

**VACON<sup>®</sup> NX**

**DC/DC DRIVES**

**ADFIF101**

**DC/DC CONVERTER**

**APPLICATION MANUAL**

**VACON<sup>®</sup>**



# Vacon® NXP DC/DC Converter Application

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## 1. INTRODUCTION

This manual describes the DC/DC converter application software that can be used with Vacon® NX products.

The DC/DC converter can be used to convert power between different DC-voltage levels. Typical applications are power conversion between battery and DC-link of a drive system or grid converter. The DC/DC converter can be used as a variable DC-voltage power supply.

This application requires the NXP3 control board and the VB761D version.

The capacitor and voltage measurements are optional, depending on the process requirements. The measurement itself can be given via analogue input or through fieldbus by power the management system. The measurement is used to smoothen the start, because the voltage control can be started at the correct level when it is known before start.

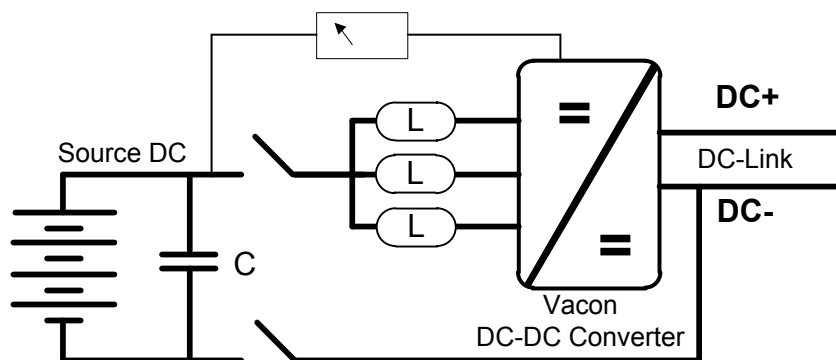


Figure 1, DC/DC connection

## 2. DC/DC APPLICATION COMPATIBILITY ISSUES

### V093 & V094

- **Compatibility note:** Source voltage limits in current control mode are now operating as limit regulators, thus it's possible to charge or discharge source while voltage stays at minimum or maximum limit. Read manual for updated descriptions or Source DC Voltage limits. [ADFIF101 DCDC New Source Voltage Limit Regulator](#)
- **Compatibility note:** On start charging and discharging current limits are released with ramp. default 1000,0 %/s
  - o P2.5.1.4 Charge Ramp Up ID1502
  - o P2.5.1.5 Discharge Ramp Up ID1532

### V109

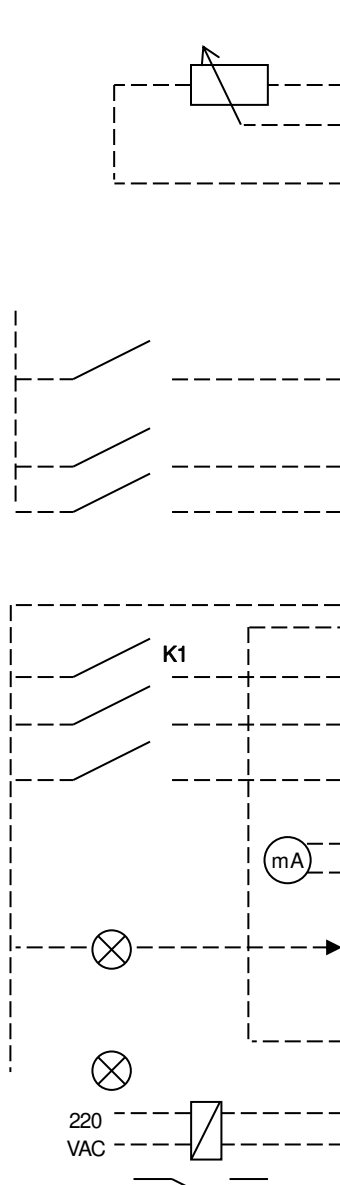
- **Compatibility note:** DC Ready signal is disabled by default. Select desirable operation for DC Ready signal behaviour with P2.4.6.2 DC Ready Mode

**Note 1:** This application parameters are not kept backwards compatible if new features or improvements would be difficult to implement by doing so. Read this change note and chapter "Compatibility issues in parameters between versions" from manual before updating the application.

**Note 2:** It's recommended to use compare function for parameter changes when updating application, especially in cases when version number change is considerably high.

Application is constantly developed; this includes changing parameter default values, and if parameters are directly downloaded to drive improved default values may be lost.

## 3. CONTROL I/O



| NXOPTA1  |                     |                                                                                                |                                                                                         |
|----------|---------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Terminal |                     | Signal                                                                                         | Description                                                                             |
| 1        | +10V <sub>ref</sub> | Reference voltage output                                                                       | Voltage for potentiometer, etc.                                                         |
| 2        | AI1+                | Analogue input 1.<br>Range 0-10V, R <sub>i</sub> = 200Ω<br>Range 0-20 mA R <sub>i</sub> = 250Ω | Analogue input 1<br>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.                                                                              | Analogue input 2                                                                        |
| 5        | AI2-                | Range 0-10V, R <sub>i</sub> = 200Ω<br>Range 0-20 mA R <sub>i</sub> = 250Ω                      | Input range selected by jumpers.<br>Default range: Current 0 – 20 mA                    |
| 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 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                                                                            | No function defined at default                                                          |
| 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                                                                              | Output range selected by jumpers.                                                       |
| 19       | AOA1-               | Programmable P2.3.1.2                                                                          | Range 0—20 mA. R <sub>L</sub> , max. 500Ω<br>Range 0—10 V. R <sub>L</sub> > 1kΩ         |
| 20       | DOA1                | Digital output<br>Ready / Warning (Blinking)                                                   | Programmable<br>Open collector, I <sub>L</sub> ≤ 50mA, U <sub>L</sub> ≤ 48 VDC          |
| NXOPTA2  |                     |                                                                                                |                                                                                         |
| 21       | RO1                 | RELAY OUTPUT 1<br>Programmable G2.4.1                                                          | Switching capacity<br>24 VDC / 8 A<br>250 VAC / 8 A<br>125 VDC / 0.4 A                  |
| 22       | RO1                 |                                                                                                |                                                                                         |
| 23       | -RO1-               |                                                                                                |                                                                                         |
| 24       | RO2                 | Relay output 2                                                                                 |    |
| 25       | RO2                 |                                                                                                |                                                                                         |
| 26       | RO2                 |                                                                                                |                                                                                         |

Table 3-1. Default I/O configuration.

K1

## 4. DC/DC APPLICATION – MONITORING VALUES

On the next pages you will find the lists of parameters within the respective parameter groups.

### 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                                                               |
|  | = On parameter code: Parameter value can only be changed after the Drive has been stopped. |
|  | = Monitoring value is possible to control from fieldbus by ID number                       |

The manual presents signals that are not normally visible for monitoring. i.e. is not a parameter or standard monitoring signal. These signals are presented with [a letter]. e.g.

[FW]Motor Regulator Status

|      |                                                                                             |
|------|---------------------------------------------------------------------------------------------|
| [V]  | Normal monitoring signal                                                                    |
| [P]  | Normal parameter in application.                                                            |
| [FW] | Firmware signal, Can be monitored with NCDrive when signal type is selected Firmware        |
| [A]  | Application signal, can be monitored with NCDrive when signal type is selected Application. |
| [R]  | Reference type parameter on keypad.                                                         |
| [F]  | Function. Signal is received as an output of function.                                      |
| [DI] | Digital input signal.                                                                       |

#### 4.1 MONITORING VALUES

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.

##### 4.1.1 MONITORING 1 VALUES

| Code  | Signal                   | Unit | Form.   | ID   | Description                                                                                                                            |
|-------|--------------------------|------|---------|------|----------------------------------------------------------------------------------------------------------------------------------------|
| V1.1  | Source Current           | A    | Varies  | 1104 |                                                                                                                                        |
| V1.2  | Source Voltage           | V    | #, #    | 1107 | Estimated at run state                                                                                                                 |
| V1.3  | Active Current Reference | %    | #, #    | 1704 |                                                                                                                                        |
| V1.4  | Active Current           | %    | #, #    | 1125 | Active current of the drive in % of Source Nominal Current<br>> 0 Current from DC-Link To Source<br>< 0 Current from Source to DC-Link |
| V1.5  | Source DC Ref.           | %    | #, #, # | 606  |                                                                                                                                        |
| V1.6  | Source DC Act.           | %    | #, #, # | 1873 | Run state calculated, scaled.                                                                                                          |
| V1.7  | Source Meas. DC          | %    | #, #, # | 1866 |                                                                                                                                        |
| V1.8  | Source Meas. Vdc         | Vdc  | #, #    | 1164 | Voltage feedback signal selected in P2.6.4.1                                                                                           |
| V1.9  | DC-Link Current          | %    | #, #    | 1861 |                                                                                                                                        |
| V1.10 | DC-Link Voltage          | V    | #       | 1108 | Measured DC Link voltage in Volts, filtered                                                                                            |
| V1.11 | DC-Link Act.             | %    | #, #, # | 7    | Percentage of source nominal voltage                                                                                                   |
| V1.12 | Unit Temperature         | °C   | #       | 1109 | Heatsink temperature                                                                                                                   |
| V1.13 | Status Word              |      | #       | 43   |                                                                                                                                        |

