stop | 0,00 | 60,00 | s | 1,000 | | 1560 | 0=DC brake is off at stop |
| P2.3.1.12 | Frequency to start DC braking during ramp stop | 0,10 | 10,00 | Hz | 0,50 | | 515 | |
| P2.3.1.13 | Delayed Brake | 0,00 | 30,00 | s | 0,00 | | 1640 | |
| P2.3.1.14 | Run Request Closing | 0 | 1 | | 1 | | 1641 | 0= Inactive<br>1= Active |
| P2.3.2.x | CLOSED LOOP PARAMETERS | | | | | | | |
| P2.3.2.1 | Current limit | 0 | 1,5 x In | A | 0,2 x In | | 1561 | Value is changed when parameter 2.1.4 is set. |
| P2.3.2.2 | Torque limit | 0 | 100,0 | % | 0 | | 1562 | |
| P2.3.2.3 | Frequency limit | 0 | 10,00 | Hz | 0,01 | | 1563 | |
| P2.3.2.4 | Brake open delay | 0 | 1,00 | s | 0,00 | | 1564 | |
| P2.3.2.5 | Freq. limit close | 0 | 20,00 | Hz | 0,01 | | 1565 | |
| P2.3.2.6 | Brake close delay | 0 | 5,00 | s | 0,00 | | 1566 | |
| P2.3.2.7 | Max. Freq. brake closed | 0 | 10,00 | Hz | 0,10 | | 1577 | |
| P2.3.2.8 | 0Hz time at start | 0 | 2,000 | s | 0,400 | | 615 | |
| P2.3.2.9 | 0Hz time at stop | 0 | 2,000 | s | 0,600 | | 616 | |
| P2.3.210 | Smooth start time | 0 | 1,00 | s | 0,10 | | 1568 | |
| P2.3.2.11 | Smooth start freq. | 0 | 5,00 | Hz | 0,02 | | 1569 | |
| P2.3.2.12 | Delayed Brake | 0,00 | 30,00 | s | 0,00 | | 1640 | |
| P2.3.2.13 | Run Request Closing | 0 | 1 | | 1 | | 1641 | 0= Inactive<br>1= Active |
| P2.3.3.x | DIGITAL INPUTS | | | | | | | |
| P2.3.3.1 | Ext. brake control | | | | 0.2 | | 1601 | See page 4. |
| P2.3.3.2 | Ext. brake supervision | | | | 0.2 | | 1602 | |
| P2.3.4.x | BRAKE SUPERVISION | | | | | | | |
| P2.3.4.1 | External brake supervision time | 0,00 | 5,00 | s | 1,00 | | 1603 | |

*Table 5. Mechanical brake control parameters, G2.4*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.4.1 | Brake chopper | 0 | 3 | | 1 | | 504 | 0=Disabled<br>1=Used when running<br>2=Ext. brake chopper<br>3=Used when stopped/running |
| P2.4.2 | Stop function | 0 | 1 | | 2 | | 506 | 0=Coasting<br>1=Ramping<br>2=Stop by Freq. limit |
| P2.4.3 | Frequency limit | 0 | MaxFreq | Hz | 5,00 | | 1624 | Used only if par 4.2=2 |
| P2.4.4 | Stop distance | 0 | 1,5 | m | 0,0 | | 1539 | 0=Not used |
| P2.4.5 | Deceleration increase/ decrease time | 0 | 1,00 | s | 0,15 | | 1626 | S-curve (jerk) time which is active only when Stop by distance is active |
| P2.4.6 | Scaling factor | 0 | 200 | % | 70 | | 1625 | Scaling factor for ramp time |

*Table 6. Drive control parameters, G2.5*

## 4.6 Motor control parameters (Control keypad: Menu M2 → G2.5)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.5.1 | Motor control mode | 0 | 1 | | 1 | | 1572 | 0=Frequency control<br>1=Speed control, (OL)<br>2=Speed control, (CL) |
| P2.5.2 | U/f optimisation | 0 | 1 | | 1 | | 1573 | 0=Not used<br>1=Automatic torque boost |
| P2.5.3 | U/f ratio selection | 0 | 3 | | 0 | | 1574 | 0=Linear<br>1=Squared<br>2=Programmable<br>3=Linear with flux optim. |
| P2.5.4 | Field weakening point | 30,00 | 320,00 | Hz | 50,00 | | 602 | |
| P2.5.5 | Voltage at field weakening point | 10,00 | 200,00 | % | 100,00 | | 603 | n% x $U_{nmot}$<br>Parameter max. value = par. 2.6.7 |
| P2.5.6 | U/f curve midpoint frequency | 0,00 | P2.6.4 | Hz | 5,00 | | 1575 | |
| P2.5.7 | U/f curve midpoint voltage | 0,00 | 100,00 | % | 10,00 | | 1576 | n% x $U_{nmot}$ |
| P2.5.8 | Output voltage at zero frequency | 0,00 | 40,00 | % | 1,30 | | 1577 | n% x $U_{nmot}$ |
| P2.5.9 | Switching frequency | 1,0 | 16,0 | kHz | Varies | | 601 | Depends on kW |
| P2.5.10 | Overvoltage controller | 0 | 1 | | 1 | | 607 | 0=Not used<br>1=Used |
| P2.5.11 | Undervoltage controller | 0 | 1 | | 1 | | 608 | 0=Not used<br>1=Used |
| P2.5.12 | Identification | 0 | 1 | | 0 | | 631 | Motor Identification in (OL), Motor Standstill |
| P2.5.13 | Measured Rs Volt Drop | 0 | 10000 | | | | 662 | |
| P2.5.14 | IrAddGenScale | 0 | 200 | % | 0 | | 665 | |
| P2.5.15 | IrAddMotorScale | 0 | 200 | % | 100 | | 667 | |
| P2.5.16 | FreqCompensationMUL | -10,00 | 10,00 | | 0 | | 1645 | Frequency Compensation for “High Slip Motors” |

*Table 7. Motor control parameters, G2.6*

## 4.7 Input signals (Control keypad: Menu M2 → G2.6)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.6.1 | Start/Stop logic | 0 | 6 | | 0 | | 300 | DIN1 / DIN2<br>0: Start fwdP / Start rvsP<br>1: Start/Stop / Rvs/Fwd<br>2: Start fwd / Start rev |
| P2.6.2 | Current reference offset | 0 | 1 | | 1 | | 302 | 0=No offset<br>1=4—20 mA |
| P2.6.3 | Reference scaling minimum value | 0,00 | par. 2.2.5 | Hz | 0,00 | | 303 | Selects the frequency that corresponds to the min. reference signal<br>0,00 = No scaling |
| P2.6.4 | Reference scaling maximum value | 0,00 | 320,00 | Hz | 0,00 | | 304 | Selects the frequency that corresponds to the min. reference signal<br>0,00 = No scaling |
| P2.6.5 | Reference inversion | 0 | 1 | | 0 | | 305 | 0=Not inverted<br>1=Inverted |
| P2.6.6 | Reference filter time | 0,00 | 10,00 | s | 0,10 | | 306 | 0=No filtering |
| P2.6.7.x | DIGITAL INPUTS | | | | | | | |
| P2.6.7.1 | External Fault, closing contact | | | | 0.1 | | 1513 | See page 4. |
| P2.6.7.2 | External fault, opening contact | | | | 0.2 | | 1514 | |
| P2.6.7.3 | Fault reset | | | | A.3 | | 1515 | |
| P2.6.7.4 | Run enable | | | | 0.2 | | 1516 | |
| P2.6.7.5 | Acceleration/Decel time selection | | | | 0.1 | | 1517 | |
| P2.6.7.6 | Stop by coast, closing contact | | | | 0.1 | | 1518 | |
| P2.6.7.7 | Stop by coast, opening contact | | | | 0.2 | | 1519 | |
| P2.6.7.8 | Override speed | | | | 0.1 | | 1520 | |
| P2.6.7.9 | Forced I/O control | | | | 0.1 | | 1521 | |
| P2.6.7.10 | Speed selection input 1 | | | | A.4 | | 1521 | |
| P2.6.7.11 | Speed selection input 2 | | | | A.5 | | 1522 | |
| P2.6.7.12 | Speed selection input 3 | | | | A.6 | | 1523 | |

*Table 8. Input signals, G2.2*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.7.1 | 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=Output 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) |
| P2.7.2 | Analogue output filter time | 0,00 | 10,00 | s | 1,00 | | 308 | |
| P2.7.3 | Analogue output inversion | 0 | 1 | | 0 | | 309 | 0=Not inverted<br>1=Inverted |
| P2.7.4 | Analogue output minimum | 0 | 1 | | 0 | | 310 | 0=0 mA<br>1=4 mA |
| P2.7.5 | Anal. output scale | 10 | 1000 | % | 100 | | 311 | |
| P2.7.6 | Digital output 1 function | 0 | 20 | | 3 | | 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<br>11=At speed<br>12=Mot. regulator active<br>13=OP freq. limit superv.<br>14=Control place: IO<br>15=ThermalFlt/Wrn<br>16=FB DigInput1<br>17=Speed below limit<br>18=Torque above limit<br>19=Mech. brake ctrl<br>20=Mech. brake ctrl inv. |
| P2.7.7 | Digital output function 1 | 0 | 1 | | 0 | | 1530 | 0=No inversion<br>1=Inverted |
| P2.7.8 | Digital output 1 delay | 0 | 10,00 | s | 0,00 | | 1531 | Delay content of DO1.<br>0,00= Delay not in used |
| P2.7.9 | Digital output 1 OFF Delay | 0 | 10,00 | S | 0,00 | | 1657 | Delay content of DO1.<br>0,00= Delay not in used |
| P2.7.10 | Relay output 1 function | 0 | 14 | | 2 | | 313 | As parameter 2.7.6 |
| P2.7.11 | Relay output 1 function inverted | 0 | 1 | | 0 | | 1532 | 0=No inversion<br>1=Inverted |
| P2.7.12 | Relay output 1 delay | 0 | 10,00 | s | 0,00 | | 1533 | Delay content of RO1.<br>0,00= Delay not in used |
| P2.7.13 | Relay output 1 OFF Delay | 0 | 10,00 | S | 0,00 | | 1658 | Delay content of RO1.<br>0,00= Delay not in used |

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.7.14 | Relay output 2 function | 0 | 14 | | 19 | | 314 | As parameter 2.7.6 |
| P2.7.15 | Relay output 2 function inverted | 0 | 1 | | 0 | | 1534 | 0=No inversion<br>1=Inverted |
| P2.7.16 | Speed supervision limit | 0 | P2.2.1 | m/s | 0,15m/s | | 1535 | |
| P2.7.17 | Motoring torque supervision | 0 | 200.0 | % | 150.0 | | 1536 | |
| P2.7.18 | Generating torque supervision | 0 | -200.0 | % | 0 | | 1537 | If set to 0 then P2.7.15 defines the limits for motoring and generating modes |
| P2.7.19 | Output frequency limit 1 supervision | 0 | 2 | | 0 | | 315 | 0=No limit<br>1=Low limit supervision<br>2=High limit supervision |
| P2.7.20 | Output frequency limit 1; Supervised value | 0,00 | 320,00 | Hz | 0,00 | | 316 | |

*Table 9. Output signals, G2.7*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.8.1.x | I/O FAULTS | | | | | | | |
| P2.8.1.1 | Response to reference fault | 0 | 5 | | 0 | | 700 | 0=No response<br>1=Warning<br>2=Warning+Old Freq.<br>3=Wrng+PresetFreq 2.8.1.2<br>4=Fault,stop acc. To 2.4.2<br>5=Fault,stop by coasting |
| P2.8.1.2 | Reference fault frequency | 0,00 | Par. 2.1.2 | Hz | 0,00 | | 728 | |
| P2.8.1.3 | Response to ext. fault | 0 | 3 | | 2 | | 701 | 0=No response<br>1=Warning<br>2=Fault,stop acc. To 2.4.2<br>3=Fault,stop by coasting |
| P2.8.2.x | GENERAL FAULTS | | | | | | | |
| P2.8.2.1 | Input phase supervision | 0 | 3 | | 0 | | 730 | |
| P2.8.2.2 | Response to undervoltage fault | 1 | 3 | | 2 | | 727 | |
| P2.8.2.3 | Output phase supervision | 0 | 3 | | 2 | | 702 | |
| P2.8.2.4 | Earth fault protection | 0 | 3 | | 2 | | 703 | |
| P2.8.2.5 | Response to fb. Fault | 0 | 3 | | 2 | | 733 | |
| P2.8.2.6 | Response to slot fault | 0 | | | 2 | | 734 | |
| P2.8.3.x | MOTOR FAULTS | | | | | | | |
| P2.8.3.1 | Thermal protection of the motor | 0 | 3 | | 2 | | 704 | |
| P2.8.3.2 | Motor ambient temperature factor | –100,0 | 100,0 | % | 0,0 | | 705 | |
| P2.8.3.3 | Motor cooling factor at zero speed | 0,0 | 150,0 | % | 40,0 | | 706 | |
| P2.8.3.4 | Motor thermal time constant | 1 | 200 | min | 45 | | 707 | |
| P2.8.3.5 | Motor duty cycle | 0 | 100 | % | 100 | | 708 | |
| P2.8.3.6 | Stall protection | 0 | 3 | | 0 | | 709 | 0=No response<br>1=Warning<br>2=Fault,stop acc. To 2.4.2<br>3=Fault,stop by coasting |
| P2.8.3.7 | Stall current | 0,1 | 6000,0 | A | 1,0 | | 710 | |
| P2.8.3.8 | Stall time limit | 1,00 | 120,00 | s | 15,00 | | 711 | |
| P2.8.3.9 | Stall frequency limit | 1,0 | Par. 2.1.2 | Hz | 25,0 | | 712 | |
| P2.8.3.10 | Response to thermistor fault | 0 | 3 | | 0 | | 732 | 0=No response<br>1=Warning<br>2=Fault,stop acc. To 2.4.2<br>3=Fault,stop by coasting |
| P2.8.4.x | LIFT SUPERVISION | | | | | | | |
| P2.8.4.1 | Mechanical brake control fault | 0 | 2 | | 0 | | 1580 | 0=No action<br>1=Warning<br>2=Fault |
| P2.8.4.2 | Shaft speed fault | 0 | 2 | | 0 | | 1581 | 0=No action<br>1=Warning<br>2=Fault |
| P2.8.4.3 | Shaft speed supervision time | 0 | 1,00 | s | 0,40 | | 1582 | |

| P2.8.4.4.x | SHAFT SPEED SUPERV. LIMIT | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P2.8.4.4.1 | Shaft speed superv. Limit[m/s] | 0 | P2.2.1 | m/s | 0,30 | | 1583 | Same parameters with different units |
| P2.8.4.4.2 | Shaft speed superv. Limit [Hz] | 0 | P2.1.2 | Hz | 15,00 | | 1584 | |
| P2.8.4.5 | Overtorque protection | 0 | 2 | | 0 | | 1585 | 0=No action<br>1=Warning<br>2=Fault |
| P2.8.4.6 | Torque superv. Time | 0 | 1,00 | s | 0,00 | | 1586 | |
| P2.8.4.7 | Response to control conflict | 0 | 2 | | 2 | | 1587 | 0=No action<br>1=Warning<br>2=Fault |
| P2.8.4.8 | Min. current limit | 0 | P1.1.4 | A | 0,00 | | 1588 | 0=No action |
| P2.8.4.9 | 0 Hz speed response | 0 | 3 | | 0 | | 1589 | 0=Not used<br>1=Warning<br>2=Warning+Stop<br>3=Fault |

