

**VACON<sup>®</sup> NX**  
AC DRIVES

# **DC/DC CONVERTER OPERATING GUIDE**

**VACON<sup>®</sup>**



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**NOTE!** You can download the English and French product manuals with applicable safety, warning and caution information from

<http://drives.danfoss.com/knowledge-center/technical-documentation/>.

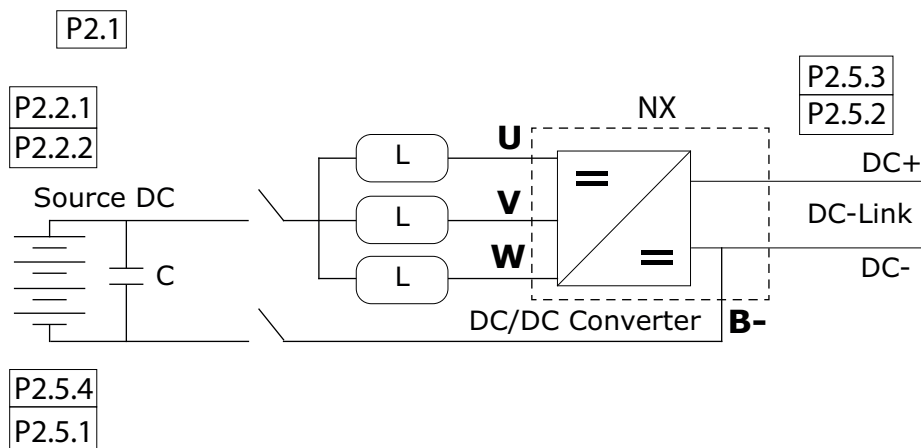
**REMARQUE** Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site <http://drives.danfoss.com/knowledge-center/technical-documentation/>.

## 1. INTRODUCTION

The DC/DC application creates output according to the needs of the system, and it is possible to integrate into the system with different topologies. Choosing applicable topology, see the Design Guide, Hybridization [DPD01887A].

### 1.1 APPLICATION FUNCTIONALITY

| DC-link side  | Controlled source side |         |
|---------------|------------------------|---------|
| Control       | Control                | Limit   |
| Under voltage | Voltage                | Voltage |
| Over voltage  | Current                | Current |



| Reference | Parameter                                 |
|-----------|-------------------------------------------|
| P2.1      | Basic parameters                          |
| P2.2.1    | Voltage reference                         |
| P2.2.2    | Current reference                         |
| P2.5.1    | Current limit                             |
| P2.5.2    | Under voltage control for DC-link voltage |
| P2.5.3    | Over voltage control for DC-link voltage  |
| P2.5.4    | Source voltage                            |

Figure 1. DC/DC connection

For more detailed parameter information, see Chapter 2 "Parameters".

### 1.2 CONNECTION

Connect the phase cables (U, V and W) and cable B-/DC- to correct terminals. See Figure 2, "FR4-FR9 main terminals," on page 3, Figure 3, "CH62 main terminals," on page 4, Figure 4, "FI4-FI10 basic wiring diagrams," on page 5 and Figure 5, "2 x FI10 basic wiring diagram," on page 6.

**NOTE:** The connection varies according to drive. Always check the connection terminals from the instruction manual of the drive in question. E.g. in FR4-FR6 INU devices (FI4-FI6) B- = DC-.