##### 4.1.2 MONITORING 2 VALUES

| Code     | Signal                   | Unit | Form.   | ID   | Description                      |
|----------|--------------------------|------|---------|------|----------------------------------|
| V1.15.1  | DC Voltage               | V    | #       | 44   | Unfiltered                       |
| V1.15.2  | Current                  | A    | Varies  | 1113 | Unfiltered                       |
| V1.15.3  | IU Current               | %    | #, #    | 1851 |                                  |
| V1.15.4  | IV Current               | %    | #, #    | 1852 |                                  |
| V1.15.5  | IW Current               | %    | #, #    | 1868 |                                  |
| V1.15.6  | Power kW                 | kW   | Varies  | 1508 |                                  |
| V1.15.7  | Discharging Limit        | %    | #, #    | 1855 |                                  |
| V1.15.8  | Charging Limit           | %    | #, #    | 1854 |                                  |
| V1.15.9  | Mindex                   | %    | #, #, # | 1856 |                                  |
| V1.15.10 | Power Ref. %             | %    | #, #    | 1700 |                                  |
| V1.15.11 | Power Act. %             | %    | #, #    | 5    |                                  |
| V1.15.12 | DIN Status Word 1        |      | #       | 56   |                                  |
| V1.15.13 | DIN Status Word 2        |      | #       | 57   |                                  |
| V1.15.14 | Measured Temperature Max | °C   | #, #    | 42   |                                  |
| V1.15.15 | Meas. Temp 1             | °C   | #, #    | 51   |                                  |
| V1.15.16 | Meas. Temp 2             | °C   | #, #    | 52   |                                  |
| V1.15.17 | Meas. Temp 3             | °C   | #, #    | 53   |                                  |
| V1.15.18 | Meas. Temp 4             | °C   | #, #    | 69   |                                  |
| V1.15.19 | Meas. Temp 5             | °C   | #, #    | 70   |                                  |
| V1.15.20 | Meas. Temp 6             | °C   | #, #    | 71   |                                  |
| V1.15.21 | Voltage U                | %    | #, #, # | 3203 | Scaled to unit nominal 675 / 931 |
| V1.15.22 | Voltage V                | %    | #, #, # | 3204 | Scaled to unit nominal 675 / 931 |
| V1.15.23 | Voltage W                | %    | #, #, # | 3205 | Scaled to unit nominal 675 / 931 |
| V1.15.24 | Status Word 2            |      | #       | 89   |                                  |

## 4.1.3 FIELDBUS VALUES

| Code     | Signal               | Unit | Form. | ID   | Description |
|----------|----------------------|------|-------|------|-------------|
| V1.16.1  | FB Control Word      |      | #     | 1160 |             |
| V1.16.2  | FB Voltage Reference | %    | #,##  | 875  |             |
| V1.16.3  | FB Status Word       |      | #     | 68   |             |
| V1.16.4  | FB Current Reference | %    | #,##  | 1140 |             |
| V1.16.5  | FB Power Reference   | %    | #,##  | 1141 |             |
| V1.16.6  | Warning No.          |      | #     | 74   |             |
| V1.16.7  | Fault No.            |      | #     | 37   |             |
| V1.16.8  | Fault Word 1         |      | #     | 1172 |             |
| V1.16.9  | Fault Word 2         |      | #     | 1173 |             |
| V1.16.10 | Warning Word 1       |      | #     | 1174 |             |
| V1.16.11 | Analogue Input 1     |      | #,##  | 13   |             |
| V1.16.12 | Analogue Input 2     |      | #,##  | 14   |             |
| V1.16.13 | Analogue Input 3     |      | #,##  | 27   |             |
| V1.16.14 | Analogue Input 4     |      | #,##  | 28   |             |
| V1.16.15 | Analogue Output 1    |      | #,##  | 26   |             |
| V1.16.16 | Analogue Output 2    |      | #,##  | 31   |             |
| V1.16.17 | FB Analog Out        | %    | #,##  | 48   |             |

## 4.1.4 MASTER-FOLLOWER VALUES

| Code    | Signal         | Unit | Form. | ID   | Description         |
|---------|----------------|------|-------|------|---------------------|
| V1.17.1 | Master CW      |      | #     | 93   | Master Control Word |
| V1.17.2 | Status Word D1 |      | #     | 1615 |                     |
| V1.17.3 | Status Word D2 |      | #     | 1602 |                     |
| V1.17.4 | Status Word D3 |      | #     | 1603 |                     |
| V1.17.5 | Status Word D4 |      | #     | 1604 |                     |

## 4.1.5 VOLTAGE REFERENCE CHAIN

| Code    | Signal               | Unit | Form. | ID   | Description                   |
|---------|----------------------|------|-------|------|-------------------------------|
| V1.18.1 | Source DC Ref In     | %    | #,##  | 1127 | Voltage reference before ramp |
| V1.18.2 | Source DC Ref.       | %    | #,##  | 606  | Voltage reference after ramp  |
| V1.18.3 | Source Ref. Final    | %    | #,##  | 1131 |                               |
| V1.18.4 | Source Measured DC   | %    | #,##  | 1866 |                               |
| V1.18.5 | Source Vdc Ref. In   | Vdc  | #,##  | 1126 |                               |
| V1.18.6 | Source Vdc Ref.      | Vdc  | #,##  | 1129 |                               |
| V1.18.7 | Source Vdc Ref Final | Vdc  | #,##  | 1128 |                               |
| V1.18.8 | Source Meas Vdc      | Vdc  | #,##  | 1164 |                               |

## 4.1.6 CLOSED LOOP MONITOR (VOLTAGE)

| Code    | Signal       | Unit | Form. | ID | Description |
|---------|--------------|------|-------|----|-------------|
| V1.19.1 | PI Reference | %    | #,##  | 20 |             |
| V1.19.2 | PI Actual    | %    | #,##  | 21 |             |
| V1.19.3 | PI Output    | #    | #,##  | 23 |             |

## 4.2 MONITORING VALUES DESCRIPTION

### 4.2.1 MONITORING 1 VALUES

#### **V1.1      *Source Current*    A      ID1104**

Sum current of all phases.

#### **V1.2      *Source Voltage*    V      ID1107**

Estimated source voltage. Value is update when drive is in run state.

#### **V1.3      *Active Current Reference*      %      ID1704**

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.

#### **V1.4      *Active Current*    %      ID1125**

Active current of the drive in percentage of Source Nominal Current

Active Current > 0: Current flow from Drive DC-Link to Source.

Active Current < 0: Current flow from Source to Drive DC-Link.

#### **V1.5      *Source DC Ref.*    %      ID606**

DC Reference for the DC Source Voltage. Percentage of Source Nom Voltage parameter.

#### **V1.6      *Source DC Act.*    %      ID1873**

DC Actual of the DC Source in percentage of Source Nom Voltage. Value is update when drive is in run state.

#### **V1.7      *Source Measured DC*    %      #,##    ID1866**

Measured DC Voltage.

If Source DC voltage is available by external measurement make connection to this by Voltage feedback analogue input signal selected in P2.6.4.1.

If used Closed Loop Control and given trough fieldbus use Fast fieldbus communication and FB Process Data In 1 channel for actual value by connecting to this monitoring signal ID1866.

#### **V1.8      *Source Measured Vdc*    Vdc      ID1164**

Measured DC Voltage in Vdc for Closed Loop control and for starting voltage.

#### **V1.9      *DC-Link Current*      %      ID1861**

Calculated DC-Link Current in percentage of Source Nom Current.

#### **V1.10      *DC-Link Voltage*    V      ID1108**

Measured DC-link voltage in Vdc

**V1.11 DC-Link Act. % ID7**

Measured DC-Link voltage in percentage of Source Nom Voltage.

**V1.12 Unit Temperature °C ID1109**

The highest measured drive temperature.

**V1.13 Status Word ID43**

Application Status Word combines different drive statuses to one data word.

| Application Status Word ID43 |                                   |                                   |
|------------------------------|-----------------------------------|-----------------------------------|
|                              | FALSE                             | TRUE                              |
| b0                           | Closed Loop Control not active    | Closed Loop Control active        |
| b1                           | Not in Ready state                | Ready                             |
| b2                           | Not Running                       | Running                           |
| b3                           | No Fault                          | Fault                             |
| b4                           | Discharging disabled, low voltage | Discharging Allowed               |
| b5                           | Charging Disabled, high voltage   | Charging Allowed                  |
| b6                           | Run Disabled                      | Run Enable                        |
| b7                           | No Warning                        | Warning                           |
| b8                           |                                   | Charging Switch closed (internal) |
| b9                           |                                   | Over Voltage Regulator Active     |
| b10                          |                                   | Under Voltage regulator active.   |
| b11                          | Quick Stop Not Active             | Quick Stop Active                 |
| b12                          | No Run Request                    | Run Request                       |
| b13                          |                                   | One or more regulators active     |
| b14                          | Current/Power Control Mode        | Voltage Control Mode.             |
| b15                          |                                   |                                   |

**4.2.2 MONITORING 2 VALUES****V1.15.1 DC Voltage V ID44**

Unfiltered DC-Link Voltage in V.

**V1.15.2 Current A ID1113**

Unfiltered source DC current in A.

**V1.15.3 IU Current % ID1851**

Unfiltered U phase current.

**V1.15.4 IV Current % ID1852**

Unfiltered U phase current.

**V1.15.5 IW Current % ID1868**

Unfiltered U phase current.

**V1.15.6 Power kWkW ID1508**

Calculated kW value of power flow.

**V1.15.7 Discharge Limit % ID1855**

Used Active discharge current limit, limit is showing 1/3 % of source nominal current. i.e. limit is per phase.

**V1.15.8 Charging Limit % ID1854**

Used Active charge current limit, limit is showing 1/3 % of source nominal current. i.e. limit is per phase.

**V1.15.9 Mindex % ID 1856**

Voltage reference as % of unit nominal voltage (500 V / 690 V)

**V1.15.10 Power Ref. % % ID1700**

Percentage power reference. Shown correctly when Power Control mode or Current Control mode active.

**V1.15.11 Power Act. % % ID5**

Percentage power value scaled to Source Nom Power parameter.

**V1.15.12 DIN Status 1 ID 56****V1.15.13 DIN Status 2 ID 57**

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

**V1.15.14 Measured Temperature °C ID42**

Maximum temperature of the first used measurement board.

|                        |                            |                  |                    |                     |
|------------------------|----------------------------|------------------|--------------------|---------------------|
| <b><i>V1.15.15</i></b> | <b><i>Meas. Temp 1</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 51</i></b> |
| <b><i>V1.15.16</i></b> | <b><i>Meas. Temp 2</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 52</i></b> |
| <b><i>V1.15.17</i></b> | <b><i>Meas. Temp 3</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 53</i></b> |
| <b><i>V1.15.18</i></b> | <b><i>Meas. Temp 4</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 69</i></b> |
| <b><i>V1.15.19</i></b> | <b><i>Meas. Temp 5</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 70</i></b> |
| <b><i>V1.15.20</i></b> | <b><i>Meas. Temp 6</i></b> | <b><i>°C</i></b> | <b><i>#, #</i></b> | <b><i>ID 71</i></b> |

Separate measurement from two temperature measurement boards. The signal has 4 s filtering time.

|                        |                          |                     |                      |                      |
|------------------------|--------------------------|---------------------|----------------------|----------------------|
| <b><i>V1.15.21</i></b> | <b><i>Voltage U</i></b>  | <b><i>%</i></b>     | <b><i>#, ##</i></b>  | <b><i>ID3203</i></b> |
| <b><i>V1.15.22</i></b> | <b><i>Voltage V</i></b>  | <b><i>%</i></b>     | <b><i>#, ##</i></b>  | <b><i>ID3204</i></b> |
| <b><i>V1.15.23</i></b> | <b><i>Voltage W%</i></b> | <b><i>#, ##</i></b> | <b><i>ID3205</i></b> |                      |

Phase voltages, scaled to unit nominal voltage.