*Table 10. Protections, G2.8*

## 4.10 Autorestart parameters (Control keypad: Menu M2 → G2.9)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.9.1 | Wait time | 0,10 | 10,00 | s | 0,50 | | 717 | |
| P2.9.2 | Trial time | 0,00 | 60,00 | s | 30,00 | | 718 | |
| P2.9.3 | Start function | 0 | 2 | | 0 | | 719 | 0=Ramp<br>1=Not used |
| P2.9.4 | Number of tries after undervoltage trip | 0 | 10 | | 0 | | 720 | |
| P2.9.5 | Number of tries after overvoltage trip | 0 | 10 | | 0 | | 721 | |
| P2.9.6 | Number of tries after overcurrent trip | 0 | 3 | | 0 | | 722 | |
| P2.9.7 | Number of tries after reference trip | 0 | 10 | | 0 | | 723 | |
| P2.9.8 | Number of tries after motor temperature fault trip | 0 | 10 | | 0 | | 726 | |
| P2.9.9 | Number of tries after external fault trip | 0 | 10 | | 0 | | 725 | |
| P2.9.10 | Number of tries after input phase supervision trip | 0 | 10 | | 0 | | 165<br>9 | |

*Table 11. Autorestart parameters, G2.9*

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.10.1 | Evacuation mode | 0 | 2 | 2 | 0 | | 1590 | 0=Not used<br>1=Manual<br>2=Automatic |
| P2.10.2 | Evacuation input | | | | 0.1 | | 1591 | See also page 4. |
| P2.10.3 | Control mode | 0 | 3 | | 1 | | 1592 | 0=Frequency control<br>1=Speed control |
| P2.10.4 | Direction change delay | 0 | 20,00 | s | 5,00 | | 1593 | |
| P2.10.5 | Test time | 0 | 20,00 | s | 3,00 | | 1594 | |
| P2.10.6 | Current read delay | 0 | 20,00 | s | 1,50 | | 1595 | |
| P2.10.7 | U/f optimisation | 0 | 1 | | 0 | | 1596 | 0=Not used<br>1=Automatic torque boost |
| P2.10.8 | U/f-curve mid point frequency | 0,00 | par. P2.6.4 | Hz | 5,00 | | 1597 | |
| P2.10.9 | U/f-curve mid point voltage | 0,00 | 100,00 | % | 10,00 | | 1598 | |
| P2.10.10 | Output voltage at zero frequency | 0,00 | 40,00 | % | 1,30 | | 1599 | |
| P2.10.11.x | MAX SPEED IN EVACUATION | | | | | | | |
| P2.10.11.1 | Max speed in evacuation [m/s] | 0 | 0.4 x P2.2.1 | m/s | 0,10 | | 1616 | Same parameters with different units. Max value is 40% of nom. Value. |
| P2.10.11.2 | Max speed in evacuation [Hz] | 0 | 0.4 x P2.1.2 | Hz | 5,00 | | 1617 | |

*Table 12. Evacuation parameters, G2.10*

## 4.12 Closed loop parameters (Control keypad: Menu M2 → G2.11)

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P2.11.1 | Magnetisation current | 0 | In | A | 0 | | 612 | |
| P2.11.2 | Speed control limit | 0 | Par. 2.11.3 | | 5,00 | | 1618 | |
| P2.11.3 | Speed control limit | Par. 2.11.2 | 0.01Hz | | 10,00 | | 1619 | |
| P2.11.4 | Speed control Kp 1 | 0 | 1000 | | 30 | | 1620 | |
| P2.11.5 | Speed control Kp 2 | 0 | 1000 | | 30 | | 1621 | |
| P2.11.6 | Speed control Ti | 0 | 500 | ms | 30,0 | | 1622 | |
| P2.11.7 | Speed control Ti | 0 | 500 | ms | 30,0 | | 1623 | |
| P2.11.8 | Current control Kp | 0 | 100 | | 40 | | 617 | |
| P2.11.9 | Encoder 1 filter time | 0 | 100.0 | ms | 0.0 | | 618 | |
| P2.11.10 | Slip adjust | 0 | 1000 | % | 100 | | 619 | |
| P2.11.11 | Start Up torque | 0 | 1 | | 0 | | 621 | |

*Table 13. Closed loop parameters, G2.11*

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

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

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Note |
|---|---|---|---|---|---|---|---|---|
| P3.1 | Control place | 1 | 3 | | 1 | | 125 | 0=I/O terminal<br>1=Keypad<br>2=Fieldbus |
| R3.2 | Keypad reference | Par. 2.1.1 | Par. 2.1.2 | Hz | | | | |
| P3.3 | Direction (on keypad) | 0 | 1 | | 0 | | 123 | 0=Forward<br>1=Reverse |
| R3.4 | Stop button | 0 | 1 | | 1 | | 114 | 0=Limited function of Stop button<br>1=Stop button always enabled |

*Table 14. Keypad control parameters, M3*

## 4.14 System menu (Control keypad: M6)

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

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

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

# 5. Description of parameters

## 5.1 BASIC PARAMETERS

### *2.1.1 Nominal voltage of the motor*

Find this value $U_n$ on the rating plate of the motor. This parameter sets the voltage at the field weakening point (parameter 2.5.5) to 100% x $U_{nmotor}$.

### *2.1.2 Nominal frequency of the motor*

Find this value $f_n$ on the rating plate of the motor. This parameter sets the field weakening point (parameter 2.5.4) to the same value.

Nominal frequency of the motor correspond the nominal lift speed (parameter 2.2.1)

### *2.1.3 Nominal speed of the motor*

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

### *2.1.4 Nominal current of the motor*

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

### *2.1.5 Motor cos phi*

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

### *2.1.6 Current limit*

This parameter determines the maximum motor current from the frequency converter. To avoid motor overload, set this parameter according to the rated current of the motor. The current limit is 1.5 times the rated current ($I_L$) by default.

## 5.2 SPEED CONTROL

### *2.2.1 Nominal Linear Speed*

Nominal linear speed corresponds to the lift speed at nominal frequency of the motor (parameter 2.1.2)
Speed parameters in group 2.2.3 are entered in linear magnitudes and parameters in group 2.2.4 are entered in Hz. There is an internal scaling between linear speeds and frequencies. Parameters in both groups correspond to each other. If the value of the nominal linear speed is changed the parameters in group 2.2.3 are recalculated accordingly.

### *2.2.2 Speed reference selection*

Defines which frequency reference source is selected when controlled from the I/O control place. Default value is 0.
0 = Activity coding
1 = Activity coding with direction
2 = Binary coding
3 = Voltage Input (AI1)
4 = Current Input (AI2)
5 = Fieldbus
6 = Keypad

Speed reference can be determined in three different ways with digital inputs. Digital inputs are programmable (see page 4).
The first column contains the state of the digital inputs (marked as default values DIN4, DIN5 and DIN6). The correct input signal can be programmed with parameters 2.6.7.10, 2.6.7.11 and 2.6.7.12.

The second column contains the parameter and the next column the corresponding speed reference. The priority column defines which speed is activated if more than one digital input is activated. If Speed reference is different when running to different direction the direction is defined in direction column.

0 = Activity coding

Four different constant speeds can be selected.

| DIN [4,5,6] | Parameters | SpeedRef | Priority | Direction |
|---|---|---|---|---|
| [0;0;0] | 2.2.3.1/2.2.4.1 | (levelling speed) | 0 low | irrelevant |
| [1;0;0] | 2.2.3.2/2.2.4.2 | (full speed) | 1 medium | irrelevant |
| [0;1;0] | 2.2.3.3/2.2.4.3 | (limited speed) | 2 high | irrelevant |
| [0;0;1] | 2.2.3.4/2.2.4.4 | (inspection speed) | 3 highest | irrelevant |

*Table 15. Activity reference.*

1 = Activity coding with direction

The constant speeds are selected according to the state of digital inputs and motor direction. Four different speeds per direction are available.

| DIN [4,5,6] | Parameters | SpeedRef | Priority | Direction |
|---|---|---|---|---|
| [0;0;0] | 2.2.3.1/2.2.4.1 | (levelling speed) | 0 low | forward |
| [1;0;0] | 2.2.3.2/2.2.4.2 | (full speed) | 1 medium | forward |
| [0;1;0] | 2.2.3.3/2.2.4.3 | (limited speed) | 2 high | forward |
| [0;0;1] | 2.2.3.4/2.2.4.4 | (inspection speed) | 3 highest | forward |
| [0;0;0] | 2.2.3.5/2.2.4.5 | (preset speed 4) | 0 low | reverse |
| [1;0;0] | 2.2.3.6/2.2.4.6 | (preset speed 5) | 1 medium | reverse |
| [0;1;0] | 2.2.3.7/2.2.4.7 | (preset speed 6) | 2 high | reverse |
| [0;0;1] | 2.2.3.8/2.2.4.8 | (preset speed 7) | 3 highest | reverse |

*Table 16. Activity reference with direction.*

2 = Binary coding

Eight different constant speeds are selected according to binary word formed through digital inputs.

| DIN [4,5,6] | Parameters | SpeedRef | Priority | Direction |
|---|---|---|---|---|
| [0;0;0] | 2.2.3.1/2.2.4.1 | (levelling speed) | - | irrelevant |
| [1;0;0] | 2.2.3.2/2.2.4.2 | (full speed) | - | irrelevant |
| [0;1;0] | 2.2.3.3/2.2.4.3 | (limited speed) | - | irrelevant |
| [1;1;0] | 2.2.3.4/2.2.4.4 | (inspection speed) | - | irrelevant |
| [0;0;1] | 2.2.3.5/2.2.4.5 | (preset speed 4) | - | irrelevant |
| [1;0;1] | 2.2.3.6/2.2.4.6 | (preset speed 5) | - | irrelevant |
| [0;1;1] | 2.2.3.7/2.2.4.7 | (preset speed 6) | - | irrelevant |
| [1;1;1] | 2.2.3.8/2.2.4.8 | (preset speed 7) | - | irrelevant |

*Table 17. Binary reference.*

### *Speed reference [m/s] parameters (M2 -> G2.2.3)*

Parameters in group 2.2.3 define the speed reference in linear magnitudes [m/s]. Parameters correspond to the parameters of group 2.2.4 and they will be updated automatically if values are changed in the other group. They will also be updated if the value of parameter 2.2.1 is changed.

*2.2.3.1 Levelling Speed*
*2.2.3.2 Full Speed*
*2.2.3.3 Limited Speed*
*2.2.3.4 Inspection Speed*
*2.2.3.5 Speed reference 4*
*2.2.3.6 Speed reference 5*
*2.2.3.7 Speed reference 6*
*2.2.3.8 Speed reference 7*
*2.2.3.9 Override Speed*

### Speed Reference [Hz] parameters (M2 -> G2.2.4)

Parameters in group 2.2.4 define the speed reference in frequency [Hz]. The parameters correspond to the parameters in group 2.2.3 and they will be updated automatically if the values in the other group are changed.

*2.2.4.1 Levelling Speed*
*2.2.4.2 Full Speed*
*2.2.4.3 Limited Speed*
*2.2.4.4 Inspection Speed*
*2.2.4.5 Speed reference 4*
*2.2.4.6 Speed reference 5*
*2.2.4.7 Speed reference 6*
*2.2.4.8 Speed reference 7*
*2.2.4.9 Override Speed*

### Speed Curve 1 parameters (M2 -> G2.2.5)

Speed curve 1 is used as the default values for acceleration and deceleration and jerks.

*2.2.5.1 Acceleration time 1*

*2.2.5.2 Deceleration time 1*

Acceleration and deceleration of the lift car are presented in [m/s2]. Acceleration and deceleration curves are affected by the jerk time settings, too.

*2.2.5.3 Acc inc jerk 1*

Acceleration increase jerk1. Jerk times are presented in [ms].

*2.2.5.4 Acc dec jerk 1*

Acceleration decrease jerk 1.

*2.2.5.5 Dec inc jerk 1*

Deceleration increase jerk 1.

*2.2.5.6 Dec dec jerk 1*

Deceleration decrease jerk 1.