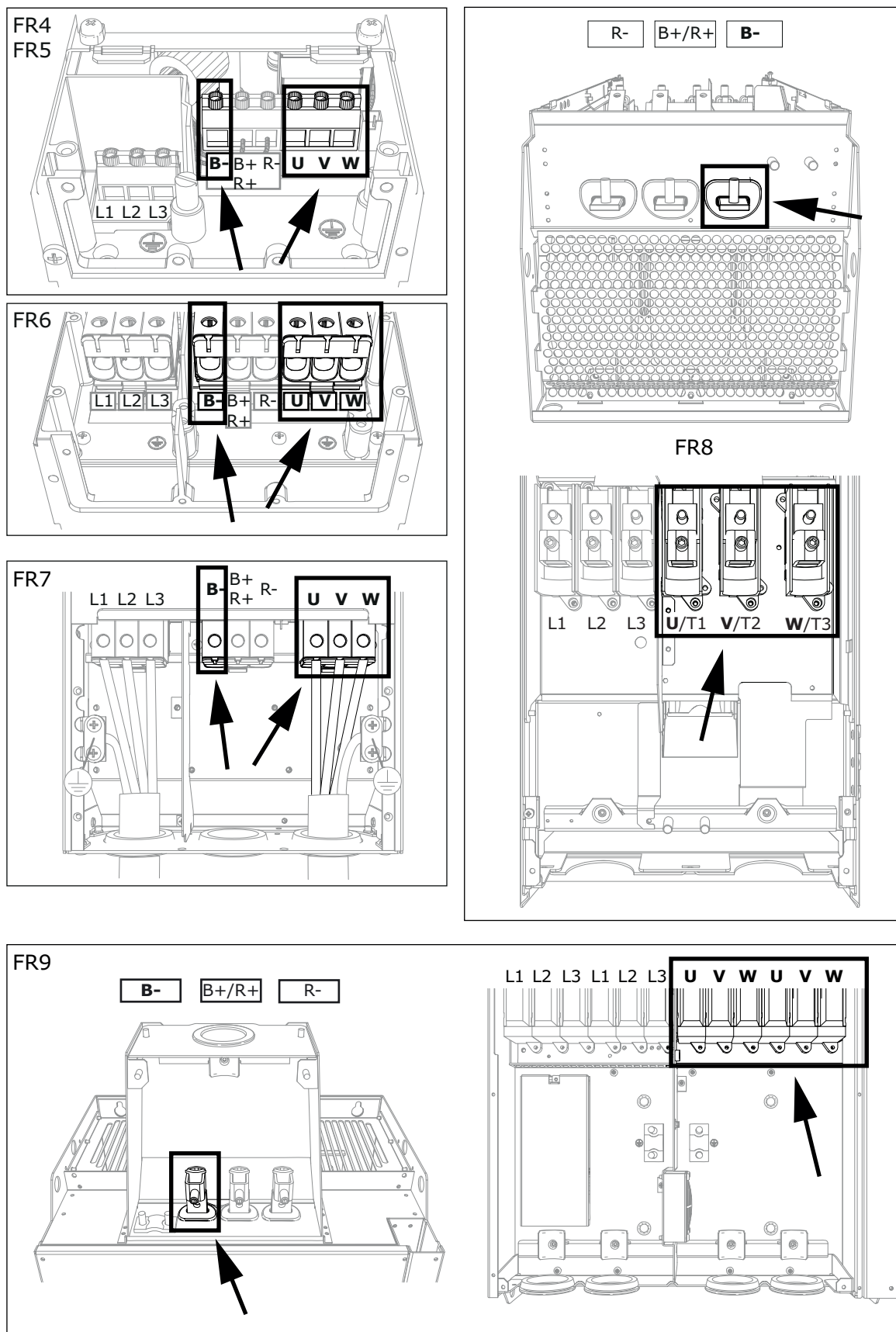


Figure 2. FR4-FR9 main terminals

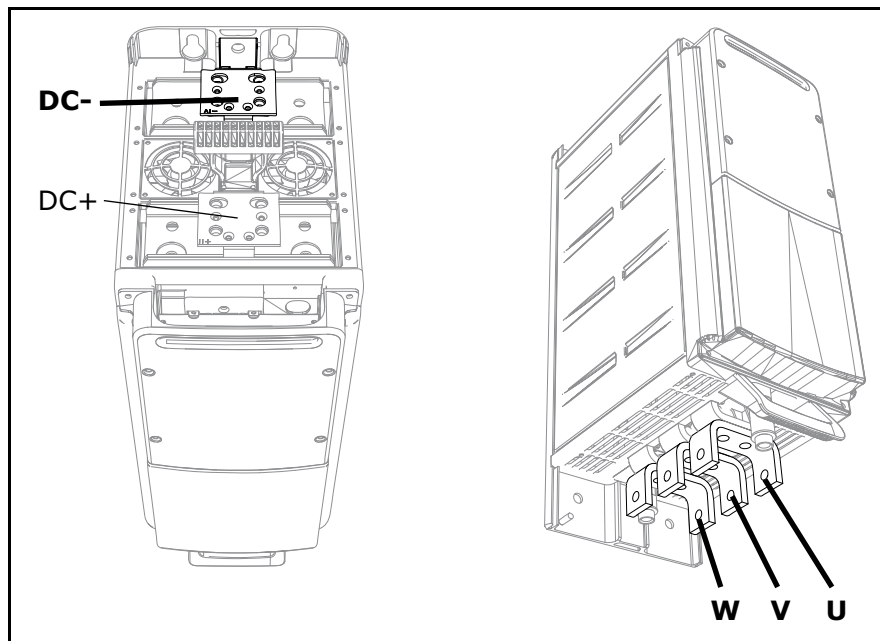


Figure 3. CH62 main terminals

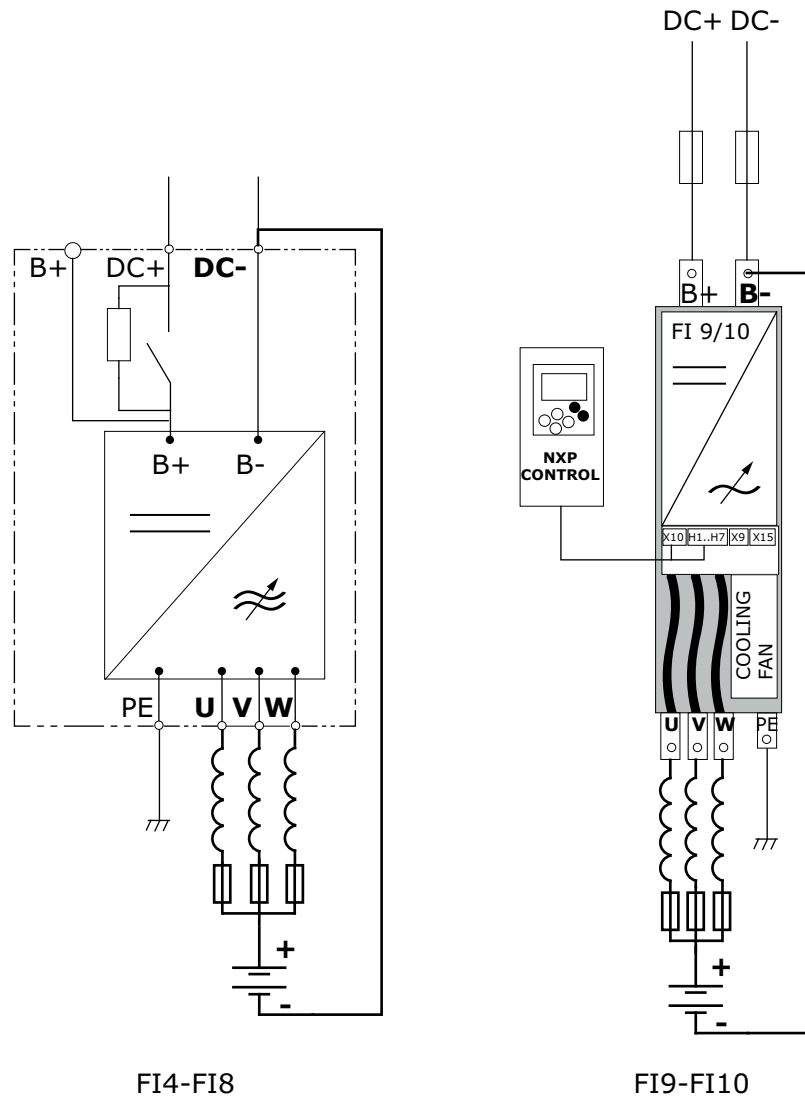


Figure 4. FI4-FI10 basic wiring diagrams

**NOTE:** The location and selection of fuses varies according to system design.

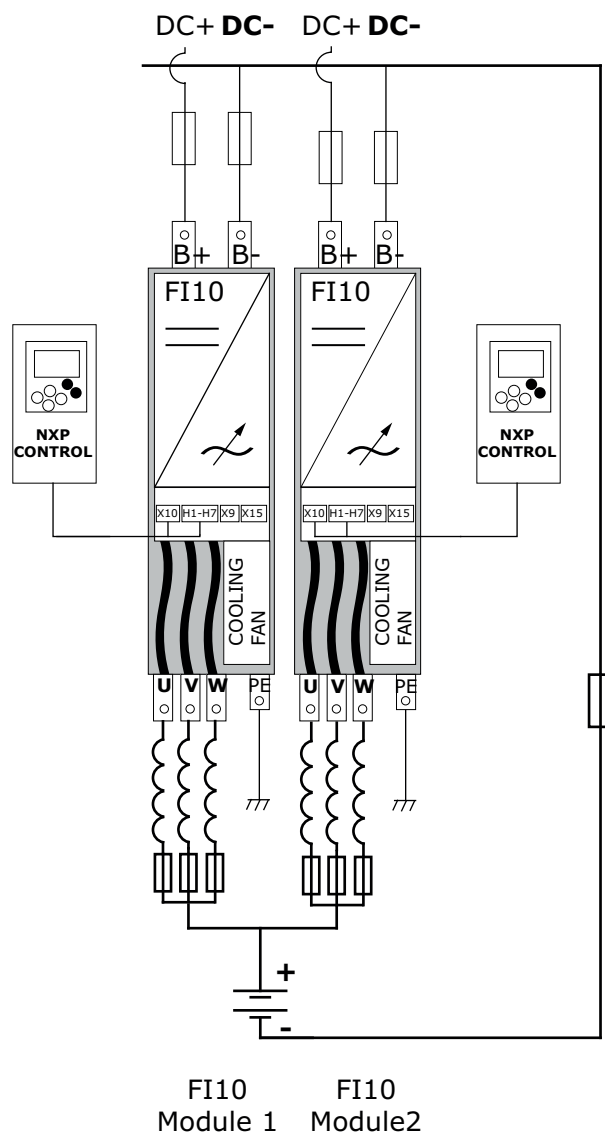


Figure 5. 2 x FI10 basic wiring diagram

**NOTE:** The location and selection of fuses varies according to system design.

## 2. PARAMETERS

### 2.1 SOURCE SIDE PARAMETERS

#### 2.1.1 BASIC PARAMETERS

Table 1. Basic parameters

| Code   | Parameter          | Min | Max    | Unit | Default | ID   | Note                                       |