500 Vac unit: 674 Vdc

690 Vac unit: 931 Vdc

#### ***V1.15.24*** ***Status Word 2*** ***ID89***

Application Status Word 2 combines different drive statuses to one data word.

| Application Status Word 2 ID89 |                 |                      |
|--------------------------------|-----------------|----------------------|
|                                | FALSE           | TRUE                 |
| b0                             |                 |                      |
| b1                             |                 |                      |
| b2                             |                 |                      |
| b3                             | Not Charging    | Charging > 0,5 %     |
| b4                             | Not Discharging | Discharging < -0,5 % |
| b5                             |                 |                      |
| b6                             |                 |                      |
| b7                             |                 |                      |
| b8                             |                 |                      |
| b9                             |                 |                      |
| b10                            |                 |                      |
| b11                            |                 |                      |
| b12                            |                 |                      |
| b13                            |                 |                      |
| b14                            |                 |                      |
| b15                            |                 |                      |

#### 4.2.3 FIELDBUS MONITORING VALUES

See detail descriptions from chapter Control and Status words

##### ***V1.16.1    FB Control Word            ID 1160***

Control word from fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode. See details from chapter 8 Fieldbus profile for Vacon DC/DC Drive.

| FB Control Word ID1160 |              |                                                                      |
|------------------------|--------------|----------------------------------------------------------------------|
| Bit                    | Signal       | Comment                                                              |
| B00                    | DC Charge    | 0=<br>1= Charge DC                                                   |
| B01                    |              |                                                                      |
| B02                    |              |                                                                      |
| B03                    | Run          | 0= DC/DC Converter is stopped<br>1= DC/DC Converter is started       |
| B04                    |              |                                                                      |
| B05                    |              |                                                                      |
| B06                    |              |                                                                      |
| B07                    | Reset        | 0>1 Reset fault.                                                     |
| B08                    |              |                                                                      |
| B09                    |              |                                                                      |
| B10                    | PLC Control  | 0= Disable FB Control<br>1= Enable FB Control                        |
| B11                    | FB DIN1 / WD | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B12                    | FB DIN2      | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B13                    | FB DIN3      | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B14                    | FB DIN4      | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B15                    |              |                                                                      |

##### ***V1.16.2    FB Voltage Reference    [%]    ID875***

Voltage reference from fieldbus. Connection to here is made with ID number with Fieldbus data mapping.

**V1.16.3    FB Status Word    ID 68**

Status word to fieldbus. Below table is for bypass operation for such fieldbus board that natively supports this or can be parameterized to bypass mode.

| FB Status Word ID68 |                         |                                                                               |
|---------------------|-------------------------|-------------------------------------------------------------------------------|
|                     | Signal                  | Comment                                                                       |
| B00                 | Ready On                | 0=Drive not ready to switch on<br>1=Drive ready to start charging             |
| B01                 | Ready Run               | 0=Drive not ready to run<br>1=Drive ready and Main Contactor is ON            |
| B02                 | Running                 | 0=Drive not running<br>1=Drive in Run state (Modulating)                      |
| B03                 | Fault                   | 0=No active fault<br>1=Fault is active                                        |
| B04                 | Run Enable Status       | 0= Run Disabled. Drive in stop state<br>1= Run Enabled. Drive can be started. |
| B05                 |                         |                                                                               |
| B06                 | Inhibit                 | 0= Drive in operating condition.<br>1= Run disabled or fault state.           |
| B07                 | Warning                 | 0= No active warnings<br>1= Warning active                                    |
| B08                 |                         |                                                                               |
| B09                 | Fieldbus Control Active | 0=Fieldbus control not active<br>1=Fieldbus control active                    |
| B10                 |                         |                                                                               |
| B11                 |                         |                                                                               |
| B12                 |                         |                                                                               |
| B13                 |                         |                                                                               |
| B14                 |                         |                                                                               |
| B15                 | WD Pulse                | Feedback from FB Control Word B11                                             |

**V1.16.4    FB Current Reference    [%]    ID1140**

Current reference from fieldbus. Connection to here is made with ID number with Fieldbus data mapping.

**V1.16.5    FB Power Reference    [%]    ID1141**

Power reference from fieldbus. Connection to here is made with ID number with Fieldbus data mapping.

**V1.16.6    Warning No.    ID74**

Number if last active warning.

**V1.16.7    Fault No.    ID37**

Number if last active fault.

***V1.16.8    Fault Word 1                    ID1172***

|     | Fault Word 1 ID1172                      |
|-----|------------------------------------------|
| Bit | Fault(s)                                 |
| B0  | F1 Over current, F31 IGBT, F41 IGBT      |
| B1  | F2 Over Voltage                          |
| B2  | F9 Under Voltage                         |
| B3  |                                          |
| B4  | F3 Earth Fault                           |
| B5  |                                          |
| B6  | F14 Unit Over Temperature                |
| B7  | F29 Thermistor                           |
| B8  |                                          |
| B9  |                                          |
| B10 |                                          |
| B11 | F52 Keypad or F52 PC communication fault |
| B12 | F53 FieldBus fault                       |
| B13 |                                          |
| B14 | F54 Slot Communication fault             |
| B15 | F50 4mA fault                            |

***V1.16.9    Fault Word 2                    ID 1173***

|     | Fault Word 2 ID1173 |
|-----|---------------------|
| Bit | Fault(s)            |
| B0  |                     |
| B1  |                     |
| B2  |                     |
| B3  |                     |
| B4  |                     |
| B5  |                     |
| B6  | F51 External fault  |
| B7  |                     |
| B8  |                     |
| B9  | F31 IGBT, F41 IGBT  |
| B10 |                     |
| B11 |                     |
| B12 |                     |
| B13 |                     |
| B14 |                     |
| B15 |                     |

**V1.16.10 Warning Word 1 ID 1174**

| Warning Word 1 ID1174 |                         |
|-----------------------|-------------------------|
| Bit                   | Warning(s)              |
| B0                    |                         |
| B1                    | W29 Thermistor          |
| B2                    |                         |
| B3                    |                         |
| B4                    |                         |
| B5                    |                         |
| B6                    | F53 FB Warning          |
| B7                    |                         |
| B8                    | F14 Over Temperature    |
| B9                    |                         |
| B10                   |                         |
| B11                   | W63 or F63 Quick Stop   |
| B12                   | W62 or F62 Run Disabled |
| B13                   |                         |
| B14                   |                         |
| B15                   |                         |

**V1.16.11 Analogue input 1 % ID 13****V1.16.12 Analogue input 2 % ID 14**

Unfiltered analogue input level.

0 % = 0 mA / 0 V, - 100 % = - 10 V, 100 % = 20 mA / 10 V.

Monitoring scaling is determined by the option board parameter.

**V1.16.13 Analogue input 3 % ID 27****V1.16.14 Analogue input 4 % ID 28**

It is possible to adjust this input value from fieldbus when the input terminal selection is 0.1. This way it is possible to adjust the free analogue input from fieldbus and have all analogue input functions available for fieldbus process data.

**V1.16.15 Analogue Out 1 % ID 26****V1.16.16 Analogue Out 2 % ID 31**

Analogue Output value 0 % = 0 mA / 0 V, 100 % = 20 mA / 10 V

**V1.16.17 FB Analog Out % #,## ID48**

## 4.2.4 MASTER-FOLLOWER MONITORING VALUES

***V1.17.1 Master CW ID93***

SystemBus Master Control word that is send by master drive and received by follower drives.

|     | Master Control Word ID93 |         |
|-----|--------------------------|---------|
|     | Signal                   | Comment |
| b0  |                          |         |
| b1  |                          |         |
| b2  |                          |         |
| b3  | Fault Reset              |         |
| b4  | Master Running           |         |
| b5  |                          |         |
| b6  |                          |         |
| b7  | WD Pulse                 |         |
| b8  |                          |         |
| b9  | Datalogger Trig command  |         |
| b10 |                          |         |
| b11 |                          |         |
| b12 |                          |         |
| b13 |                          |         |
| b14 | Voltage Control          |         |
| b15 |                          |         |

***V1.17.2 Status Word D1 ID1615***

***V1.17.3 Status Word D2 ID1602***

***V1.17.4 Status Word D3 ID1603***

***V1.17.5 Status Word D4 ID1604***

Follower status words received by SystemBus master drive from followers.

|     | Follower Status Word |         |
|-----|----------------------|---------|
|     | Signal               | Comment |
| b0  |                      |         |
| b1  | Ready                |         |
| b2  | Run                  |         |
| b3  | Fault                |         |
| b4  | Charge SW State      |         |
| b5  |                      |         |
| b6  | Run Enable           |         |
| b7  | Warning              |         |
| b8  |                      |         |
| b9  |                      |         |
| b10 | Synchronized         |         |
| b11 |                      |         |
| b12 | Run Request          |         |
| b13 | Limit Regulator      |         |
| b14 |                      |         |
| b15 | WD Pulse             |         |

## 4.2.5 VOLTAGE REFERENCE CHAIN

***V1.18.1 Source DC Ref. In % ID1127***

DC Reference for the DC Source voltage before the ramp.

***V1.18.2 Source DC Ref. % ID606***

DC Reference for the DC Source Voltage after the ramp. Percentage of Source Nom Voltage parameter.

***V1.18.3 Source Ref. Final % ID1131***

DC Reference for the DC Source Voltage after Closed Loop PI controller.

***V1.18.4 Source Measured DC % ID1866***

Measured Source DC Voltage.

If Source DC voltage is available by external measurement make connection to this by Voltage feedback analogue input signal selected in P2.6.4.1.