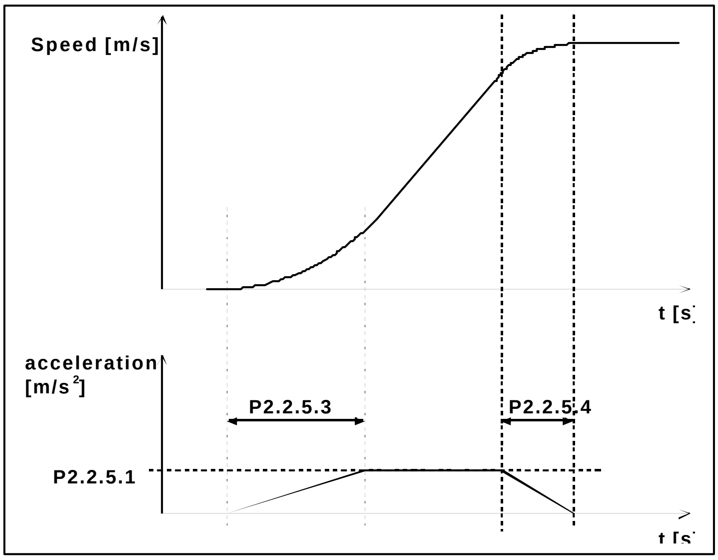



*Figure 3. Jerks related to speed and acceleration*

*Speed Curve 1 parameters (M2 -> G2.2.6)*

Parameters in group Speed curve 2 are used when internal ramp switch function is activated (see parameter P2.2.6.1). Then the Speed curve 1 parameters will be replaced by Speed curve 2 parameters.

*2.2.6.1 Internal Ramp switching frequency*

0 = Not used
The ramp set 2 (Speed Curve2 parameters) can be activated internally. The update is done when the speed is decelerated below the internal ramp switch frequency and the reference frequency is reached.
Ramp set 1 (Speed Curve1 parameters) is changed back when the Run request of the frequency converter is inactivated.

> Note: *If Stop by distance function (parameter 2.4.4) is used the internal ramp switch function is not active.*

*2.2.6.2 Acceleration time 2*
*2.2.6.3 Deceleration time 2*

Acceleration and deceleration of the lift car are presented in [m/s2]. Acceleration and deceleration curves are affected by the jerk time settings, too.

*2.2.6.4 Acc inc jerk 2*

Acceleration increase jerk 2. See Figure 3.

*2.2.6.5 Acc dec jerk 2*

Acceleration decrease jerk 2.

*2.2.6.6 Dec inc jerk 2*

Deceleration increase jerk 2.

*2.2.6.7 Dec dec jerk 2*

Deceleration decrease jerk 2.

*2.2.7 Enable Jerks*

0 = Disabled
1 = Enabled
Acceleration and deceleration rounding with jerks can be disabled by setting this parameter to 0. If set to 0 (Disabled) jerk values have no effect.

### 2.2.8 Reference Hold Time

The parameter defines the time how long the frequency reference is held after start signal. During that time the speed reference is not changed.
This function is also called the 'half floor ride'. The start and stop inputs are not affected by this function.

Reference hold time starts when the frequency is released to nominal value after start. This occurs when the mechanical brake is opened and the brake reaction delay has expired (see page 26).
When reference hold timer has elapsed Acceleration decrease jerk time (parameter 2.2.5.4) and Deceleration increase jerk time (parameter 2.2.5.5) affect the speed curve (see picture below).

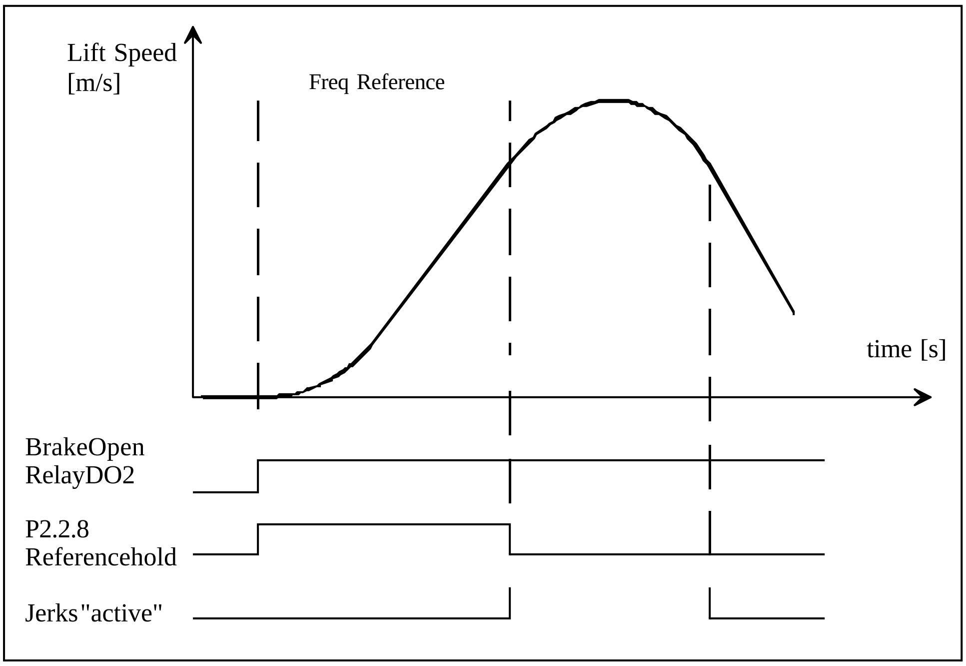



*Figure 4. Reference hold time*

### 2.2.9 Stop State (DIN456)

0 = Normal operation
1 = Stop if DIN456 are OFF

Special stop mode when 1 is selected. Stop state is activated when all speed reference inputs are OFF (Default values are DIN4, DIN5 and DIN6, see parameter 2.2.2).

Note: Even if DIN1 or DIN2 is ON and DIN456 are OFF stop state is activated.
Restart requires that DIN1 and DIN2 are switched OFF.

## 5.3 MECHANICAL BRAKE CONTROL

The mechanical brake control parameters affect the mechanical brake control, the smooth start and stop function and the safety functions.
The mechanical brake can be set to release on current, on torque, on frequency or on external input. The closing can be performed by frequency, by external input or by Run request signal. In case of fault the brake closes immediately without delay.

The mechanical brake control in open loop and in closed loop control mode is different. The parameters are divided in two different groups. The parameters of closed loop control group are not valid in open loop mode and vice versa. There are also some common parameters. Figure 5 and Figure 6 give a graphical presentation of the control logic of the brake control

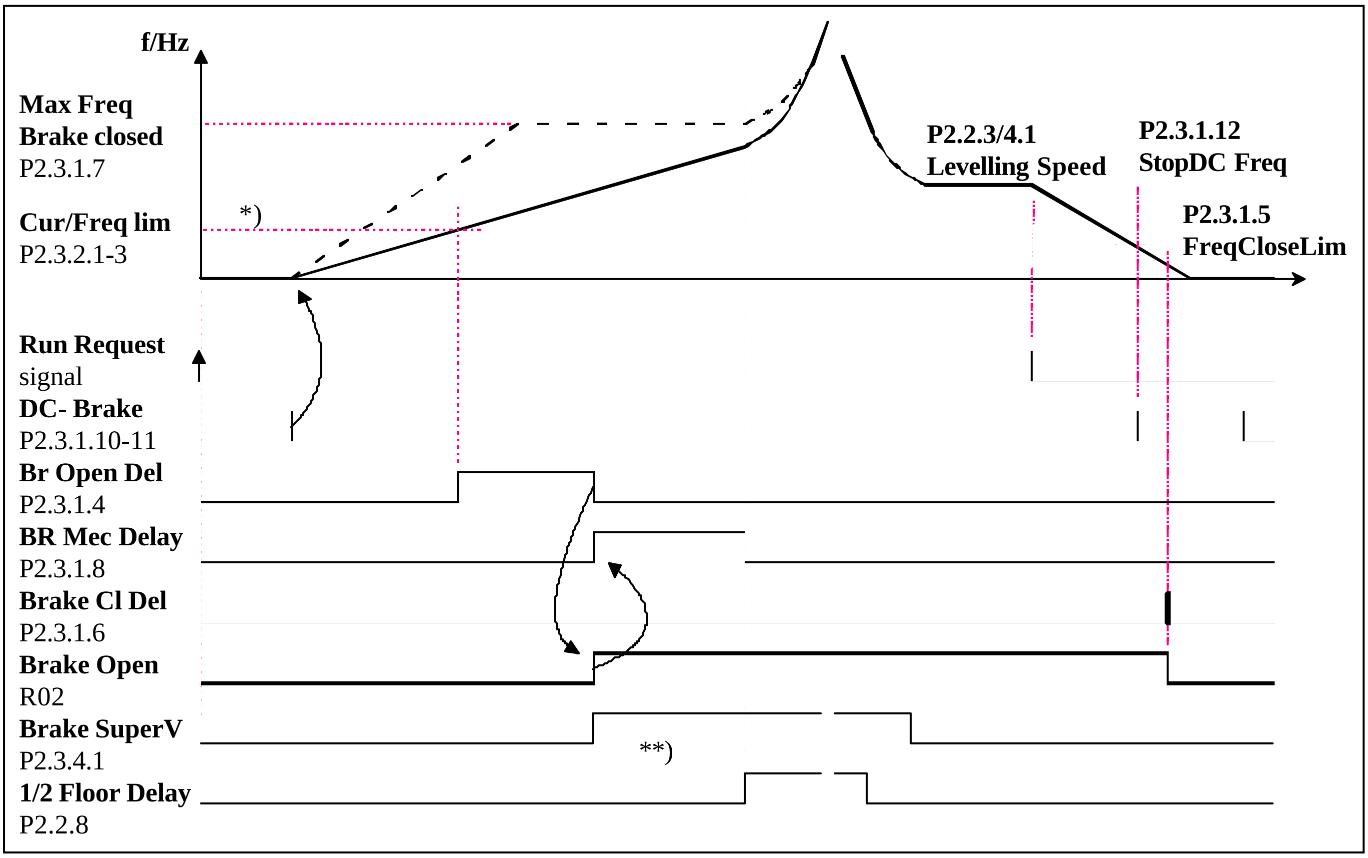



*Figure 5. Mechanical brake control logic in open loop.*
**) Start signal to Brake open delay when current, freq. and torque exceed limits defined by parameters. External input must be ON if used.*
***) During the Brake supervision time the digital input must be switched ON if used.*

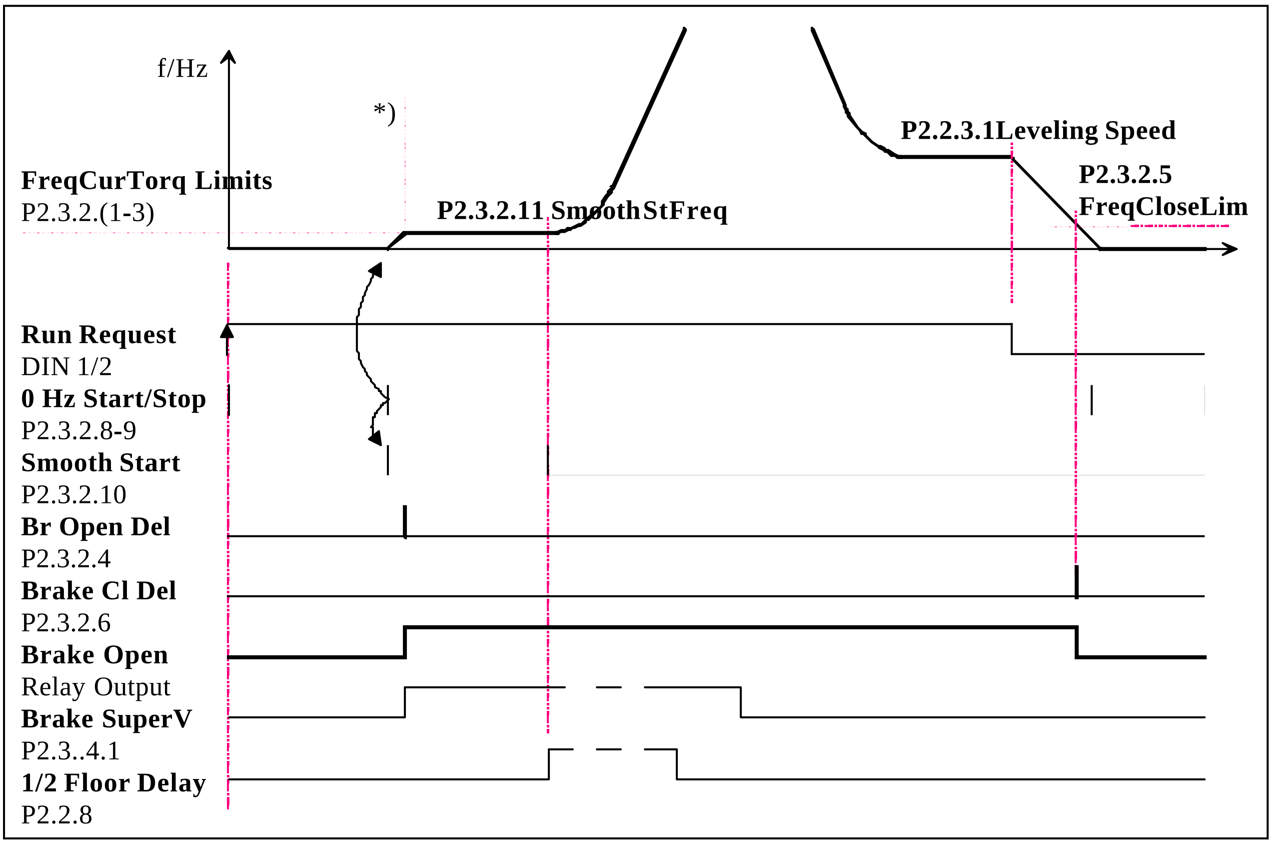



*Figure 6. Mechanical brake control logic in closed loop.*
**) Start signal to Brake open delay when current, freq. and torque exceed limits defined by parameters. External input must be ON if used.*
***) During the Brake supervision time the digital input must be switched ON if used*