|--------|--------------------|-----|--------|------|---------|------|--------------------------------------------|
| P2.1.1 | Source Nom Current | 0.0 | Varies | A    | Varies  | 113  | Capacity of supply                         |
| P2.1.2 | Source Nom Voltage | 200 | 1099   | V    | Varies  | 110  |                                            |
| P2.1.3 | Source Nom Power   | 0   | 32000  | kW   | 0       | 116  |                                            |
| P2.1.4 | Control Mode       | 0   | 1      |      | 0       | 1858 | 0 = Current<br>1 = Voltage                 |
| P2.1.5 | Identification     | 0   | 1      |      | 0       | 631  | 0 = No Action<br>1 = Current, Meas, Offset |

#### **P2.1.1 SOURCE NOM CURRENT ID113**

This parameter defines the current value that is used as the 100 % current for e.g. charging current limit.

#### **P2.1.2 SOURCE NOM VOLTAGE ID110**

This parameter defines the absolute voltage value that is used as the 100 % voltage for e.g. the voltage reference.

#### **P2.1.3 SOURCE NOM POWER ID116**

This parameter is used for scaling the percentage power monitoring value.

#### **P2.1.4 CONTROL MODE ID1858**

This parameter is used to select the control mode of the drive.

0 = Current control mode

1 = Voltage control mode

#### **P2.1.5 IDENTIFICATION ID631**

This parameter is used to calibrate the current measurement.