If used Closed Loop Control and given through fieldbus use Fast fieldbus communication and FB Process Data In 1 channel for actual value.

***V1.18.5 Source Vdc Ref. In Vdc #,# ID1126***

DC Reference for the DC Source voltage before the ramp.

***V1.18.6 Source Vdc Ref. Vdc #,# ID1129***

DC Reference for the DC Source Voltage after the ramp. Percentage of Source Nom Voltage parameter.

***V1.18.7 Source Vdc Ref Final Vdc #,# ID1128***

DC Reference for the DC Source Voltage after Closed Loop PI controller.

***V1.18.8 Source Meas. Vdc Vdc #,# ID 1164***

Measured Source DC Voltage.

If Source DC voltage is available by external measurement make connection to this by Voltage feedback analogue input signal selected in P2.6.4.1.

#### 4.2.6 CLOSED LOOP MONITOR (VOLTAGE)

***V1.19.1 PI Reference % ### ID 20***

Voltage reference used by closed loop voltage controller.

***V1.19.2 PI Actual % ### ID 21***

Actual voltage used by closed loop voltage controller.

***V1.19.3 PI Output % ### ID 23***

Output of the closed loop voltage controller. This output is added to final DC Voltage Reference.

## 5. PARAMETER LIST (CONTROL KEYPAD: MENU M2)

### 5.1 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 | 24   | 1203   | V    | 400<br>690 | 110  |                                             |
| P2.1.3 | Source Nom Power   | 0    | 32000  | kW   | 0          | 116  |                                             |
| P2.1.4 | Control Mode       | 0    | 2      |      | 0          | 1858 | 0 = Current<br>1 = Voltage<br>2 = Power     |
| P2.1.5 | Voltage Reference  | 0    | 320    | %    | 100        | 1462 |                                             |
| P2.1.6 | Current Reference  | -150 | 150    | %    | 0          | 1860 | Common current reference                    |
| P2.1.7 | Power Reference    | -150 | 150    | %    | 0          | 1869 | Common power reference                      |
| P2.1.8 | Identification     | 0    | 1      |      | 0          | 631  | 0 = No Action<br>1 = Current. Meas. Offset. |

Table 5-1. Basic parameters

### 5.2 REFERENCE HANDLING

#### 5.2.1 REFERENCE HANDLING

| Code   | Parameter            | Min | Max | Unit | Default | ID   | Note                                                                                       |
|--------|----------------------|-----|-----|------|---------|------|--------------------------------------------------------------------------------------------|
| P2.2.1 | IO Control Mode      | 0   | 3   |      | 0       | 1856 | 0 = Control Mode P2.1.4<br>1 = Current Control<br>2 = Voltage Control<br>3 = Power Control |
| P2.2.2 | IO Voltage Ref Sel.  | 0   | 1   |      | 0       | 117  | 0 = Voltage Ref. ID1462<br>1 = FB Voltage Ref. ID875                                       |
| P2.2.3 | IO Current Ref. Sel. | 0   | 1   |      | 0       | 131  | 0 = Current Ref. ID1860<br>1 = FB Current Ref. ID1140                                      |
| P2.2.4 | IO Power Ref. Sel.   | 0   | 1   |      | 0       | 1620 | 0 = Power Ref. ID1869<br>1 = FB Power Ref. ID1141                                          |
| P2.2.5 | FB Control Mode      | 0   | 3   |      | 0       | 1848 | 0 = Control Mode ID1858<br>1 = Current Control<br>2 = Voltage Control<br>3 = Power Control |
| P2.2.6 | FB Voltage Ref Sel.  | 0   | 1   |      | 0       | 112  | 0 = Voltage Ref. ID1462<br>1 = FB Voltage Ref. ID875                                       |
| P2.2.7 | FB Current Ref. Sel. | 0   | 1   |      | 0       | 641  | 0 = Current Ref. ID1860<br>1 = FB Current Ref. ID1140                                      |
| P2.2.8 | FB Power Ref. Sel.   | 0   | 1   |      | 0       | 1621 | 0 = Power Ref. ID1869<br>1 = FB Power Ref. ID1141                                          |

Table 5-2. Current Reference Handling

#### 5.2.2 VOLTAGE REFERENCE

| Code     | Parameter                   | Min | Max  | Unit | Default | ID   | Note              |
|----------|-----------------------------|-----|------|------|---------|------|-------------------|
| P2.2.9.1 | Drooping                    | 0   | 100  | %    | 0       | 620  |                   |
| P2.2.9.2 | Voltage Reference Ramp Rate | -1  | 3200 | %/s  | 5       | 1867 | <0 = No ramp      |
| P2.2.9.3 | Direct Vdc Control          | 0   | 1    |      | 0       | 1743 | 0 = No<br>1 = Yes |

Table 5-3. Voltage Reference Handling

### 5.2.3 CURRENT REFERENCE

| Code      | Parameter            | Min     | Max    | Unit | Default | ID   | Note                                                   |
|-----------|----------------------|---------|--------|------|---------|------|--------------------------------------------------------|
| P2.2.10.1 | Curr.Ref.RampUp      | -1,0    | 3200,0 | %/s  | -1,0    | 1810 |                                                        |
| P2.2.10.2 | CurrRefRampDown      | -1,0    | 3200,0 | %/s  | -1,0    | 1811 |                                                        |
| P2.2.10.3 | Phase Reference Mode | 0       | 3      |      | 0       | 1859 | 0 = Average<br>1 = Individual<br>2 = Same<br>3 = Same+ |
| P2.2.10.4 | Constant Reference 1 | -320,00 | 320,00 | %    | 0,0     | 1239 |                                                        |
| P2.2.10.5 | Constant Reference 2 | -320,00 | 320,00 | %    | 0,0     | 1240 |                                                        |
| P2.2.10.6 | IU Current Reference | -300    | 300    | %    | 0       | 128  |                                                        |
| P2.2.10.7 | IV Current Reference | -300    | 300    | %    | 0       | 129  |                                                        |
| P2.2.10.8 | IW Current Reference | -300    | 300    | %    | 0       | 130  |                                                        |

Table 5-4. Current Reference Handling

### 5.2.4 START REFERENCE HANDLING

| Code      | Parameter                  | Min | Max | Unit | Default | ID   | Note                                                                        |
|-----------|----------------------------|-----|-----|------|---------|------|-----------------------------------------------------------------------------|
| P2.2.11.1 | Voltage Reference At Start | 0   | 2   |      | 3       | 1864 | 0 = Reference<br>1 = Start Voltage Reference<br>2 = Measurement<br>3 = 80 % |
| P2.2.11.2 | Start Voltage Reference    | 0   | 320 | %    | 90      | 1865 |                                                                             |

Table 5-4. Start Reference Handling

### 5.3 INPUT SIGNALS

#### 5.3.1 BASIC SETTINGS

| Code     | Parameter        | Min | Max | Unit | Default | ID  | Description                                            |
|----------|------------------|-----|-----|------|---------|-----|--------------------------------------------------------|
| P2.3.1.1 | Start/Stop Logic | 0   | 2   |      | 0       | 300 | 0 = Start-No Act<br>1 = RPuls-FPuls<br>2 = RPuls-RPuls |

Table 5-5. Basic Settings

#### 5.3.2 DIGITAL INPUTS

| Code      | Parameter           | Min | Max  | Unit  | Default | ID   | Description |
|-----------|---------------------|-----|------|-------|---------|------|-------------|
| P2.3.1.1  | Start Signal 1      | 0.1 | E.10 | DigIn | A.1     | 403  |             |
| P2.3.2.2  | Start Signal 2      | 0.1 | E.10 | DigIn | 0.1     | 404  |             |
| P2.3.2.3  | Run Enable          | 0.1 | E.10 | DigIn | 0.2     | 407  |             |
| P2.3.2.4  | Fault Reset         | 0.1 | E.10 | DigIn | A.3     | 414  |             |
| P2.3.2.5  | External fault      | 0.1 | E.10 | DigIn | 0.1     | 405  |             |
| P2.3.2.6  | External fault      | 0.1 | E.10 | DigIn | 0.1     | 406  |             |
| P2.3.2.7  | Enable Constant Ref | 0.1 | E.10 | DigIn | 0.1     | 532  |             |
| P2.3.2.8  | Constant Ref. 1     | 0.1 | E.10 | DigIn | 0.1     | 530  |             |
| P2.3.2.9  | Constant Ref. 2     | 0.1 | E.10 | DigIn | 0.1     | 531  |             |
| P2.3.2.10 | I/O Term Control    | 0.1 | E.10 | DigIn | 0.1     | 409  |             |
| P2.3.2.11 | Keypad Control      | 0.1 | E.10 | DigIn | 0.1     | 410  |             |
| P2.3.2.12 | Fieldbus Control    | 0.1 | E.10 | DigIn | 0.1     | 411  |             |
| P2.3.2.13 | DC CB State         | 0.1 | E.10 | DigIn | 0.1     | 1453 |             |
| P2.3.2.14 | Thermal Switch      | 0.1 | E.10 | DigIn | 0.2     | 1179 |             |
| P2.3.2.15 | Quick Stop          | 0.1 | E.10 | DigIn | 0.2     | 1213 |             |
| P2.3.2.16 | Charge Limit 1      | 0.1 | E.10 | DigIn | 0.1     | 1500 |             |
| P2.3.2.17 | Charge Limit 2      | 0.1 | E.10 | DigIn | 0.1     | 1501 |             |
| P2.3.2.18 | Discharge Limit 1   | 0.1 | E.10 | DigIn | 0.1     | 1506 |             |
| P2.3.2.19 | Discharge Limit 2   | 0.1 | E.10 | DigIn | 0.1     | 1624 |             |
| P2.3.2.20 | Cooling Monitor     | 0.1 | E.10 | DigIn | 0.2     | 750  |             |
| P2.3.2.21 | Klixon In 1         | 0   | E.10 | DigIn | 0.2     | 780  |             |
| P2.3.2.22 | Klixon In 2         | 0   | E.10 | DigIn | 0.2     | 781  |             |
| P2.3.2.23 | Input Switch        | 0   | E.10 | DigIn | 0.2     | 1209 |             |
| P2.3.2.24 | Ambient Temp        | 0   | E.10 | DigIn | 0.2     | 783  |             |