## Mechanical Brake Control Logic

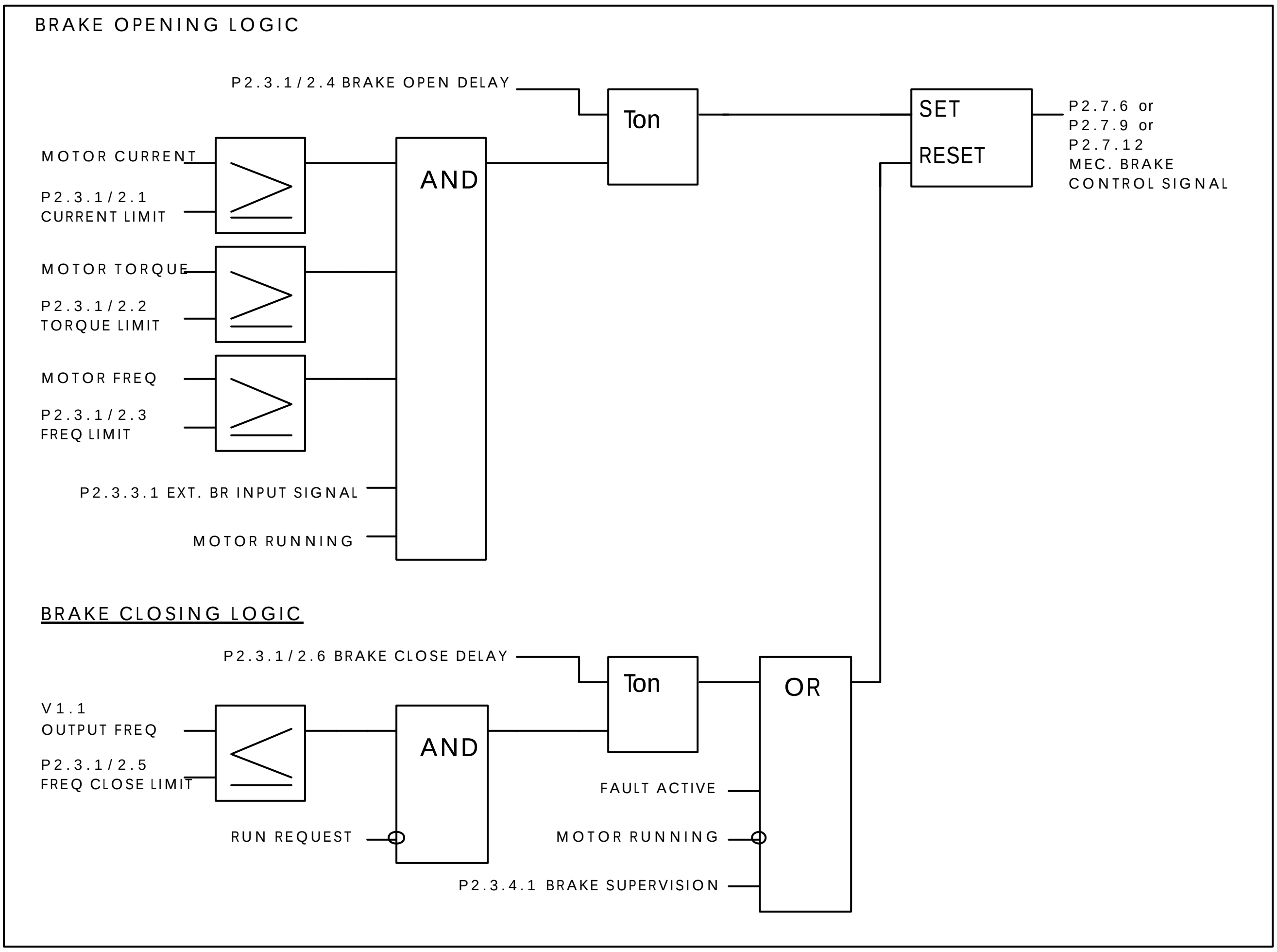



*Figure 7. Mechanical brake control logic in open loop.*

Mechanical brake control signal can be selected to any digital or relay output to control the external mechanical brake.

In the upper section of Figure 7 you can find the mechanical brake opening logic. Five signals and the delay are required for the mechanical brake to open. If current, torque or frequency signal is not needed for brake opening, then these parameters can be set to zero. The external brake input signal is programmable and any digital input can be used for that purpose.

In the lower section of Figure 7 you can find the mechanical brake closing logic. The brake close circuit has higher priority than the open circuit. So if closing signal is active the mechanical brake will be closed.

The brake will be closed immediately in case of fault or an external supervision signal or when the motor is stopped.

In normal operation the brake will be closed when frequency falls below the Frequency close limit (P2.3.1.5 or P2.3.2.5) and the Run Request signal is switched OFF. If the Frequency close limit signal is not needed for the closing logic it can be set to zero. After the conditions are true there is a brake close delay (P2.3.1.6/P2.3.2.6) after which the brake will be closed.

*Open Loop Parameters (M2 -> G2.3.1)*

Parameters in group 2.3.1.x are valid in open loop control mode only.
(parameter 2.5.1= 0 or 1).

### *2.3.1.1 Current Limit*

Parameter defines the actual current limit that has to be exceeded for a brake release. If set to zero this condition is excluded. The value is updated always when the nominal current of the motor (parameter 2.1.4) is set (see Figure 7).

### *2.3.1.2 Torque limit*

Parameter defines the actual torque limit that has to be exceeded for a brake release. If set to zero this condition is excluded.
100 % corresponds to the calculated nominal torque of the motor (see Figure 7).

### *2.3.1.3 Frequency limit*

Parameter defines the actual frequency limit that has to be exceeded for brake release. If set to zero this condition is excluded (see Figure 7).

### *2.3.1.4 Opening delay*

Delay which starts when the opening conditions (see parameters 2.3.1.1-2.3.1.3) are TRUE (see Figure 7).

### *2.3.1.5 Frequency limit closing*

The output frequency limit for the brake closing. The run request signal needs to be disabled to allow the signal to affect.

### *2.3.1.6 Closing delay*

The brake closing is delayed with defined time. If set to zero there is no delay between the brake closing condition and the actual brake closing.

### *2.3.1.7 Maximum frequency brake closed*

Output frequency does not exceed this value when mechanical brake is closed. When modifying this parameter make sure that the brake release by frequency (see parameter 2.3.1.3) is possible with new value.

### *2.3.1.8 Mechanical brake reaction time*

Mechanical brake reaction time will hold the speed reference for a defined time. This hold time should be set according to the mechanical brake reaction time (see Figure 5).

### *2.3.1.9 DC-brake current*

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

### 2.3.1.10 *DC-braking time at start*

DC-brake is activated when the start command is given. This parameter defines the time before the brake is released.

### 2.3.1.11 *DC-braking time at stop*

Determines if braking is ON or OFF and the braking time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, parameter 2.4.2.

| | |
|---|---|
| 0 | DC-brake is not used |
| >0 | DC-brake is in use and its function depends on the Stop function, (par. 2.4.2). The DC-braking time is determined with this parameter |

Par. 2.4.2 = 0; Stop function = Coasting:

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

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

The braking time is scaled according to the frequency when the DC-braking starts. If the frequency is ≥ the nominal frequency of the motor, the set value of parameter 2.3.1.11 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter 2.3.1.11.

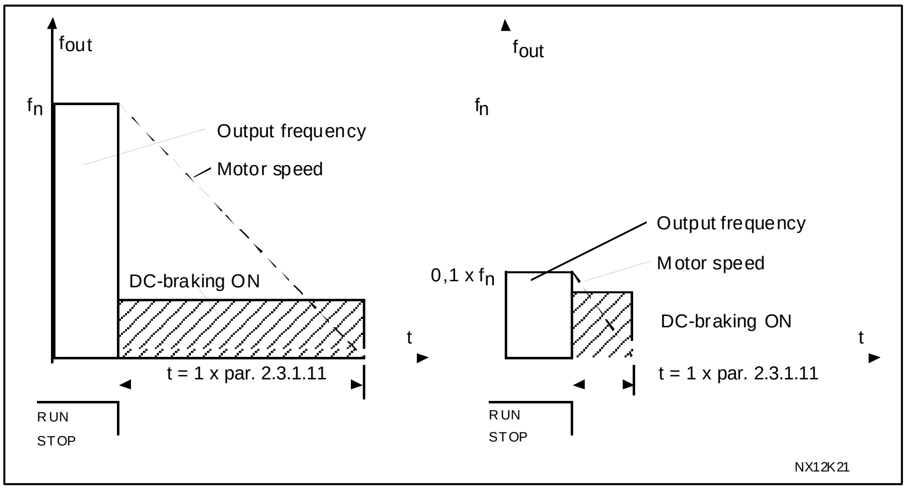



*Figure 8. DC-braking time when Stop mode = Coasting.*

Par. 2.4.2 = 1; Stop function = Ramp

After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with parameter 2.3.1.12, where the DC-braking starts.

The braking time is defined with parameter 2.3.1.11. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See Figure 9.

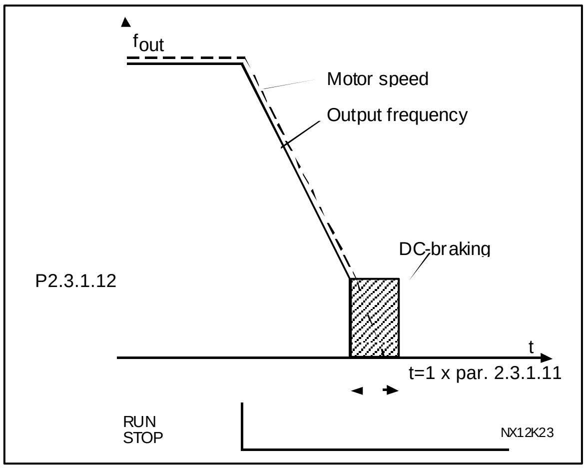



*Figure 9. DC-braking time when Stop mode = Ramp*

Par. 2.4.2 = 2; Stop function = Stop by frequency. limit

Stop mode depends on the actual frequency of the motor. If frequency is above the frequency limit (par. 2.4.3) then the stop mode is coasting (see Figure 8). If frequency is even or below the frequency limit then the stop mode is ramp (see Figure 9).

### *2.3.1.12 DC-braking frequency at stop*

The output frequency which the DC-braking is applied. See Figure 9

### *2.3.1.13 Brake delayd*

O= Function is not active
Brake can be delayed after brake close command.
Can be used e.g. emergency stop situation to get smooth stop.

### *2.3.1.14 Run Request Closing*

O= Inactivated
1= Activated
Run request signal during brake closing can be inactivated by this parameter. In normal operation Brake close command requires Run request signal to go low. If parameter is 0, then brake will be closed when frequency goes below the limit.

NOTE: If 0 is selected then Frequency limit close (P2.3.1.5 or P2.3.2.5) must be less than maximum frequency brake close (P2.3.1.7 or P2.3.2.7). Otherwise brake control logic does not work.

### *Closed Loop Parameters (M2 -> G2.3.2)*

Parameters in group 2.3.2.x are valid in closed loop motor control mode (parameter 2.5.1 =2) only.

### *2.3.2.1 Current Limit*

Parameter defines the actual current limit that has to be exceeded for a brake release. If set to zero this condition is excluded. The value is updated always when the nominal current of the motor (parameter 2.1.4) is set. See Figure 7.

### *2.3.2.2 Torque limit*

Parameter defines the actual torque limit that has to be exceeded for a brake release. If set to zero this condition is excluded.
100 % corresponds to the calculated nominal torque of the motor (See Figure 7).

### *2.3.2.3 Frequency limit*

Parameter defines the actual frequency limit that has to be exceeded for brake release. If set to zero this condition is excluded (See Figure 7).

### *2.3.2.4 Opening delay*

Delay which starts when the opening conditions (see parameters 2.3.2.1-2.3.2.3) are TRUE (See Figure 7).

### *2.3.2.5 Frequency limit closing*

The output frequency limit for the brake closing. The run request signal needs to be disabled to allow the signal to affect.

### *2.3.2.6 Closing delay*

The brake closing is delayed with defined time. If set to zero there is no delay between the brake closing condition and the actual brake closing.

### *2.3.2.7 Maximum frequency brake closed*

Output frequency does not exceed this value when the mechanical brake is closed. When modifying this parameter make sure that the brake release by frequency (parameter 2.3.2.3) is possible with new value.

### *2.3.2.8 Zero Hz time at start*

### *2.3.2.9 Zero Hz time at stop*

Zero hertz time during start and stop. Motor can be magnetised and torque generated during that time. In closed loop mode, this time should be used. Smooth start time (par 2.3.2.10) will commence straight after zero hertz time. The mechanical brake should be set to release when this change takes place (see Figure 6).

### *2.3.2.10 Smooth start time*

The smooth start time function is used in closed loop mode. It cannot be used in open loop. After the start command has been given the drive is rotating the motor shaft with a very low frequency (par 2.3.2.11) to overcome the static friction.

Smooth start time will commence straight after zero hertz time (par 2.3.2.8). The mechanical brake should be set to release when this change takes place. This is achieved through setting the same value for the frequency limit (par 2.3.2.3) and the smooth start frequency (par 2.3.2.11).

When smooth start time has elapsed the frequency will be released.

### *2.3.2.11 Smooth start frequency*

Smooth start frequency is a reference frequency that is used with the smooth start time operation. Value should be set very low.

### *2.3.2.12 Brake delayd*

O= Function is not active
Brake can be delayed after brake close command.
Can be used e.g. emergency stop situation to get smooth stop.

### *2.3.2.13 Run Request Closing*

O= Inactivated
1= Activated
Run request signal during brake closing can be inactivated by this parameter. In normal operation Brake close command requires Run request signal to go low. If parameter is 0, then brake will be closed when frequency goes below the limit.

NOTE: If 0 is selected then Frequency limit close (P2.3.1.5 or P2.3.2.5) must be less than maximum frequency brake close (P2.3.1.7 or P2.3.2.7). Otherwise brake control logic does not work.

### *Digital Inputs (M2 -> G2.3.3)*

All digital inputs (except DIN1 and DIN2) are programmable. See instructions on page 4.

### *2.3.3.1 External brake control*

Programmable digital input for external brake control. If digital input is selected it must be ON before brake can be opened. If input is not used set it to default value (=0.2).

### *2.3.3.2 External brake supervision*

Programmable digital input for external brake supervision. After the mechanical brake is released, the selected input can be used to verify the brake open state. If the input is not used, set it to default value (=0.2).