0 = No Action

1 = Current measurement offset

When the identification is finished, the drive must be connected to the battery system or the used DC power source. There should also not be any load on the DC-link.

Select the identification run and give the DC/DC converter a start command within 20 seconds after the identification mode is selected.

**2.1.2 VOLTAGE REFERENCE***Table 2. Voltage reference handling*

| Code      | Parameter                   | Min | Max | Unit | Default | ID   | Note                                                                       |
|-----------|-----------------------------|-----|-----|------|---------|------|----------------------------------------------------------------------------|
| P2.2.1.1  | Voltage Reference           | 0   | 320 | %    | 100     | 1462 |                                                                            |
| P 2.2.1.2 | Drooping                    | 0   | 100 | %    | 0       | 620  |                                                                            |
| P 2.2.1.3 | Voltage Reference Ramp Rate | -1  | 320 | %/s  | 5       | 1867 |                                                                            |
| P2.2.1.4  | Voltage Reference At Start  | 0   | 2   |      | 3       | 1864 | 0 = Reference<br>1 = Start Voltage Reference<br>2 = Measurement<br>3 = 80% |
| P2.2.1.5  | Start Voltage Reference     | 0   | 320 | %    | 90      | 1865 |                                                                            |

**P2.2.1.1 DC VOLTAGE REFERENCE ID1462**

Voltage reference in percentage of Source Nom Voltage.

**P2.2.1.2 DROOPING ID620**

Voltage reference drooping. Used when parallel DC-DC converters are used.

**P2.2.1.3 REACTIVE CURRENT REFERENCE SOURCE SELECTION ID1867**

Voltage reference ramp rate in in percentage or in seconds.

**P2.2.1.4 VOLTAGE REFERENCE AT START ID1864**

This parameter is used to define how the voltage reference starting value is handled in a start. The start will be smoother when the value is close to the actual source voltage.

**0 = Reference**

Starting voltage is a directly given reference P2.2.1.1 Voltage Reference.

**1 = V Ref Start**

Starting voltage is defined by parameter P2.2.1.5 Start Voltage Reference and ramped to actual reference with set ramp rate.

**2 = Measurement**

Starting voltage is taken from measured voltage V1.12.11 Voltage Meas. ID1866. This monitoring value can be written by analogue ID function or from fieldbus.

**3 = 80 %**

Drive will start as an initial guess of 80% of source voltage.

**P2.2.1.5 START VOLTAGE REFERENCE ID1865**

The voltage value that is used for the initial start voltage when P2.2.1.4 Voltage Reference At Start is 1 / V Ref Start.

**2.1.3 CURRENT REFERENCE***Table 3. Current reference handling*

| Code        | Parameter            | Min  | Max | Unit | Default | ID   | Note                                       |
|-------------|----------------------|------|-----|------|---------|------|--------------------------------------------|
| P2.2.2.1    | Current Reference    | -150 | 150 | %    | 0       | 1860 | Common reference for all phases.           |
| P 2.2.2.2.1 | Phase Reference Mode | 0    | 1   |      | 0       | 1859 | <b>0</b> = Common<br><b>1</b> = Individual |
| P 2.2.2.2.2 | IU Current Reference | -300 | 300 | %    | 0       | 128  |                                            |
| P2.2.2.2.3  | IV Current Reference | -300 | 300 | %    | 0       | 129  |                                            |
| P2.2.2.2.4  | IW Current Reference | -300 | 300 | %    | 0       | 130  |                                            |

**P2.2.2.1 CURRENT REFERENCE ID1860**

The active current reference of the drive in percentage of Source Nominal Current.

Active Curr. Ref > 0: Current flow from drive DC-Link to source.

Active Curr. Ref < 0: Current flow from source to drive DC-Link.

**P2.2.2.2.1 PHASE REFERENCE MODE ID1859**

This parameter is used to select if the same current reference is used for all phases or if the current is controlled individually.

**0 = Common**

P: Current reference is used for all phases.

**1 = Individual phase control**

Each phase is controlled separately with G2.2.2.2 parameters.

Used when each phase have a separate DC source.