Table 5-6. Digital inputs parameters

## 5.3.3 ANALOGUE INPUT 1

| Code     | Parameter                            | Min     | Max    | Unit | Default | ID   | Note |
|----------|--------------------------------------|---------|--------|------|---------|------|------|
| P2.3.3.1 | AI1 signal selection                 | 0.1     | E.10   |      | 0.1     | 377  |      |
| P2.3.3.2 | AI1 filter time                      | 0,000   | 32,000 | s    | 0,000   | 324  |      |
| P2.3.3.3 | AI1 custom minimum setting           | -160,00 | 160,00 | %    | 0,00    | 321  |      |
| P2.3.3.4 | AI1 custom maximum setting           | -160,00 | 160,00 | %    | 100,00  | 322  |      |
| P2.3.3.5 | AI1 signal inversion                 | 0       | 1      |      | 0       | 387  |      |
| P2.3.3.6 | AI1 reference scaling, minimum value | -32000  | 32000  |      | 0       | 303  |      |
| P2.3.3.7 | AI1 reference scaling, maximum value | -32000  | 32000  |      | 0       | 304  |      |
| P2.3.3.8 | AI1 Controlled ID                    | 0       | 10000  |      | 0       | 1507 |      |

Table 5-7. ANALOG INPUT 1,

## 5.3.4 ANALOGUE INPUT 2

| Code     | Parameter                            | Min     | Max    | Unit | Default | ID   | Note |
|----------|--------------------------------------|---------|--------|------|---------|------|------|
| P2.3.4.1 | AI2 signal selection                 | 0.1     | E.10   |      | 0.1     | 388  |      |
| P2.3.4.2 | AI2 filter time                      | 0,000   | 32,000 | s    | 0,000   | 329  |      |
| P2.3.4.3 | AI2 custom minimum setting           | -160,00 | 160,00 | %    | 0,00    | 326  |      |
| P2.3.4.4 | AI2 custom maximum setting           | -160,00 | 160,00 | %    | 100,00  | 327  |      |
| P2.3.4.5 | AI2 signal inversion                 | 0       | 1      |      | 0       | 398  |      |
| P2.3.4.6 | AI2 reference scaling, minimum value | -32000  | 32000  |      | 0       | 393  |      |
| P2.3.4.7 | AI2 reference scaling, maximum value | -32000  | 32000  |      | 0       | 394  |      |
| P2.3.4.8 | AI2 Controlled ID                    | 0       | 10000  |      | 0       | 1511 |      |

Table 5-8. ANALOG INPUT 2,

## 5.3.5 ANALOGUE INPUT 3

| Code     | Parameter                            | Min     | Max    | Unit | Default | ID   | Note |
|----------|--------------------------------------|---------|--------|------|---------|------|------|
| P2.3.5.1 | AI3 signal selection                 | 0.1     | E.10   |      | 0.1     | 141  |      |
| P2.3.5.2 | AI3 filter time                      | 0,000   | 32,000 | s    | 0,000   | 142  |      |
| P2.3.5.3 | AI3 custom minimum setting           | -160,00 | 160,00 | %    | 0,00    | 144  |      |
| P2.3.5.4 | AI3 custom maximum setting           | -160,00 | 160,00 | %    | 100,00  | 145  |      |
| P2.3.5.5 | AI3 signal inversion                 | 0       | 1      |      | 0       | 151  |      |
| P2.3.5.6 | AI3 reference scaling, minimum value | -32000  | 32000  |      | 0       | 1037 |      |
| P2.3.5.7 | AI3 reference scaling, maximum value | -32000  | 32000  |      | 0       | 1038 |      |
| P2.3.5.8 | AI3 Controlled ID                    | 0       | 10000  |      | 0       | 1509 |      |

Table 5-9. ANALOG INPUT 3,

**5.3.6 ANALOGUE INPUT 4**

| Code     | Parameter                            | Min     | Max    | Unit | Default | ID   | Note |
|----------|--------------------------------------|---------|--------|------|---------|------|------|
| P2.3.6.1 | <a href="#">AI4 signal selection</a> | 0.1     | E.10   |      | 0.1     | 152  |      |
| P2.3.6.2 | AI4 filter time                      | 0,000   | 32,000 | s    | 0,000   | 153  |      |
| P2.3.6.3 | AI4 custom minimum setting           | -160,00 | 160,00 | %    | 0,00    | 155  |      |
| P2.3.6.4 | AI4 custom maximum setting           | -160,00 | 160,00 | %    | 100,00  | 156  |      |
| P2.3.6.5 | AI4 signal inversion                 | 0       | 1      |      | 0       | 162  |      |
| P2.3.6.6 | AI4 reference scaling, minimum value | -32000  | 32000  |      | 0       | 1039 |      |
| P2.3.6.7 | AI4 reference scaling, maximum value | -32000  | 32000  |      | 0       | 1040 |      |
| P2.3.6.8 | <a href="#">AI4 Controlled ID</a>    | 0       | 10000  |      | 0       | 1510 |      |

Table 5-10. ANALOG INPUT 4,

**5.3.7 INPUT OPTIONS**

| Code     | Parameter    | Min | Max   | Unit | Default | ID   | Note |
|----------|--------------|-----|-------|------|---------|------|------|
| P2.3.7.1 | DI Inversion | 0   | 65535 |      | 2       | 1091 |      |

Table 5-10. Input options

**5.4 OUTPUT SIGNALS****5.4.1 DIGITAL OUTPUTS**

| Code     | Parameter               | Min | Max  | Unit  | Default | ID   | Description |
|----------|-------------------------|-----|------|-------|---------|------|-------------|
| 2.4.1.1  | Ready                   | 0.1 | E.10 | DiOut | 0.1     | 432  |             |
| 2.4.1.2  | Running                 | 0.1 | E.10 | DiOut | 0.1     | 433  |             |
| 2.4.1.3  | Fault                   | 0.1 | E.10 | DiOut | 0.1     | 434  |             |
| 2.4.1.4  | Fault, Inverted         | 0.1 | E.10 | DiOut | 0.1     | 435  |             |
| 2.4.1.5  | <a href="#">Warning</a> | 0.1 | E.10 | DiOut | 0.1     | 436  |             |
| 2.4.1.6  | FB Dig Input 1          | 0.1 | E.10 | DiOut | 0.1     | 455  |             |
| 2.4.1.7  | FB DIN 1 Par ID         | 0   | 4999 | ID    | 0       | 891  |             |
| 2.4.1.8  | FB Dig Input 2          | 0.1 | E.10 | DiOut | 0.1     | 456  |             |
| 2.4.1.9  | FB DIN 2 Par ID         | 0   | 4999 | ID    | 0       | 892  |             |
| 2.4.1.10 | FB Dig Input 3          | 0.1 | E.10 | DiOut | 0.1     | 457  |             |
| 2.4.1.11 | FB DIN 3 Par ID         | 0   | 4999 | ID    | 0       | 893  |             |
| 2.4.1.12 | FB Dig Input 4          | 0.1 | E.10 | DiOut | 0.1     | 169  |             |
| 2.4.1.13 | FB DIN 4 Par ID         | 0   | 4999 | ID    | 0       | 894  |             |
| 2.4.1.14 | Charge DC               | 0.1 | E.10 | DiOut | 0.1     | 1668 |             |
| 2.4.1.15 | DC Ready                | 0.1 | E.10 | DiOut | 0.1     | 1218 |             |
| 2.4.1.16 | Charging                | 0.1 | E.10 | DiOut | 0.1     | 1219 |             |
| 2.4.1.17 | Discharging             | 0.1 | E.10 | DiOut | 0.1     | 1220 |             |

Table 5-11. Digital outputs parameters

## 5.4.2 ANALOGUE OUTPUT 1

| Code     | Parameter          | Min  | Max  | Unit  | Default | ID  | Description                                                                                                                                                                                   |
|----------|--------------------|------|------|-------|---------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P2.4.2.1 | lout 1 Signal      | 0.1  | E.10 | AnOUT | 0.1     | 464 |                                                                                                                                                                                               |
| P2.4.2.2 | lout 1 Content     | 0    | 8    |       | 0       | 307 | 0= 4 mA<br>1=±2* Active Current<br>2=Source Voltage<br>3=Measured Source Voltage<br>4=DC Voltage Unfiltered<br>5=DC Current<br>6= Power<br>7=FB Analogue Input ID48<br>8=Value Control Output |
| P2.4.2.3 | lout 1 Filter Time | 0    | 10   | s     |         | 308 |                                                                                                                                                                                               |
| P2.4.2.4 | lout 1 Invert      | 0    | 1    |       |         | 309 |                                                                                                                                                                                               |
| P2.4.2.5 | lout 1 Minimum     | 0    | 1    |       |         | 310 |                                                                                                                                                                                               |
| P2.4.2.6 | lout 1 Scale       | 10   | 1000 | %     |         | 311 |                                                                                                                                                                                               |
| P2.4.2.7 | lout 1 Offset      | -100 | 100  | %     |         | 375 |                                                                                                                                                                                               |

Table 5-12. Analogue Output 1 parameters

## 5.4.3 ANALOGUE OUTPUT 2

| Code     | Parameter          | Min  | Max  | Unit  | Default | ID  | Description  |
|----------|--------------------|------|------|-------|---------|-----|--------------|
| P2.4.3.1 | lout 2 Signal      | 0.1  | E.10 | AnOUT |         | 471 |              |
| P2.4.3.2 | lout 2 Content     | 0    | 8    |       | 0       | 472 | See P2.4.2.2 |
| P2.4.3.3 | lout 2 Filter Time | 0    | 10   | s     |         | 473 |              |
| P2.4.3.4 | lout 2 Invert      | 0    | 1    |       |         | 474 |              |
| P2.4.3.5 | lout 2 Minimum     | 0    | 1    |       |         | 475 |              |
| P2.4.3.6 | lout 2 Scale       | 10   | 1000 | %     |         | 476 |              |
| P2.4.3.7 | lout 2 Offset      | -100 | 100  | %     |         | 477 |              |