If the digital input is used it must be activated during the defined time (parameter 2.3.4.1) from the brake release. If it is not activated, external brake fault is generated.

The response to external brake fault can be set with parameter 2.8.4.1.

### *Brake Supervision Parameters (M2 -> G2.3.4)*

#### *2.3.4.1 External brake supervision time*

A time window within which the external brake supervision input (par2.3.3.2) has to be activated after the brake is released.

# 5.4 DRIVE CONTROL

### *2.4.1 Brake chopper*

0 = No brake chopper used
1 = Brake chopper in use when running
2 = External brake chopper
3 = Used when stopped/running

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

### *2.4.2 Stop function*

Coasting:

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

Ramp:

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

Frequency limit

2 Coasting Stop if the motor frequency is above the frequency limit (par. 2.4.3) when stop request is given. Stop by ramp if the motor frequency is the same or below this parameter when stop request is given.

### *2.4.3 Frequency limit*

Defines the frequency limit for the stop function if selected as the frequency limit (par. 2.4.2=2).
If the motor frequency is above the frequency limit the motor costs to stop and if it is below or the same as the frequency limit the stop function is ramp.

### *2.4.4 Stop distance*

0 = Not used

Parameter is active only if stop function is selected as a frequency limit (parameter 2.4.2=2).

Parameter defines the distance from certain floor switch to complete stop to floor.
Parameter value is presented in meters.

Stop value is calculated from Nominal linear speed (parameter 2.2.1) and from motor nominal frequency (parameter 2.1.1). The calculated distance is correct only if these two parameters are set correctly and if stop ramp is linear (parameter 2.4.5=0).

If stop ramp is S-shaped instead of linear (S-curve is used), then stopping distance must be fine-adjusted with parameter 2.4.6.

> *Note: If Stop by distance function is used the internal ramp switch function (parameter 2.2.6.1) is not active.*

### *2.4.5 S-Curve time*

Special deceleration increase and decrease time if stop by distance function is selected. This jerk time is activated when the speed is decelerated below frequency limit and the reference frequency is reached.

Jerk times in Speed Curve 1 group are used if the frequency is above the frequency limit (see Figure 3). Jerk times in Speed Curve 1 group are changed back when the frequency converter enters the stop stage.

### *2.4.6 Scaling factor*

Ramp Scaling factor for stop distance function. Stop distance is calculated based on the linear ramp. Stopping distance is accurate only when jerk times are not used (parameter 2.2.7=0 or 2.4.5=0). If jerk times are used the stopping distance will be longer than it should be. Scaling factor can be used to fine-adjust the stopping distance. Scaling factor recalculates the ramp time.

## 5.5 MOTOR CONTROL

### *2.5.1 Motor control mode*

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

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

2 Speed control CL Closed loop speed control mode. The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed. Encoder is required. Closed loop parameters in group G2.11must be set accordingly

### *2.5.2 U/f optimisation*

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

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

### *2.5.3 U/f ratio selection*

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

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

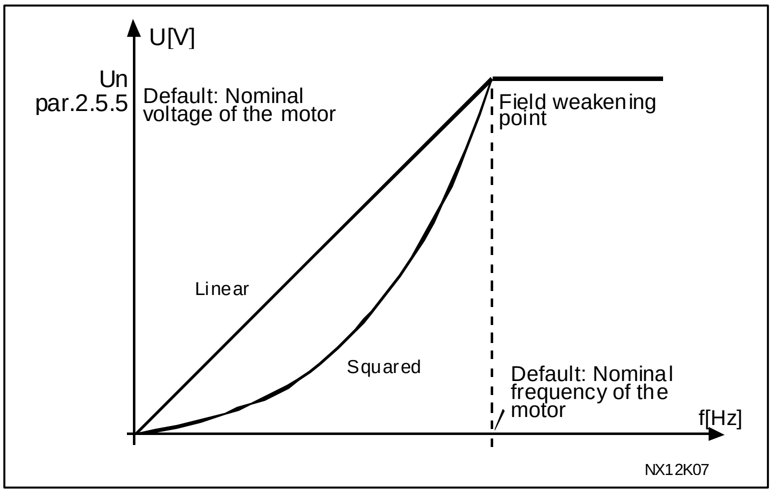



*Figure 10. Linear and squared change of motor voltage*

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.

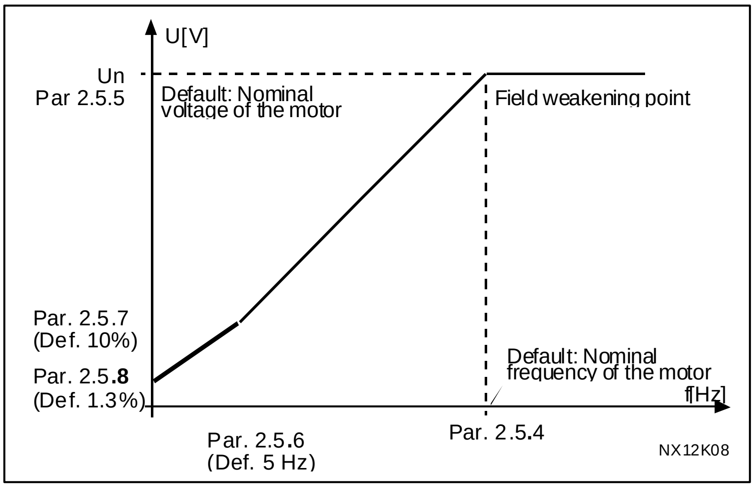



*Figure 11. Programmable U/f curve.*

Linear with flux optimisation:

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

### *2.5.4 Field weakening point*

The field weakening point is the output frequency at which the output voltage reaches the set (par. 2.5.5) maximum value.

### *2.5.5 Voltage at field weakening point*

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the U/f curve parameters. See parameters 2.5.2, 2.5.3, 2.5.6 and 2.5.7.

When the parameters 2.1.1 and 2.1.2 (nominal voltage and nominal frequency of the motor) are set the parameters 2.5.4 and 2.5.5 are automatically given the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting the parameters 2.1.1 and 2.1.2.

### *2.5.6 U/f curve, middle point frequency*

If the programmable U/f curve has been selected with the parameter 2.5.3 this parameter defines the middle point frequency of the curve. See Figure 11.

### *2.5.7 U/f curve, middle point voltage*

If the programmable U/f curve has been selected with the parameter 2.5.3 this parameter defines the middle point voltage of the curve. See Figure 11.

### *2.5.8 Output voltage at zero frequency*

If the programmable U/f curve has been selected with the parameter 2.5.3 this parameter defines the zero frequency voltage of the curve. See Figure 11.

### *2.5.9 Switching frequency*

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

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

### *2.5.10 Overvoltage controller*
### *2.5.11 Undervoltage controller*

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

Note: Over-/undervoltage trips may occur when controllers are switched out of operation. Undervoltage controller is turned off automatically if evacuation is active.

0 Controller switched off
1 Controller switched on

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24-hour support: +358-40-8371 150 Email: vacon@vacon.com

### 2.5.12 *Identification*

Motor Identification in Open Loop. U/f Curve and RS Voltage Drop is included. When parameter is set to 1 motor must be started within 20 seconds. Identification is performed in standstill. The Mechanical Brake remains closed.

### 2.5.13. *Measured RS voltage drop*

Measured Voltage drop at stator resistance between two phases of the motor with nom current of motor.

### 2.5.14 *Ir Add Generator Scale*

Scaling factor for generator side IR-compensation (0 ... 200%)

### 2.5.15 *Ir Add Motor Scale*

Scaling factor for Motor side IR-compensation (0 ... 200%)

### 2.5.16 *Frequency Compensation Multiplier*

0 = Not Used
1 = Compensation active
Other Values just for fine-tuning

Function can be used to improve speed accuracy during positioning and levelling when “High Slip” motors are used.
When parameter is set to 0 , function is not active. When Compensation is used it is recommended to set parameter to 1 (other values just for fine tuning).

## 5.6 INPUT SIGNALS

### *2.6.1 Start/Stop logic selection*

0 DIN1: closed contact = start forward (rising edge pulse is required)
DIN2: closed contact = start reverse (rising edge pulse is required)

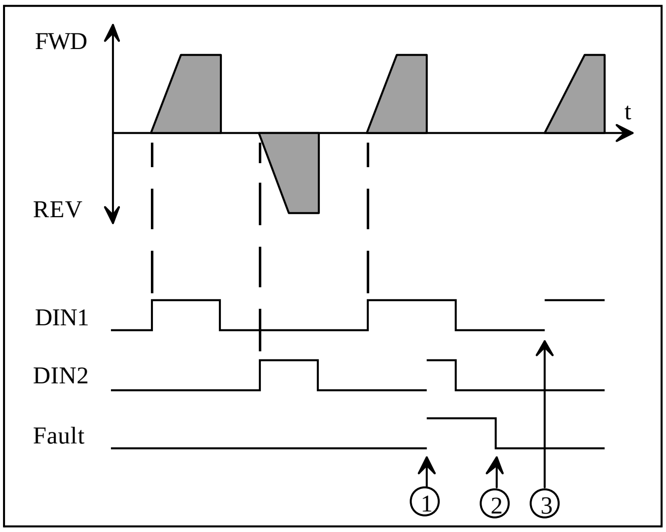


*Figure 12. Start forward/Start reverse*

① If both DIN switches are ON at the same time fault is activated.

② Fault reset.

③ The drive can be re-started after fault reset and when both DIN switches are in OFF position.

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

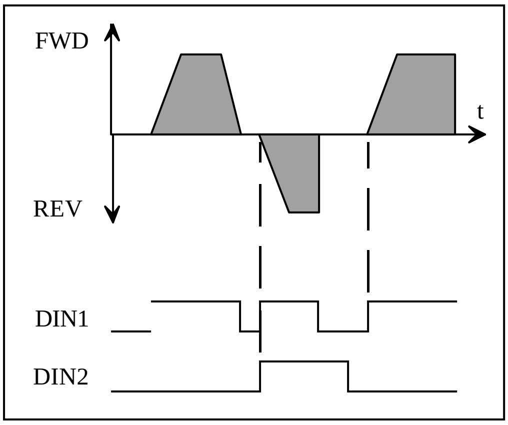


Figure 13. Start, Stop, Reverse

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

Sama as selection 0 except rising edge pulse is not required.
Fault is not activated if both DIN switches are on.

### *2.6.2 Reference offset for current input*

0 No offset
1 Offset 4 mA ("living zero") provides supervision of zero level signal. The response to reference fault can be programmed with parameter 2.8.1.1.

### *2.6.3 Reference scaling, minimum value*

### *2.6.4 Reference scaling, maximum value*

Setting value limits: 0 ≤ par. 2.6.3 ≤ par. 2.6.4 ≤ par. 2.1.2. If parameter 2.6.4 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.

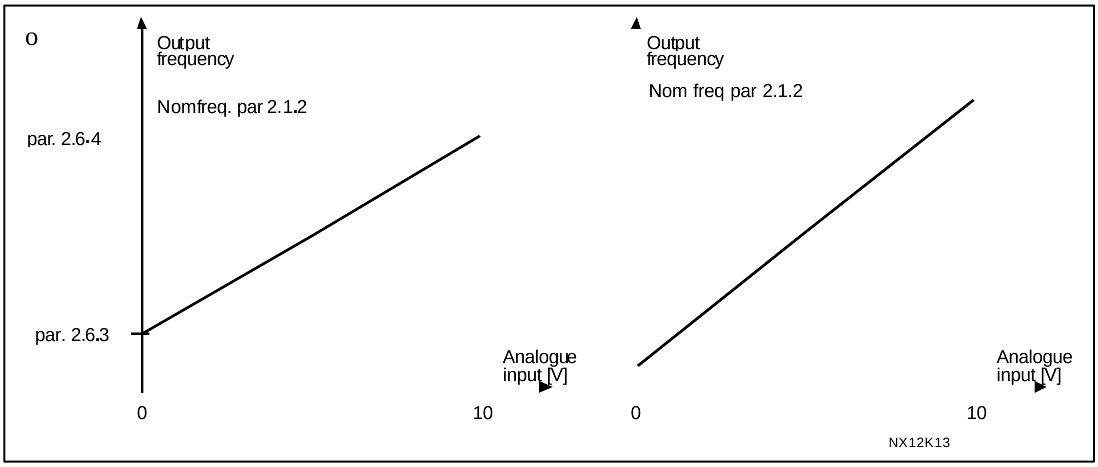


*Figure 14. Left: Reference scaling; Right: No scaling used (par. 2.6.5 = 0).*

### *2.6.5 Reference inversion*

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

0 No inversion
1 Reference inverted

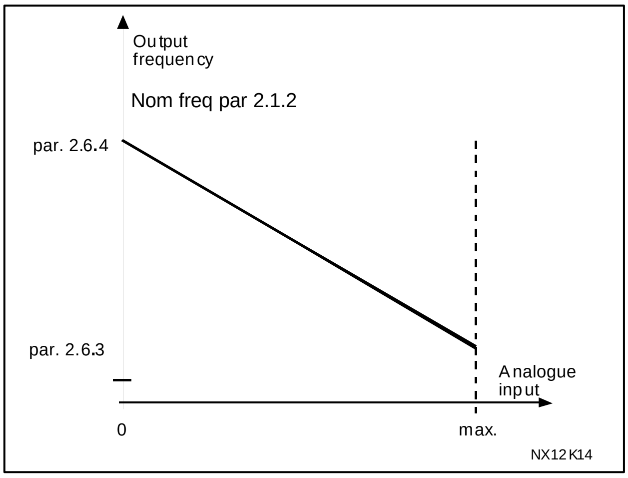


*Figure 15. Reference invert.*

### *2.6.6 Reference filter time*

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

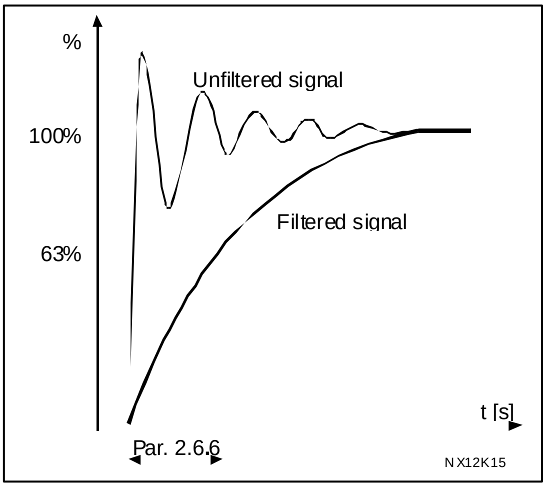


*Figure 16. Reference filtering*

### *Digital Inputs (M2 -> G2.6.7)*

All digital inputs (except DIN1 and DIN2) are programmable. See instructions on page 4.