**P2.2.2.2.2 IU CURRENT REFERENCE ID128**

The U phase current reference on an individual mode.

**P2.2.2.2.3 IV CURRENT REFERENCE ID129**

The V phase current reference on an individual mode.

**P2.2.2.2.4 IW CURRENT REFERENCE ID130**

The W phase current reference on an individual mode.

**2.1.4 SOURCE VOLTAGE***Table 4. Source voltage*

| Code     | Parameter                 | Min  | Max    | Unit | Default  | ID   | Note            |
|----------|---------------------------|------|--------|------|----------|------|-----------------|
| P2.5.4.1 | Source min voltage        | 50.0 | 1100.0 | Vdc  | 200/345  | 1893 | Discharge limit |
| P2.5.4.2 | Source max voltage        | 50.0 | 1100.0 | Vdc  | 749/1099 | 1895 | Charge limit    |
| P2.5.4.3 | Source voltage hysteresis | 0.0  | 100.0  | Vdc  | 5.0      | 1896 |                 |

**P2.5.4.1 SOURCE MIN VOLTAGE ID1893**

If Source DC voltage reaches this minimum value, discharging is disabled.

**P2.5.4.2 SOURCE MAX VOLTAGE ID1895**

If Source DC voltage reaches this maximum value, charging is disabled.

**P2.5.4.3 SOURCE VOLTAGE HYSTERESIS ID1896**

The hysteresis for the limiting functions.

**2.1.5 CURRENT LIMIT***Table 5. Current limit*

| Code     | Parameter         | Min | Max    | Unit | Default | ID   | Note                        |
|----------|-------------------|-----|--------|------|---------|------|-----------------------------|
| P2.5.1.1 | Current Limit     | 0   | Varies | A    | Varies  | 107  | Total current limit         |
| P2.5.1.2 | Charging Limit    | 0   | 300    | %    | 105     | 1290 | A percentage of nom current |
| P2.5.1.2 | Discharging Limit | 0   | 300    | %    | 105     | 1289 | A percentage of nom current |

**P2.5.1.1 CURRENT LIMIT ID107**

Current limit in amperes.

**P2.5.1.2 CHARGING LIMIT ID1290**

The charging current limit in percentage of Source Nom Current.

**P2.5.1.3 DISCHARGE LIMIT ID107**

The discharging current limit in percentage of Source Nom Current.

## 2.2 DC-LINK SIDE PARAMETERS

### 2.2.1 OVER VOLTAGE CONTROL FOR DC-LINK VOLTAGE

Table 6. Over voltage control for DC-link voltage

| Code      | Parameter              | Min | Max | Unit | Default | ID   | Note                                                                                            |
|-----------|------------------------|-----|-----|------|---------|------|-------------------------------------------------------------------------------------------------|
| P 2.5.3.1 | Over voltage reference | 0   | 320 | %    | 118     | 1528 | A percentage of unit nominal DC-Link voltage.<br>500 Vac unit: 675 Vdc<br>690 Vac unit: 931 Vdc |
| P 2.5.3.2 | Over voltage droop     | 0   | 100 | %    | 0       | 1862 |                                                                                                 |

#### P2.5.3.1 OVER VOLTAGE REFERENCE ID1528

The over voltage reference in percentage of Nominal DC Voltage of the drive.

#### P2.5.3.2 OVER VOLTAGE DROOP ID1862

The over voltage reference drooping. The set drooping is reached when the active current is 100%.

### 2.2.2 UNDER VOLTAGE CONTROL FOR DC-LINK VOLTAGE

Table 7. Under voltage control for DC-link voltage

| Code      | Parameter               | Min | Max | Unit | Default | ID   | Note                                                                                       |
|-----------|-------------------------|-----|-----|------|---------|------|--------------------------------------------------------------------------------------------|
| P 2.5.2.1 | Under Voltage Reference | 0   | 320 | %    | 65      | 1567 | A percentage of nominal DC-Link voltage.<br>500 Vac unit: 675 Vdc<br>690 Vac unit: 931 Vdc |
| P 2.5.2.2 | Under Voltage Droop     | 0   | 100 | %    | 0       | 1863 |                                                                                            |

#### P2.5.2.1 UNDER VOLTAGE REFERENCE ID1567

The under voltage reference in percentage of Nominal DC Voltage of the drive.