Table 5-13. Analogue Output 2 parameters

## 5.4.4 DELAYED DIGITAL OUTPUT 1

| Code     | Parameter                         | Min  | Max     | Unit | Default | Cust | ID   | Note                                                                                                                                                                                                                                        |
|----------|-----------------------------------|------|---------|------|---------|------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P2.4.4.1 | Digital output 1 signal selection | 0.1  | E.10    |      | 0.1     |      | 486  | Possibility to invert by ID1808 Output Inversion                                                                                                                                                                                            |
| P2.4.4.2 | Digital output 1 function         | 0    | 12      |      | 0       |      | 312  | 0=Not used<br>1=Ready<br>2=Run<br>3=Fault<br>4=Fault inverted<br>5=Warning<br>6=Therm. fault or warn.<br>7=Fieldbus input data 1<br>8=Fieldbus input data 2<br>9=Fieldbus input data 3<br>10=ID.Bit Select<br>11=Charging<br>12=Discharging |
| P2.4.4.3 | Digital output 1 on delay         | 0.00 | 320.00  | s    | 0.00    |      | 487  | 0.00 = On delay not in use                                                                                                                                                                                                                  |
| P2.4.4.4 | Digital output 1 off delay        | 0.00 | 320.00  | s    | 0.00    |      | 488  | 0.00 = Off delay not in use                                                                                                                                                                                                                 |
| P2.4.4.5 | ID.Bit Free DO                    | 0.00 | 2000.15 |      | 0.00    |      | 1217 |                                                                                                                                                                                                                                             |

## 5.4.5 DELAYED DIGITAL OUTPUT 2

| Code     | Parameter                         | Min  | Max     | Unit | Default | Cust | ID   | Note                                             |
|----------|-----------------------------------|------|---------|------|---------|------|------|--------------------------------------------------|
| P2.4.5.1 | Digital output 2 signal selection | 0.1  | E.10    |      | 0.1     |      | 489  | Possibility to invert by ID1808 Output Inversion |
| P2.4.5.2 | Digital output 2 function         | 0    | 28      |      | 0       |      | 490  | See P2.4.4.2                                     |
| P2.4.5.3 | Digital output 2 on delay         | 0.00 | 320.00  | s    | 0.00    |      | 491  | 0.00 = On delay not in use                       |
| P2.4.5.4 | Digital output 2 off delay        | 0.00 | 320.00  | s    | 0.00    |      | 492  | 0.00 = Off delay not in use                      |
| P2.4.5.5 | ID.Bit Free DO                    | 0.00 | 2000.15 |      | 0.00    |      | 1385 |                                                  |

## 5.4.6 OUTPUT OPTIONS

| Code     | Parameter        | Min | Max   | Unit | Default | Cust | ID   | Note                                                       |
|----------|------------------|-----|-------|------|---------|------|------|------------------------------------------------------------|
| P2.4.6.1 | Output Inversion | 0   | 65535 |      | 0       |      | 1808 |                                                            |
| P2.4.6.2 | DC Ready Mode    | 0   | 3     |      | 0       |      | 1607 | 0=Not used<br>1=AFE Ready<br>2=Charge Switch<br>3=DC Ready |

## 5.5 LIMIT SETTINGS

### 5.5.1 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    | 900    | %    | 105     | 1290 | % of Source Nom Current |
| P2.5.1.3 | Discharge Limit   | 0    | 900    | %    | 105     | 1289 | % of Source Nom Current |
| P2.5.1.4 | Charge Ramp Up    | -1,0 | 3200   | %/s  | 1000,0  | 1502 |                         |
| P2.5.1.5 | Discharge Ramp Up | -1,0 | 3200   | %/s  | 1000,0  | 1532 |                         |
| P2.5.1.6 | Charge Limit 1    | 0    | 9000   | %    | 100,0   | 1503 |                         |
| P2.5.1.7 | Charge Limit 2    | 0    | 9000   | %    | 50,00   | 1625 |                         |
| P2.5.1.8 | Discharge Limit 1 | 0    | 9000   | %    | 100,0   | 1513 |                         |
| P2.5.1.9 | Discharge Limit 2 | 0    | 9000   | %    | 50,0    | 1514 |                         |

Table 5-14. Current limit parameters

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

| Code     | Parameter               | Min  | Max    | Unit | Default | ID   | Note                                                                                                         |
|----------|-------------------------|------|--------|------|---------|------|--------------------------------------------------------------------------------------------------------------|
| P2.5.2.1 | Under Voltage Reference | 0,00 | 118,00 | %    | 65,00   | 1567 | % of unit nominal DC-Link voltage.<br>500 Vac unit: 675 Vdc<br>690 Vac unit: 931 Vdc<br>690 Vac NX8: 963 Vdc |
| P2.5.2.2 | Under Voltage Droop     | 0    | 100    | %    | 93      | 1863 |                                                                                                              |
| P2.5.2.3 | Under Voltage Kp        | 0    | 32000  |      | 50      | 1468 |                                                                                                              |
| P2.5.2.4 | Under Voltage Ti        | 0    | 32000  |      | 15      | 1409 |                                                                                                              |
| P2.5.2.5 | Under Voltage Kp Add    | 0    | 32000  |      | 50      | 1425 |                                                                                                              |
| P2.5.2.6 | Enable Black Start      | 0    | 65535  |      | 0       | 1813 | > 0, enabled.                                                                                                |

Table 5-15. Under voltage control parameters

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

| Code     | Parameter              | Min  | Max    | Unit | Default | ID   | Note                                                                                                         |
|----------|------------------------|------|--------|------|---------|------|--------------------------------------------------------------------------------------------------------------|
| P2.5.2.1 | Over Voltage Reference | 0,00 | 118,00 | %    | 118,00  | 1528 | % of unit nominal DC-Link voltage.<br>500 Vac unit: 675 Vdc<br>690 Vac unit: 931 Vdc<br>690 Vac NX8: 963 Vdc |
| P2.5.2.2 | Over Voltage Droop     | 0    | 100    | %    | 93      | 1862 |                                                                                                              |
| P2.5.2.3 | Over Voltage Kp        | 0    | 32000  |      | 50      | 699  |                                                                                                              |
| P2.5.2.4 | Over Voltage Ti        | 0    | 32000  |      | 15      | 698  |                                                                                                              |
| P2.5.2.5 | Over Voltage Kp Add    | 0    | 32000  |      | 50      | 697  |                                                                                                              |

Table 5-16. Over voltage control parameters

## 5.5.4 SOURCE VOLTAGE

| Code     | Parameter                 | Min  | Max    | Unit | Default             | ID   | Note            |
|----------|---------------------------|------|--------|------|---------------------|------|-----------------|
| P2.5.4.1 | Source Min Voltage        | 0,0  | 1100,0 | Vdc  | 200<br>345          | 1893 | Discharge limit |
| P2.5.4.2 | Source Max Voltage        | 24,0 | 1100,0 | Vdc  | 797<br>1099<br>1136 | 1895 | Charge limit    |
| P2.5.4.3 | Source Voltage Hysteresis | 0,0  | 100,0  | Vdc  | 5,0                 | 1896 |                 |
| P2.5.4.4 | Reverse Current Limit     | 0,0  | 900,0  | %    | 2,0                 | 1539 |                 |

Table 5-17. Source voltage parameters

## 5.5.5 POWER LIMIT

| Code     | Parameter             | Min  | Max | Unit | Default | ID   | Note |
|----------|-----------------------|------|-----|------|---------|------|------|
| P2.5.5.1 | Charge Power Limit    | -900 | 900 | %    | -0,1    | 1287 |      |
| P2.5.5.2 | Discharge Power Limit | -900 | 900 | %    | -0,1    | 1288 |      |

Table 5-17. Source voltage parameters

## 5.6 DC CONTROL PARAMETERS

| Code   | Parameter       | Min | Max | Unit | Default | ID  | Description                  |
|--------|-----------------|-----|-----|------|---------|-----|------------------------------|
| P2.6.1 | DC Control Mode | 0   | 1   |      | 0       | 600 | 0=Open Loop<br>1=Closed Loop |

Table 5-18. DC control parameters

## 5.6.1 INNER CONTROL

| Code     | Parameter          | Min  | Max    | Unit | Default | ID   | Description |
|----------|--------------------|------|--------|------|---------|------|-------------|
| P2.6.2.1 | Current Control Kp | 1,00 | 320,00 | %    | 20,00   | 617  |             |
| P2.6.2.2 | Current Control Ti | 0,1  | 3200,0 | ms   | 1,5     | 657  |             |
| P2.6.2.3 | Voltage Control Kp | 1    | 32000  |      | 200     | 1870 |             |
| P2.6.2.4 | Voltage Control Ti | 1    | 32000  |      | 50      | 1871 |             |

Table 5-19. Inner control loop parameters

## 5.6.2 CLOSED LOOP

| Code     | Parameter                          | Min  | Max   | Unit | Default | ID   | Description                           |
|----------|------------------------------------|------|-------|------|---------|------|---------------------------------------|
| P2.6.3.1 | DC Control Kp                      | 0,00 | 2000  | %    | 100,00  | 613  |                                       |
| P2.6.3.2 | DC Control Ti                      | 0    | 10000 | ms   | 1000    | 614  |                                       |
| P2.6.3.3 | DC PI Max Adjust                   | 0,00 | 20    | %    | 5,00    | 1906 | Also trip limit.                      |
| P2.6.3.5 | Closed Loop Feedback loss response | 0    | 2     |      | 2       | 752  | 0=No response<br>1=Warning<br>2=Fault |

Table 5-20. Closed Loop control loop parameters

### 5.6.3 VOLTAGE FEEDBACK SIGNAL

| Code     | Parameter             | Min     | Max    | Unit | Default | ID   | Description |
|----------|-----------------------|---------|--------|------|---------|------|-------------|
| P2.6.4.1 | Feedback AnIN         | 0.1     | E.10   | AnIN | 0.1     | 1595 |             |
| P2.6.4.2 | Feedback Filter TC    | 0       | 1000   | ms   | 3       | 618  |             |
| P2.6.4.3 | Nom Vdc Signal Level  | 0,00    | 320,00 | %    | 90,00   | 337  |             |
| P2.6.4.4 | Zero Vdc Signal Level | -320,00 | 320,00 | %    | 20,00   | 320  |             |

Table 5-21. Voltage feedback signal parameters

### 5.7 DRIVE CONTROL PARAMETERS

| Code   | Parameter           | Min | Max    | Unit | Default | ID   | Description         |
|--------|---------------------|-----|--------|------|---------|------|---------------------|
| P2.7.1 | Switching frequency | 3,6 | Varies | kHz  | 5,0     | 601  | Switching frequency |
| P2.7.2 | Control Options 1   | 0   | 65535  |      | 0       | 1707 |                     |
| P2.7.3 | DC/DC Options       | 0   | 65535  |      | 0       | 1463 |                     |