*2.6.7.1 External Fault closing contact*
*2.6.7.2 External Fault opening contact*
*2.6.7.3 Fault Reset*
*2.6.7.4 Run Enable*
*2.6.7.5 Acc/Dec time selection*
*2.6.7.6 Stop by coast, closing contact*
*2.6.7.7 Stop by coast, opening contact*
*2.6.7.8 Override Speed*
*2.6.7.9 Forced I/O control*
*2.6.7.10 Speed selection input 1*
*2.6.7.11 Speed selection input 2*
*2.6.7.12 Speed selection input 3*

Parameters 2.6.7.10-2.6.7.12 are speed reference selection inputs (see also parameter 2.2.2).

## 5.7 OUTPUT SIGNALS

### 2.7.1 *Analogue output function*

This parameter selects the desired function for the analogue output signal.
See Table 9. Output signals, G2. on page 14 for the parameter values.

### 2.7.2 *Analogue output filter time*

Defines the filtering time of the analogue output signal.

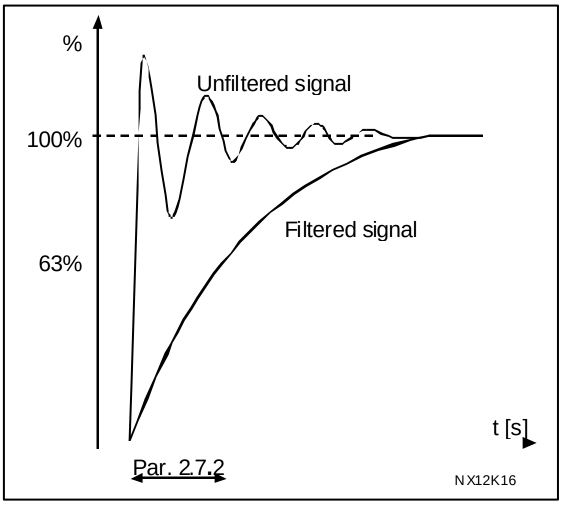


*Figure 17. Analogue output filtering*

### 2.7.3 *Analogue output invert*

Inverts the analogue output signal:

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

See parameter 2.7.5.

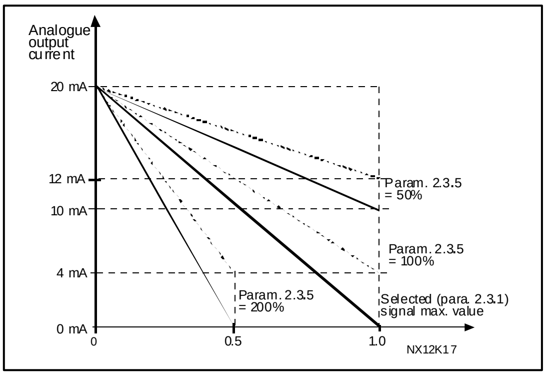


*Figure 18. Analogue output invert*

### 2.7.4 *Analogue output minimum*

Defines the signal minimum to either 0 mA or 4 mA (living zero). Note the difference in analogue output scaling in parameter 2.7.5 (see Figure 17).

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

## 2.7.5 *Analogue output scale*

Scaling factor for analogue output.

| Signal | Max. value of the signal |
|---|---|
| Output frequency | Nom frequency (par. 2.1.2) |
| Freq. Reference | Nom frequency (par. 2.1.2) |
| Motor speed | Motor nom. speed $1xn_{mMotor}$ |
| Output current | Motor nom. current $1xI_{nMotor}$ |
| Motor torque | Motor nom. torque $1xT_{nMotor}$ |
| Motor power | Motor nom. power $1xP_{nMotor}$ |
| Motor voltage | 100% x $U_{nmotor}$ |
| DC-link voltage | 1000 V |

*Table 18. Analogue output scaling*

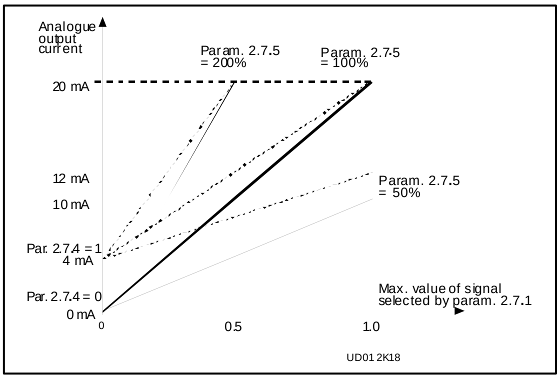


*Figure 19. Analogue output scaling*

## 2.7.6 *Digital output function*

| 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 par. 2.7.3 |
| 7 = Reference fault or warning | Fault or warning depending on par. 2.7.1<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 | The preset 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 supervision | The output frequency goes outside the set low limit/high limit (see parameters 2.7.17 and 2.7.18) |
| 14 = Control from I/O terminals | I/O control mode selected (in menu M3) |
| 15 = Thermal fault/warning | Thermal fault/warning active |
| 16 = Fieldbus DIN1 | |
| 17 = Speed below limit | Lift speed goes below limit (par 2.7.14) |
| 18 = Torque limit supervision | Motor torque goes beyond the set supervision low limit/high limit (see par. 2.7.15 and 2.7.16) |
| 19 = Mechanical brake control | External brake ON/OFF control<br>(see parameter Group G2.3) |
| 20 = Mech. brake control inverted | External brake ON/OFF control (see parameter Group G2.3). Output active when brake control is OFF. |

*Table 19. Output signals via DO1 and output relays RO1 and RO2.*

### *2.7.7 Digital output 1 function inverted*

0 = DO1 Not inverted
1 = DO1 Inverted

### *2.7.8 Digital output 1 ON Delay*

Timer On delay for digital output 1.

### *2.7.9 Digital output 1 OFF Delay*

Timer OFF delay for digital output 1.

### *2.7.10 Relay output 1 function*

See parameter 2.7.6.

### *2.7.11 Relay output 1 function inverted*

0 = RO1 Not inverted
1 = RO1 Inverted

### *2.7.12 Relay output 1 ON delay*

Timer On delay for relay output 1.

### *2.7.13 Relay output 1 OFF Delay*

Timer OFF delay for digital output 1.

### *2.7.14 Relay output 2 function*

See parameter 2.7.6.

### *2.7.15 Relay output 2 function inverted*

0 = RO2 Not inverted
1 = RO2 Inverted

### *2.7.16 Speed supervision limit*

If lift speed is below the speed supervision limit Speed below limit-signal is TRUE. See Table 19 for the “Speed below limit” signal.

### *2.7.17 Motoring torque supervision*

Torque limit when operating in motoring mode. If the actual motor torque is above the motor torque supervision limit for a defined time (par 2.8.4.6) then internal “overtorque”-signal is set. Response to signal can be given by parameter 2.8.4.5.

### *2.7.18 Generating torque supervision*

Torque limit when operating in generating mode. If set to 0.0 % this parameter is ignored and the limit is defined by parameter 2.7.15.

### *2.7.19 Output frequency limit supervision function*

0 No supervision
1 Low limit supervision
2 High limit supervision

If the output frequency goes under/over the set limit (P 2.7.18) this function generates a warning message via the digital output DO1 and via the relay output RO1 or RO2 depending on the settings of parameters 2.7.6, 2.7.9 and 2.7.12.

### *2.7.20 Output frequency limit supervision value*

Selects the frequency value supervised by parameter 2.7.17.

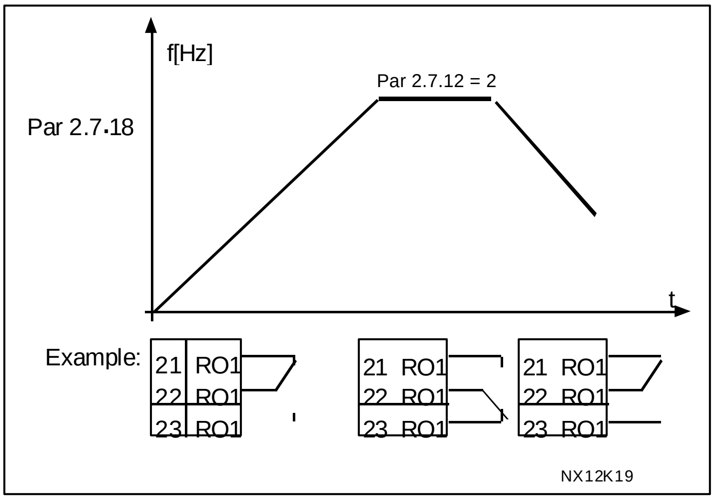


*Figure 20. Output frequency supervision*

## 5.8 PROTECTIONS

### *I/O Faults parameters (M2 -> G2.8.1)*

#### *2.8.1.1 Response to the reference fault*

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset Frequency (Par. 2.7.2) is set as reference
4 = Fault, stop mode after fault according to parameter 2.4.2.
5 = Fault, stop mode after fault always by coasting

A warning or a fault action and message is generated if the 4…20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2.

#### *2.8.1.2 4 mA Fault: preset frequency reference*

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

#### *2.8.1.3 Response to external fault*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
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 (see parameter 2.6.7.1). The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

### *General faults parameters (M2 -> G2.8.2)*

#### *2.8.2.1 Input phase supervision*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

#### 2.8.2.2 *Response to undervoltage fault*

1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

#### 2.8.2.3 *Output phase supervision*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

#### 2.8.2.4 *Earth fault protection*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
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.

#### 2.8.2.5 *Response to fieldbus fault*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

#### 2.8.2.6 *Response to slot fault*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

*Motor Faults parameters (M2 -> G2.8.3)*

Parameters 2.8.3.1—2.8.3.5, Motor thermal protection:
General

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

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

The motor thermal protection can be adjusted with parameters. The thermal current $I_T$ specify 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 Vacon NX User's Manual, Chapter 7.3.1.

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

## *2.8.3.1 Motor thermal protection*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

## *2.8.3.2 Motor thermal protection: Motor ambient temperature factor*

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

### 2.8.3.3 *Motor thermal protection: Zero frequency current*

The current can be set between 0—150.0% x $I_{nMotor}$. This parameter sets the value for thermal current at zero frequency. See Figure 21.

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, parameter 2.1.4 (Nominal current of motor), not the drive's nominal output current. The motor's nominal current is the current that the motor can withstand in direct on-line use without being overheated.

If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value.
Setting this parameter does not affect the maximum output current of the drive which is determined by parameter 2.1.6 alone (Current limit).

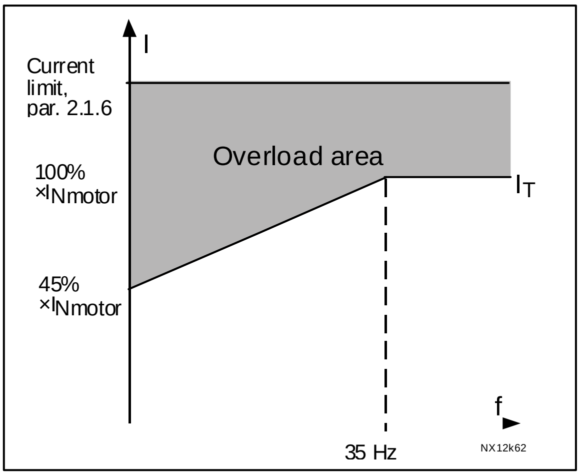


*Figure 21. Motor thermal current $I_T$ curve*

### 2.8.3.4 *Motor thermal protection: Time constant*

This time can be set between 1 and 200 minutes.

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

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

If the motor's t6–time (t6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set basing on it. As a rule of thumb, the motor thermal time constant in minutes equals to 2xt6. If the drive is in stop stage the time constant is internally increased to three times the set parameter value. The cooling in the stop stage is based on convection and the time constant is increased. See also Figure 22.

### *2.8.3.5 Motor thermal protection: Motor duty cycle*

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

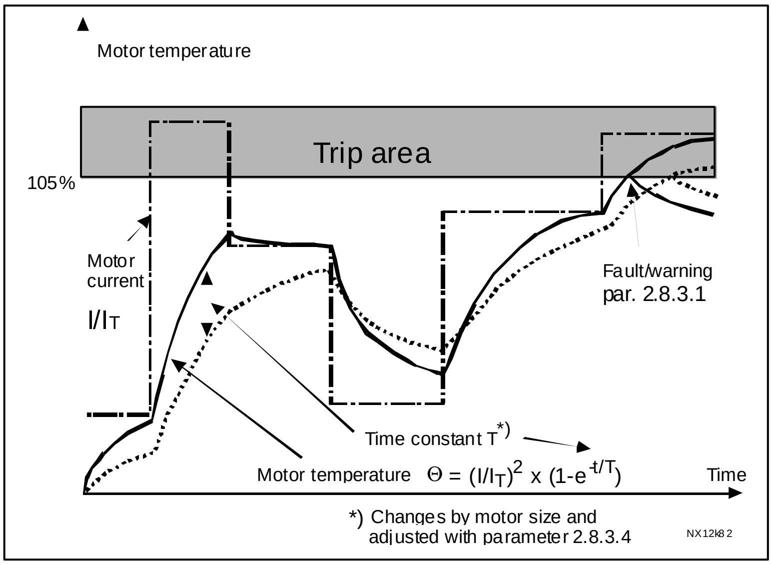


*Figure 22. Motor temperature calculation*

Parameters 2.8.3.6-2.8.3.9, Stall protection:

General

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of motor thermal protection. The stall state is defined with two parameters, 2.8.3.7 (Stall current) and 2.8.3.9 (Stall frequency). If the current is higher than the set limit and output frequency is lower than the set limit, the stall state is true. There is actually no real indication of the shaft rotation. Stall protection is a type of overcurrent protection.