#### P2.5.2.2 UNDER VOLTAGE DROOP ID1863

The under voltage reference drooping. The set drooping is reached when the active current is 100%.

**NOTE:** For more detailed parameter information, see the Vacon NX Programming Guide (DPD01886A).

### 3. CONTROL I/O

Table 8. Default I/O configuration

| NXOPTA1  |          |                                                                                         |                                                                                                                 |
|----------|----------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Terminal |          | Signal                                                                                  | Description                                                                                                     |
| 1        | +10 Vref | Reference voltage output                                                                | Voltage for potentiometer, etc.                                                                                 |
| 2        | AI1+     | Analogue input 1.<br>Range 0-10V, $R_i = 200\Omega$<br>Range 0-20 mA, $R_i = 250\Omega$ | Analogue input 1 Input range selected by jumpers.<br>Default range: Voltage 0-10 V                              |
| 3        | AI1-     | I/O ground                                                                              | Ground for reference and controls                                                                               |
| 4        | AI2+     | Analogue input 2.<br>Range 0-10V, $R_i = 200\Omega$<br>Range 0-20 mA, $R_i = 250\Omega$ | Analogue input 2<br>Input range selected by jumpers.                                                            |
| 5        | AI2-     |                                                                                         | Default range:<br>Current 0 – 20 mA                                                                             |
| 6        | +24V     | Control voltage output                                                                  | Voltage for switches, etc.<br>max 0.1 A                                                                         |
| 7        | GND      | I/O ground                                                                              | Ground for reference and controls                                                                               |
| 8        | DIN1     | Start Request<br>Programmable G2.3.1                                                    | Contact closed = Start Request                                                                                  |
| 9        | DIN2     | Programmable G2.3.1                                                                     | No function defined at default                                                                                  |
| 10       | DIN3     | Fault reset<br>Programmable G2.3.1                                                      | Rising edge will reset active faults.                                                                           |
| 11       | CMA      | Common for DIN 1—DIN 3                                                                  | Connect to GND or +24V                                                                                          |
| 12       | +24V     | Control voltage output                                                                  | Voltage for switches (see #6)                                                                                   |
| 13       | GND      | I/O ground                                                                              | Ground for reference and controls                                                                               |
| 14       | DIN4     | Programmable G2.3.1                                                                     | Contact closed = MCC Closed                                                                                     |
| 15       | DIN5     | Programmable G2.3.1                                                                     | No function defined at default                                                                                  |
| 16       | DIN6     | Programmable G2.3.1                                                                     | No function defined at default                                                                                  |
| 17       | CMB      | Common for DIN4—DIN6                                                                    | Connect to GND or +24V                                                                                          |
| 18       | AOA1+    | Analogue output 1<br>Programmable P2.3.1                                                | Output range selected by jumpers.<br>Range 0—20 mA. $R_L$ , max. 500 $\Omega$<br>Range 0—10 V. $R_L > 1k\Omega$ |
| 19       | AOA1-    |                                                                                         |                                                                                                                 |
| 20       | DOA1     | Digital output<br>Ready / Warning (Blinking)                                            | Programmable<br>Open collector, $I_s \leq 50mA$ ,<br>$U \leq 48 VDC$                                            |
| NXOPTA2  |          |                                                                                         |                                                                                                                 |
| 21       | RO 1     | Relay output 1<br>Programmable G2.4.1                                                   | Switchin capacity<br>24 VCD / 8 A<br>250 VAC / 8 A<br>125 VDC / 0.4 A                                           |
| 22       | RO 1     |                                                                                         |                                                                                                                 |
| 23       | RO 1     |                                                                                         |                                                                                                                 |
| 24       | RO 2     | Relay output 2                                                                          |                                                                                                                 |
| 25       | RO 2     |                                                                                         |                                                                                                                 |
| 26       | RO 2     |                                                                                         |                                                                                                                 |

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