Table 5-22. Drive control parameters

#### 5.7.1 IDENTIFICATION

| Code    | Parameter            | Min    | Max   | Unit | Default | ID  | Description |
|---------|----------------------|--------|-------|------|---------|-----|-------------|
| 2.7.4.1 | IU Offset            | -32000 | 32000 |      | 10000   | 668 |             |
| 2.7.4.2 | IV Offset            | -32000 | 32000 |      | 0       | 669 |             |
| 2.7.4.3 | IW Offset            | -32000 | 32000 |      | 0       | 670 |             |
| 2.7.4.4 | Charge Resistance    | 0      | 10000 |      | 1       | 662 |             |
| 2.7.4.5 | Discharge Resistance | 0      | 10000 |      | 1       | 665 |             |
| 2.7.4.6 | DCLinkMeasCalib      | -2,00  | 2,00  | %    | 0,00    | 549 |             |

Table 5-23. Identification parameters

#### 5.7.2 SYSTEM TEST (INTERNAL)

| Code    | Parameter                        | Min  | Max   | Unit | Default | ID   | Description |
|---------|----------------------------------|------|-------|------|---------|------|-------------|
| 2.7.5.1 | Modulation Limit                 | 0    | 250   |      | 100     | 1515 |             |
| 2.7.5.2 | Advanced Options 1               | 0    | 65535 |      | 0       | 1560 |             |
| 2.7.5.3 | Advanced Options 2               | 0    | 65535 |      | 0       | 1561 |             |
| 2.7.5.4 | Inverse Synch                    | 0    | 1     |      | 0       | 1857 |             |
| 2.7.5.5 | DC Ripple Compensation Kp        | 0    | 1000  |      | 0       | 1897 |             |
| 2.7.5.6 | DC Ripple Compensation Phase     | -360 | 360   |      | 0       | 1898 |             |
| 2.7.5.7 | DC Ripple Compensation Frequency | 0    | 1000  | Hz   | 300     | 1899 |             |
| 2.7.5.8 | DC/DC Options 2                  | 0    | 65535 |      | 0       | 1464 |             |

Table 5-24. System Test parameters

## 5.7.3 BATTERY EMULATOR/SIMULATOR

| Code       | Parameter     | Min | Max | Unit | Default | ID   | Description                                                                         |
|------------|---------------|-----|-----|------|---------|------|-------------------------------------------------------------------------------------|
| P 2.7.6.1  | Emulator Mode |     |     |      | 0       | 3501 | 0 = off<br>1 = Emulator mode<br>2 = Simulation mode<br>3 = Parallel Simulation mode |
| P 2.7.6.2  | Model A       |     |     | %    | 10,00   | 3502 |                                                                                     |
| P 2.7.6.3  | Model B       |     |     | %    | 1500    | 3503 |                                                                                     |
| P 2.7.6.4  | Model K       |     |     | %    | 4,00    | 3504 |                                                                                     |
| P 2.7.6.5  | Model Q       |     |     | %    | 130,00  | 3505 |                                                                                     |
| P 2.7.6.6  | Model Qnomh   |     |     | %    | 100     | 3506 |                                                                                     |
| P 2.7.6.7  | Model R       |     |     | %    | 2,00    | 3507 |                                                                                     |
| P 2.7.6.8  | Model Set SoC |     |     | %    | 90,00   | 3508 |                                                                                     |
| V 2.7.6.9  | Model Voltage |     |     | %    |         | 3509 |                                                                                     |
| V 2.7.6.10 | Model SoC     |     |     | %    |         | 3510 |                                                                                     |

Table 5-25. Battery Emulator/Simulator parameters

## 5.8 MASTER-FOLLOWER PARAMETERS

| Code   | Parameter             | Min  | Max   | Unit | Default | ID   | Description |
|--------|-----------------------|------|-------|------|---------|------|-------------|
| P2.8.1 | MF Mode               | 0    | 2     |      | 0       | 1324 |             |
| P2.8.2 | SB Comm. Fault        | 0    | 2     |      | 2       | 1082 |             |
| P2.8.3 | SB Fault Delay        | 0,00 | 10,00 |      | 0,50    | 1352 |             |
| P2.8.4 | Synch. Fault Response | 0    | 2     |      | 1       | 1701 |             |
| P2.8.5 | Follower fault        | 0    | 2     |      | 1       | 1536 |             |

Table 5-23. Master-Follower parameters

## 5.9 FIELDBUS PARAMETERS

| Code    | Parameter                      | Min | Max   | Unit | Default | ID   | Description                                |
|---------|--------------------------------|-----|-------|------|---------|------|--------------------------------------------|
| P2.9.1  | FB Actual Selection            | 0   | 10000 |      | 1125    | 1853 | Choose monitoring data with parameter ID   |
| P2.9.2  | GSW ID                         | 0   | 10000 |      | 0       | 897  |                                            |
| P2.9.3  | Fieldbus data out 1 selection  | 0   | 10000 |      | 0       | 852  |                                            |
| P2.9.4  | Fieldbus data out 2 selection  | 0   | 10000 |      | 0       | 853  |                                            |
| P2.9.5  | Fieldbus data out 3 selection  | 0   | 10000 |      | 0       | 854  |                                            |
| P2.9.6  | Fieldbus data out 4 selection  | 0   | 10000 |      | 0       | 855  |                                            |
| P2.9.7  | Fieldbus data out 5 selection  | 0   | 10000 |      | 0       | 856  |                                            |
| P2.9.8  | Fieldbus data out 6 selection  | 0   | 10000 |      | 0       | 857  |                                            |
| P2.9.9  | Fieldbus data out 7 selection  | 0   | 10000 |      | 0       | 858  |                                            |
| P2.9.10 | Fieldbus data out 8 selection  | 0   | 10000 |      | 0       | 859  |                                            |
| P2.9.11 | Fieldbus data out 9 selection  | 0   | 10000 |      | 0       | 558  | Visible with correct hardware and software |
| P2.9.12 | Fieldbus data out 10 selection | 0   | 10000 |      | 0       | 559  | Visible with correct hardware and software |
| P2.9.13 | Fieldbus data out 11 selection | 0   | 10000 |      | 0       | 560  | Visible with correct hardware and software |
| P2.9.14 | Fieldbus data out 12 selection | 0   | 10000 |      | 0       | 561  | Visible with correct hardware and software |
| P2.9.15 | Fieldbus data out 13 selection | 0   | 10000 |      | 0       | 562  | Visible with correct hardware and software |
| P2.9.16 | Fieldbus data out 14 selection | 0   | 10000 |      | 0       | 563  | Visible with correct hardware and software |
| P2.9.17 | Fieldbus data out 15 selection | 0   | 10000 |      | 0       | 564  | Visible with correct hardware and software |
| P2.9.18 | Fieldbus data out 16 selection | 0   | 10000 |      | 0       | 565  | Visible with correct hardware and software |
| P2.9.19 | FB Reference Selector          | 0   | 10000 |      | 0       | 1850 | Choose controlled data with parameter ID   |
| P2.9.20 | Fieldbus data in 1 selection   | 0   | 10000 |      | 0       | 876  |                                            |
| P2.9.21 | Fieldbus data in 2 selection   | 0   | 10000 |      | 0       | 877  |                                            |
| P2.9.22 | Fieldbus data in 3 selection   | 0   | 10000 |      | 0       | 878  |                                            |
| P2.9.23 | Fieldbus data in 4 selection   | 0   | 10000 |      | 0       | 879  |                                            |
| P2.9.24 | Fieldbus data in 5 selection   | 0   | 10000 |      | 0       | 880  |                                            |
| P2.9.25 | Fieldbus data in 6 selection   | 0   | 10000 |      | 0       | 881  |                                            |
| P2.9.26 | Fieldbus data in 7 selection   | 0   | 10000 |      | 0       | 882  |                                            |
| P2.9.27 | Fieldbus data in 8 selection   | 0   | 10000 |      | 0       | 883  |                                            |
| P2.9.28 | Fieldbus data in 9 selection   | 0   | 10000 |      | 0       | 550  | Visible with correct hardware and software |

| Code    | Parameter                     | Min  | Max     | Unit | Default | ID   | Description                                                                                                                                         |
|---------|-------------------------------|------|---------|------|---------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| P2.9.29 | Fieldbus data in 10 selection | 0    | 10000   |      | 0       | 551  | Visible with correct hardware and software                                                                                                          |
| P2.9.30 | Fieldbus data in 11 selection | 0    | 10000   |      | 0       | 552  | Visible with correct hardware and software                                                                                                          |
| P2.9.31 | Fieldbus data in 12 selection | 0    | 10000   |      | 0       | 553  | Visible with correct hardware and software                                                                                                          |
| P2.9.32 | Fieldbus data in 13 selection | 0    | 10000   |      | 0       | 554  | Visible with correct hardware and software                                                                                                          |
| P2.9.33 | Fieldbus data in 14 selection | 0    | 10000   |      | 0       | 555  | Visible with correct hardware and software                                                                                                          |
| P2.9.34 | Fieldbus data in 15 selection | 0    | 10000   |      | 0       | 556  | Visible with correct hardware and software                                                                                                          |
| P2.9.35 | Fieldbus data in 16 selection | 0    | 10000   |      | 0       | 557  | Visible with correct hardware and software                                                                                                          |
| P2.9.36 | Control Slot Selector         | 0    | Varies  |      | 0       | 1440 | 0=Not sel., 4=Slot D, 5=Slot E, 6=Slot D Fast, 7=Slot E Fast, 8=Slot D 16, 9=Slot E 16<br><br>Note: 6-9 visible with correct hardware and software. |
| P2.9.37 | State Machine                 | 0    | 1       |      | 0       | 896  |                                                                                                                                                     |
| P2.9.38 | SWB11 ID.Bit                  | 0.00 | 2000.15 |      | 0.00    | 1907 |                                                                                                                                                     |
| P2.9.39 | SWB12 ID.Bit                  | 0.00 | 2000.15 |      | 0.00    | 1908 |                                                                                                                                                     |
| P2.9.40 | SWB13 ID.Bit                  | 0.00 | 2000.15 |      | 0.00    | 1909 |                                                                                                                                                     |
| P2.9.41 | SWB14 ID.Bit                  | 0.00 | 2000.15 |      | 0.00    | 1910 |                                                                                                                                                     |