### *2.8.3.6 Stall protection*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

### 2.8.3.7 Stall current limit

The current can be set to 0.0…6000.0 A. For a stall stage to occur, the current must have exceeded this limit. See Figure 23. This value is set in percentage of the motor's name plate data (parameter 2.1.4). If the parameter 2.1.4 Nominal current of motor is changed, this parameter is automatically restored to the default value.

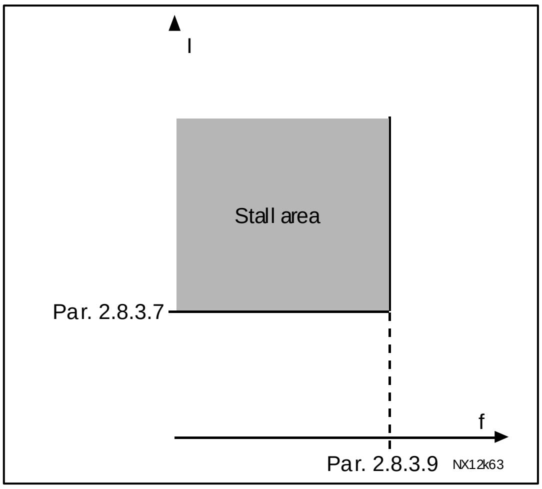


*Figure 23. Stall characteristics settings*

### 2.8.3.8 Stall time

This time can be set between 1.0 and 120.0s.
This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter.
If the stall time counter value goes above this limit the protection will cause a trip (see parameter 2.8.3.6).

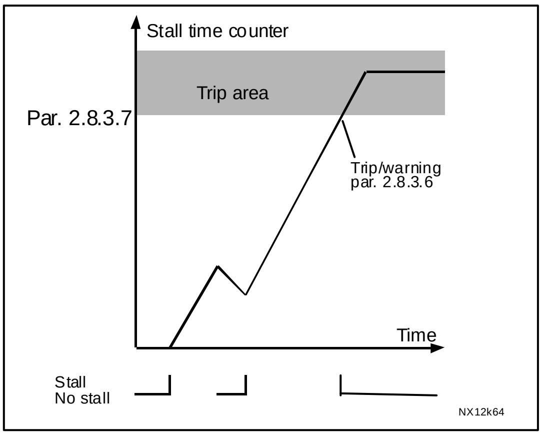


*Figure 24. Stall time count*

### 2.8.3.9 Maximum stall frequency

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

### 2.8.3.10 Response to thermistor fault

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to parameter 2.4.2.
3 = Fault, stop mode after fault always by coasting

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

*Lift Supervision parameters (M2 -> G2.8.4)*

### *2.8.4.1 Mechanical brake control fault*

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

Mechanical brake supervision fault ensures that the brake is released within the defined time and the external brake supervision does not trigger a fault. With this parameter this function can be turned off.

### *2.8.4.2 Shaft speed fault*

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

Actual shaft speed according to encoder and calculated shaft speed from motor control are compared and in case the speed difference is more than the set limit (parameter 2.8.4.4) per a defined time (parameter 2.8.4.3) the set action is taken.
This fault is generated only when the mechanical brake is open. i.e. if running against mechanical brake this fault is not generated.
In open loop motor control mode this fault is not generated. See Figure 25.

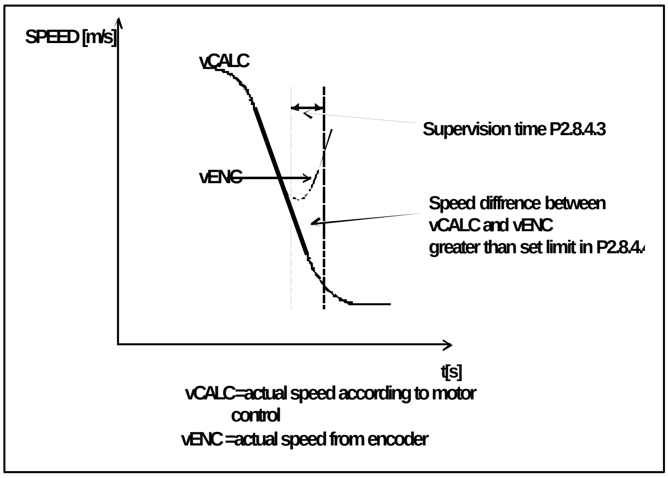


*Figure 25. Stall time count*

### *2.8.4.3 Shaft speed supervision time*

If the speed difference in shaft speed supervision is greater than the set limit (parameter 2.8.4.2) for a defined supervision time the shaft speed warning or fault is generated. See Figure 25.

### *2.8.4.4 Shaft speed supervision limit*

The speed difference between the actual and the calculated lift speed, which will cause tripping. See Figure 25.

*Parameter 2.8.4.4.1* is the Shaft speed supervision limit in [m/s] and
*Parameter 2.8.4.4.2* is the Shaft speed supervision limit in [Hz].

### 2.8.4.5 *Response to overtorque protection fault*

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

The actual torque is compared to torque limits set with parameter 2.7.15 and parameter 2.7.16. If exceeded the defined action is taken.

### 2.8.4.6 *Torque supervision time*

If torque exceeds limits (set with parameters 2.7.15 and 2.7.16) the overtorque protection fault is activated after the overshoot situation has been present for the defined time. If time is set to zero the fault is activated once the actual torque exceeds the supervision limits. Response to overtorque protection fault is set in parameter 2.8.4.5.

### 2.8.4.7 *Response to control conflict*

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

Status of the DIN1 and DIN2 switches is supervised by the application. If they are active at the same time a control conflict fault will be generated. The response to fault is given with this parameter.

### 2.8.4.8 *Minimum current*

If actual current of the motor is below the minimum current limit fault is activated. The fault is activated only when the mechanical brake is open. 100% correspond to frequency converter nominal current.

### 2.8.4.9 *0Hz Speed response*

0= Not used
1= Warning
2= Warning + Stop
3= Fault

0 Hz speed supervision is active two seconds after the start command. During that time frequency reference must increase over 0 Hz otherwise fault is activated. Response to fault is given with this parameter.

## 5.9 AUTO RESTART PARAMETERS

### *2.9.1 Automatic restart: Wait time*

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

### *2.9.2 Automatic restart: Trial time*

The Automatic restart function restarts the frequency converter when the faults selected with parameters 2.9.4 to 2.9.9 have disappeared and the waiting time has elapsed.

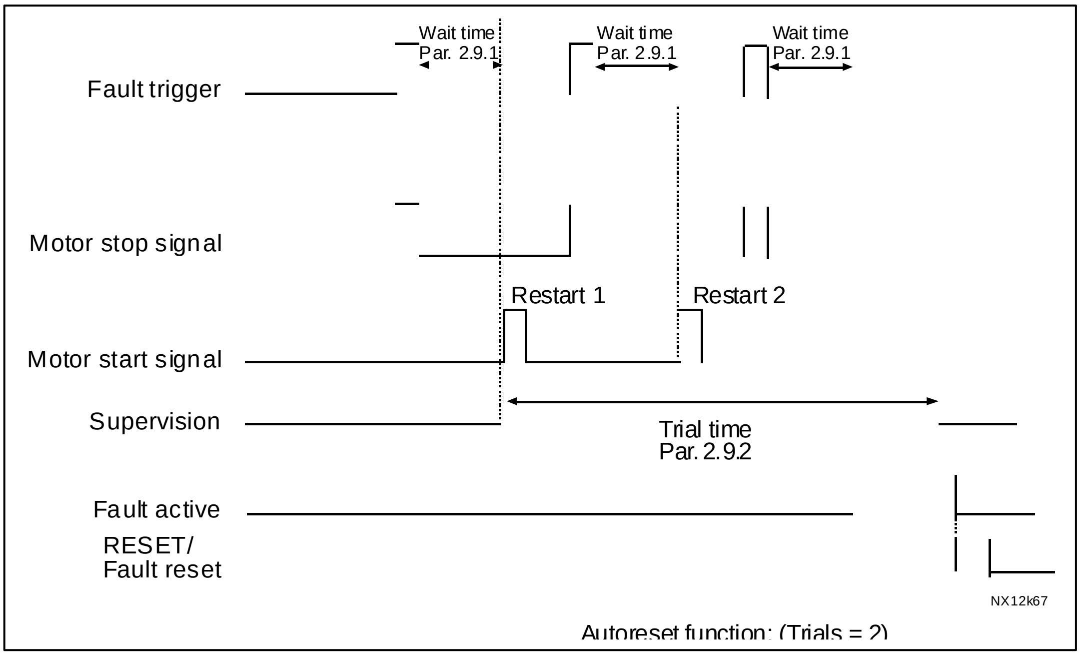


*Figure 26. Example of Automatic restart with two restarts.*

Parameters 2.9.4 to 2.9.10 determine the maximum number of automatic restarts during the trial time set by parameter 2.9.2. The time count starts from the first autorestart. If the number of faults occurring during the trial time exceeds the values of parameters 2.9.4 to 2.9.10, the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault starts the trial time count again.

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

### *2.9.3 Automatic restart, start function*

The Start function for Automatic restart is fixed to start with ramp in Lift application.

### *2.9.4 Automatic restart: Number of tries after undervoltage fault trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2 after an undervoltage trip.

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

### *2.9.5 Automatic restart: Number of tries after overvoltage trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2 after an overvoltage trip.

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

### *2.9.6 Automatic restart: Number of tries after overcurrent trip*

(NOTE! IGBT temp Fault also included)
This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2.

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

### *2.9.7 Automatic restart: Number of tries after reference trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2.

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

### *2.9.8 Automatic restart: Number of tries after motor temperature fault trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2.

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

### *2.9.9 Automatic restart: Number of tries after external fault trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2.

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

### *2.9.10 Automatic restart: Number of tries after Input phase supervision fault trip*

This parameter determines how many automatic restarts can be made during the trial time set by parameter 2.9.2.

| | | |
|---|---|---|
| 0 | = | No automatic restart after Input phase supervision fault trip |
| >0 | = | Number of automatic restarts after Input phase supervision fault trip |

## 5.10 EVACUATION PARAMETERS

Evacuation is specially designed for power down situations. When there is power down situation then the 3-phase Mains supply must be disconnected and the 1-phase supply must be connected to Terminals L1-L2. Supply Voltage must be 1-phase 220VAC (±10%). If DC- batteries are used DC-link voltage must reamain at least 250 VDC, otherwise under voltage fault will occur.
The Elevator Car can be moved to nearest floor. The maximum Lift speed during the Evacuation is 40% of the Nominal Linear Speed. If Evacuation is activated then Mains supply must be correct, otherwise the Evacuation fault will occur.

### *2.10.1 Motor control mode during the evacuation*

0 = Not used
1 = Manual
2 = Automatic

Evacuation Mode is activated or deactivated only in Stop State. In manual mode, the lift controller controls the evacuation process and inputs DIN1 and DIN2 are used normally.

In Automatic mode, the evacuation process is controlled automatically. When the evacuation input (parameter 2.10.2) is switched ON the evacuation is activated. The drive checks the current of the motor in forward direction. After that it checks the current of the motor in backward direction. Then it automatically selects right direction to move.
The fault is generated if DIN1 or DIN2 is switched ON during the automatic evacuation process.

### *2.10.2 Evacuation input*

Parameter selects the input that activates the evacuation mode.

### *2.10.3 Motor control mode*

| | |
|---|---|
| 0 = Frequency control: | The I/O terminal and panel references are frequency references and the frequency converter controls the output frequency. |
| 1 = Speed control: | The I/O terminal and panel references are speed references and the frequency converter controls the motor speed (regulation accuracy ± 1%). |
| 2 = Speed control CL: | Closed loop speed control mode. The I/O terminal and keypad references are speed references and the frequency converter controls the motor speed. Encoder is required. Closed loop parameters in group G2.11must be set accordingly. |

### *2.10.4 Direction change delay*

Time delay between forward and reverse direction test.

### *2.10.5 Testing time forward and backward*

Motor current is measured for both running directions of the elevator during automatic evacuation process. This parameter determine the test time for each direction.

### *2.10.6 Current read delay*

Motor current is measured for both running directions of the elevator during automatic evacuation process. This parameter determines the point of time when current is read. Time starts simultaneously with test time.

### *2.10.7 U/f optimisation in Evacuation*

See parameter 2.5.2.

### *2.10.8 U/f curve mid point frequency in Evacuation*

See parameter 2.5.6.

### *2.10.9 U/f curve mid point voltage in Evacuation*

See parameter 2.5.7.

### *2.10.10 Output voltage at zero frequency Evacuation*

See parameter 2.5.8.

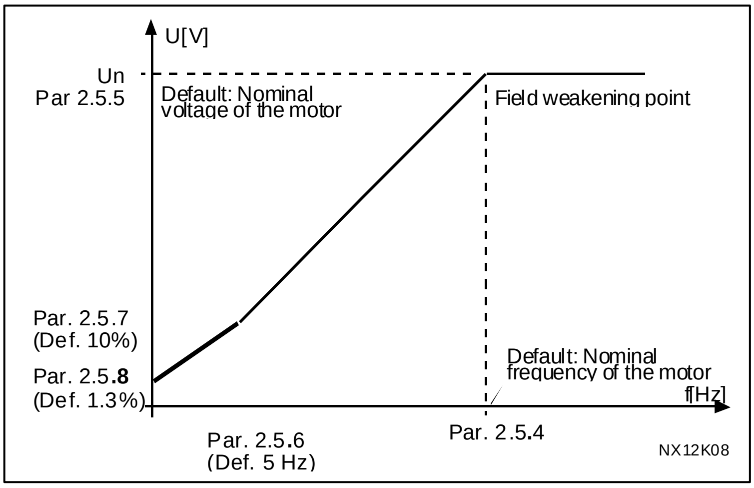


*Figure 27. Programmable U/f curve.*

### *2.10.11 Maximum speed in evacuation*

Maximum speed during the evacuation is limited with this parameter.

*Parameter 2.10.11.1* maximum speed in [m/s].
*Parameter 2.10.11.2* maximum frequency in [Hz].

## 5.11 CLOSED LOOP PARAMETERS

### *2.11.1 Magnetisation Current*

Rated magnetising current for the motor. It is used to adjust the motor voltage in no-load situation.

### *2.11.2 Speed Control Limit 1*
### *2.11.3 Speed Control Limit 2*

Change limits for speed controller gain and integral time constant. When the output frequency is below the change point 1 (par 2.11.2) the gain value is the same as parameter 11.4. If the output frequency is greater than change point 2 (par 2.11.3) then the gain value is the same as parameter 11.5. Between these two points the change is linear. See Figure 28 and Figure 29.

### *2.11.4 Speed Control Kp1*
### *2.11.5 Speed Control Kp 2*

Active Speed control gain value (%/ Hz) is P2.11.4 if the output frequency if less than P2.11.2. Active Speed control gain value is P2.11.5 if the output frequency if more than P2.11.3.

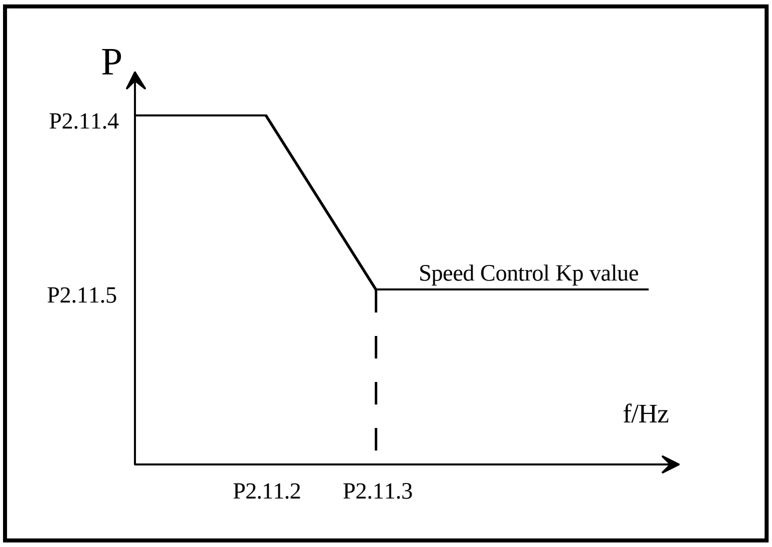


*Figure 28. Proportional Speed Control Kp Curve*

### 2.11.6 Speed Control Ti 1
### 2.11.7 Speed Control Ti 2

Active Integral time constant value for the speed controller is P2.11.6 if the output frequency if less than P2.11.2. If the output frequency is more than P2.11.3 the value is P2.11.7.

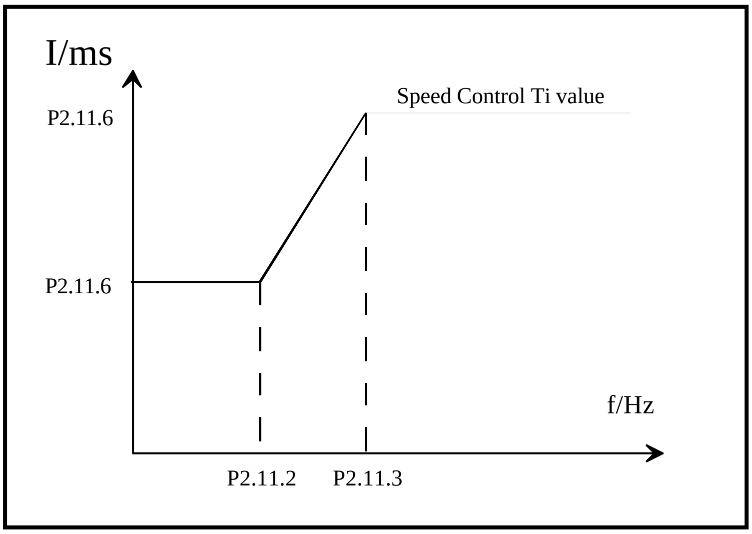


*Figure 29. Proportional Speed Control Ti Curve*

### 2.11.8 Current Control Kp

### 2.11.9 Current Control Ti

P-gain and integral time constant for the current controller. This controller is active only in closed loop mode. It generates the voltage vector reference to the modulator.

### 2.11.10 FluxCurrentKp

### 2.11.11 FluxCurrentTi

Integral time constant and Gain for FluxCurrent control

### 2.11.12 Encoder 1 filter time

Filter time constant for speed measurement

### 2.11.13 Slip adjust

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

### 2.11.14 Acceleration compensation

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.

## 5.12 KEYPAD CONTROL PARAMETERS

### *3.1 Control Place*

The active control place can be changed with this parameter. For more information, see Vacon NX User's Manual, Chapter 7.3.3.1.

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

> *Note: If fieldbus or keypad is selected for control place the speed reference (see also parameter 2.2.2) is changed accordingly.*
>
> *Also if fieldbus or keypad is selected for control place the direction can be changed when motor is running. This is not possible if control place is I/O terminal (see parameter 2.6.1).*

### *3.2 Keypad Reference*

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

The output frequency can be copied as the keypad reference by pushing the Stop button for 3 seconds when you are on any of the pages of menu *M3.* For more information, see Vacon NX User's Manual, Chapter 7.3.3.2.

### *3.3 Keypad Direction*

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

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

For more information, see Vacon NX User's Manual, Chapter 7.3.3.3.

### *3.4 Stop button activated*

If you wish to make the Stop button a "hotspot" which always stops the drive regardless of the selected control place, give this parameter the value 1.

See also parameter 3.1.

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24-hour support: +358-40-8371 150 Email: vacon@vacon.com

# 6. Control signal logic in Standard Application

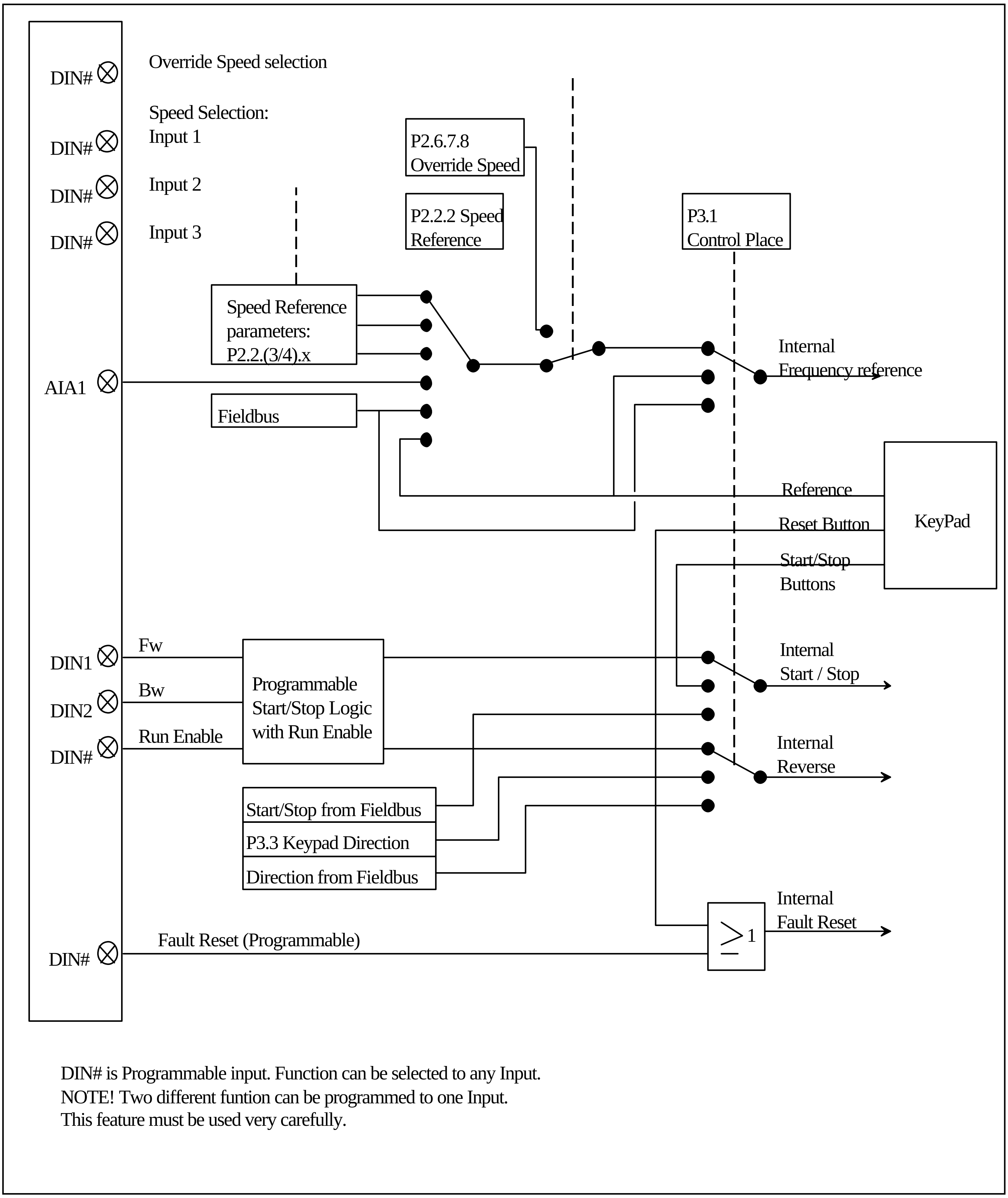


*Figure 30. Control signal logic of the Lift Application*

## 7. Fault Tracing

When a fault is detected by the frequency converter control electronics, the drive is stopped and the symbol F together with the ordinal number of the fault, the fault code and a short fault description appear on the display. The fault can be reset with the Reset button on the control keypad or via the I/O terminal. The faults are stored in the Fault History menu, which can be browsed. The different fault codes you will find in the table below.

The fault codes and their possible causes are presented in the table below.

| Fault code | Fault | Possible cause |
|---|---|---|
| 1 | Overcurrent | Frequency converter has detected too high a current (>4*$I_n$) in the motor cable:<br>- sudden heavy load increase<br>- short circuit in motor cables<br>- unsuitable motor |
| 2 | Overvoltage | The DC-link voltage has exceeded the limits defined in Table 4-1.<br>- too short a deceleration time<br>- high overvoltage spikes in utility |
| 3 | Earth fault | Current measurement has detected that the sum of motor phase current is not zero.<br>insulation failure in cables or motor |
| 5 | Charging switch | The charging switch is open, when the START command has been given.<br>- faulty operation<br>- component failure |
| 6 | Emergency stop | Stop signal has been given from the option board. |
| 7 | Saturation trip | Defective component |
| 8 | Unknown fault | The frequency converter troubleshooting system is unable to locate the fault. |
| 9 | Undervoltage | DC-link voltage is under the voltage limits defined in Table 4-2 of the Vacon NX User's Manual.<br>Most probable causes:<br>- too low a supply voltage<br>- frequency converter internal fault |
| 10 | Input line supervision | Input line phase is missing. |
| 11 | Output phase supervision | Current measurement has detected that there is no current in one motor phase. |
| 12 | Brake chopper supervision | - no brake resistor installed<br>- brake resistor is broken<br>- brake chopper failure |
| 13 | Frequency converter under-temperature | Heatsink temperature is under –10°C |
| 14 | Frequency converter overtemperature | Heatsink temperature is over 90°C.<br><br>Overtemperature warning is issued when the heatsink temperature exceeds 85°C. |
| 15 | Motor stalled | Motor stall protection has tripped. |
| 16 | Motor overtemperature | Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded. |

| Fault code | Fault | Possible cause |
|---|---|---|
| 17 | Motor underload | Motor underload protection has tripped. |
| 22<br>23 | EEPROM checksum fault | - parameter save fault<br>- faulty operation<br>- component failure |
| 24 | Changed data warning | Changes may have occurred in the different counter data due to mains interruption |
| 25 | Microprocessor watchdog fault | - faulty operation<br>- component failure |
| 29 | Thermistor fault | Thermistor is broken. |
| 37 | Device change | Option board changed.<br>Different power rating of drive. |
| 38 | Device added | Option board added.<br>Drive of different power rating added. |
| 39 | Device removed | Option board removed.<br>Drive removed. |
| 40 | Device unknown | Unknown option board or drive. |
| 41 | IGBT temperature | |
| 50 | Analogue input $I_{in}$ < 4mA (selected signal range 4 to 20 mA) | Current at the analogue input is < 4mA.<br>- control cable is broken or loose<br>- signal source has failed |
| 51 | External fault | Digital input fault. |
| 52 | Keypad communication fault | The connection between the control keypad and the frequency converter is broken. |
| 53 | Fieldbus communication fault | The connection from the fieldbus to the frequency converter is broken. |
| 54 | SPI communication fault | The connection between the component board and the control board is broken. |
| 55 | External brake control | Fault is activated by the mechanical brake control logic. Check parameters and external brake device. See parameter 2.8.4.1 |
| 56 | Shaft speed | Fault is activated if calculated speed is different compared to actual speed.<br>See parameter 2.8.4.2. |
| 57 | Torque supervision | Actual torque above torque limits. See parameter 2.8.4.6 |
| 58 | Minimum current | Motor current is less than set limit parameter 2.8.4.8 |
| 59 | Direction request | Digital inputs DIN1 and DIN2 are ON at the same time. See parameter 2.8.4.7. |
| 60 | Evacuation | Fault is generated during the evacuation process. |
| 61 | Zero speed time | Zero current measured later than 2 seconds from start command.<br>See parameter 2.8.4.9. |
| 62 | Evacuation Voltage | Evacuation active and voltage has exceeded the limit value.<br>Evacuation voltage 230VAC ±10% |

*Table 20. Fault codes*