Table 5-24. Fieldbus parameters

## 5.10 PROTECTIONS

### 5.10.1 GENERAL

| Code      | Parameter                       | Min  | Max   | Unit | Default | ID   | Description                                                                     |
|-----------|---------------------------------|------|-------|------|---------|------|---------------------------------------------------------------------------------|
| P2.10.1.1 | Max Charge Time                 | 0,00 | 10,00 | s    | 5,00    | 1522 | Charging time limit when drive charging options are used.                       |
| P2.10.1.2 | Response to 4mA reference fault | 0    | 5     |      | 0       | 700  | 0=No response<br>1=Warning<br>2=Fault                                           |
| P2.10.1.3 | Fault / Warn Indicat            | 0    | 2     |      | 1       | 1940 | 0=Static<br>1=Toggle<br>2=Marine                                                |
| P2.10.1.4 | Input Ph. Supervision           | 0    | 2     |      | 1       | 730  |                                                                                 |
| P2.10.1.5 | Quick Stop Indication           | 0    | 2     |      | 1       | 1543 |                                                                                 |
| P2.10.1.6 | Run Enable Indication           | 0    | 2     |      | 1       | 1177 |                                                                                 |
| P2.10.1.7 | Klixon Response                 | 0    | 3     |      | 2       | 782  | 0 = No Action<br>1 = Warning, Warning<br>2 = Warning, Fault<br>3 = Fault, Fault |
| P2.10.1.8 | Ambient Temp Response           | 0    | 2     |      | 1       | 784  | 0 = No Action<br>1 = Warning<br>2 = Fault                                       |
| P2.10.1.9 | Input Switch Response           | 0    | 2     |      | 2       | 785  | 0 = No Action<br>1 = Warning<br>2 = Fault                                       |

Table 5-25. Protections parameters

## 5.10.2 TEMPERATURE SENSORS

| Code        | Parameter                     | Min   | Max   | Unit | Default | ID  | Description                                                                                                                                              |
|-------------|-------------------------------|-------|-------|------|---------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| P2.10.2.1   | No. of used inputs on board 1 | 0     | 5     |      | 0       | 739 | 0=Not used (ID Write)<br>1 = Sensor 1 in use<br>2 = Sensor 1 & 2 in use<br>3 = Sensor 1 & 2 & 3 in use<br>4 = Sensor 2 & 3 in use<br>5 = Sensor 3 in use |
| P2.10.2.2   | Response to temperature fault | 0     | 2     |      | 2       | 740 | 0=No response<br>1=Warning<br>2=Fault                                                                                                                    |
| P2.10.2.3   | Board 1 warning limit         | -30,0 | 200,0 | C°   | 120,0   | 741 |                                                                                                                                                          |
| P2.10.2.4   | Board 1 fault limit           | -30,0 | 200,0 | C°   | 130,0   | 742 |                                                                                                                                                          |
| P2.10.2.5   | No. of uses inputs on board 2 | 0     | 5     |      | 0       | 743 | 0=Not used (ID Write)<br>1 = Sensor 1 in use<br>2 = Sensor 1 & 2 in use<br>3 = Sensor 1 & 2 & 3 in use<br>4 = Sensor 2 & 3 in use<br>5 = Sensor 3 in use |
| P2.10.2.6   | Response to temperature fault | 0     | 3     |      | 2       | 766 | 0=No response<br>1=Warning<br>2=Fault, stop acc. to 2.3.2<br>3=Fault, stop by coasting                                                                   |
| P2.10.2.7   | Board 2 warning limit         | -30.0 | 200.0 | C°   | 120.0   | 745 |                                                                                                                                                          |
| P2.10.2.8   | Board 2 fault limit           | -30.0 | 200.0 | C°   | 130.0   | 746 |                                                                                                                                                          |
| P2.10.2.9.1 | Channel 1B Warn               | -30.0 | 200.0 | C°   | 0.0     | 764 |                                                                                                                                                          |
| P2.10.2.9.2 | Channel 1B Fault              | -30.0 | 200.0 | C°   | 0.0     | 765 |                                                                                                                                                          |
| P2.10.2.9.3 | Channel 1C Warn               | -30.0 | 200.0 | C°   | 0.0     | 768 |                                                                                                                                                          |
| P2.10.2.9.4 | Channel 1C Fault              | -30.0 | 200.0 | C°   | 0.0     | 769 |                                                                                                                                                          |
| P2.10.2.9.5 | Channel 2B Warn               | -30.0 | 200.0 | C°   | 0.0     | 770 |                                                                                                                                                          |
| P2.10.2.9.6 | Channel 2B Fault              | -30.0 | 200.0 | C°   | 0.0     | 771 |                                                                                                                                                          |
| P2.10.2.9.7 | Channel 2C Warn               | -30.0 | 200.0 | C°   | 0.0     | 772 |                                                                                                                                                          |
| P2.10.2.9.8 | Channel 2C Fault              | -30.0 | 200.0 | C°   | 0.0     | 773 |                                                                                                                                                          |

Table 5-26. Protections parameters

## 5.10.3 THERMAL PROTECTION

| Code      | Parameter                     | Min | Max  | Unit | Default | ID  | Description |
|-----------|-------------------------------|-----|------|------|---------|-----|-------------|
| P2.10.3.1 | Response to temperature fault | 0   | 3    |      | 2       | 740 |             |
| P2.10.3.2 | Thermal Fault Delay           | 0   | 1800 | s    | 0       | 707 |             |

Table 5-27. Thermal protection

## 5.10.4 FIELD BUS PROTECTION

| Code      | Parameter                 | Min  | Max   | Unit | Default | ID   | Description     |
|-----------|---------------------------|------|-------|------|---------|------|-----------------|
| P2.10.4.1 | FB Communication Response | 0    | 2     |      | 2       | 733  |                 |
| P2.10.4.2 | FB WD Delay               | 0,00 | 30,00 | S    | 0,00    | 1354 | 0,00 = Disabled |

Table 5-28. Fieldbus protection

## 5.10.5 EXTERNAL FAULTS

| Code      | Parameter                    | Min | Max | Unit | Default | ID   | Description                           |
|-----------|------------------------------|-----|-----|------|---------|------|---------------------------------------|
| P2.10.5.1 | Response to external fault 1 | 0   | 3   |      | 2       | 701  | 0=No response<br>1=Warning<br>2=Fault |
| P2.10.5.2 | Response to external fault 2 | 0   | 3   |      | 2       | 1504 | 0=No response<br>1=Warning<br>2=Fault |

Table 5-29. Protections parameters

## 5.10.6 REFERENCE ERROR

| Code      | Parameter               | Min | Max   | Unit | Default | ID   | Description |
|-----------|-------------------------|-----|-------|------|---------|------|-------------|
| P2.10.6.1 | Ref Error Response      | 0   | 2     |      | 0       | 735  |             |
| P2.10.6.2 | Ref Error Hysteresis    | -1  | 200   | %    |         | 753  |             |
| P2.10.6.3 | Ref Error Delay         | 0   | 32000 | s    | 2,000   | 754  |             |
| P2.10.6.4 | Source Vdc Lim Response | 0   | 2     |      | 1       | 1012 |             |
| P2.10.6.5 | Source Vdc Lim Delay    | 0   | 32000 | s    | 3,000   | 737  |             |

Table 5-29. Protections parameters

## 5.10.7 COOLING PROTECTION

| Code      | Parameter              | Min  | Max  | Unit | Default | Cust | ID  | Note                                                                                     |
|-----------|------------------------|------|------|------|---------|------|-----|------------------------------------------------------------------------------------------|
| P2.10.7.1 | Cooling Fault Response | 1    | 2    |      | 2       |      | 762 | 0= No Action, Warning<br>1= Warning, Warning<br>2= Warning, Fault<br>3= No Action, Fault |
| P2.10.7.2 | Cooling Fault delay    | 0.00 | 7.00 | s    | 2.00    |      | 751 |                                                                                          |

Table 5-29. Protections parameters

## 5.10.8 CURRENT MONITORING

| Code      | Parameter        | Min    | Max   | Unit | Default | Cust | ID   | Description |
|-----------|------------------|--------|-------|------|---------|------|------|-------------|
| P2.10.8.1 | Fault Mode       | 0      | 4     |      | 0       |      | 3511 |             |
| P2.10.8.1 | High Fault Limit | -32000 | 32000 |      | 32000   |      | 3512 |             |
| P2.10.8.1 | High Warn Limit  | -32000 | 32000 |      | 31000   |      | 3513 |             |
| P2.10.8.1 | Low Warn Limit   | -32000 | 32000 |      | -31000  |      | 3514 |             |
| P2.10.8.1 | Low Fault Limit  | -32000 | 32000 |      | -32000  |      | 3515 |             |

Table 5-32. Signal Fault Function

## 5.10.9 EXTRA

| Code    | Parameter         | Min | Max   | Unit | Default | ID   | Description |
|---------|-------------------|-----|-------|------|---------|------|-------------|
| P2.10.7 | Fault Simulation  | 0   | 65535 |      | 0       | 1569 |             |
| P2.10.8 | Reset Data Logger | 0   | 1     |      | 0       | 1849 |             |

Table 5-29. Protections parameters



## 5.1.1 ID CONTROL FUNCTIONS

### 5.1.1.1 VALUE CONTROL

| Code       | Parameter                     | Min    | Max    | Unit | Default | Cust | ID   | Note                                                                                         |
|------------|-------------------------------|--------|--------|------|---------|------|------|----------------------------------------------------------------------------------------------|
| P2.11.1.1  | Control Mode                  | 0      | 5      |      | 0       |      | 1586 | 0=SR ABS<br>1=Scale ABS<br>2=Scale INV ABS<br>3=SR<br>4=Scale<br>5=Scale INV<br>6=XY-Control |
| P2.11.1.2  | Control Input Signal ID       | 0      | 10000  | ID   | 0       |      | 1580 |                                                                                              |
| P2.11.1.3  | Control Input Off Limit       | -32000 | 32000  |      | 0       |      | 1581 |                                                                                              |
| P2.11.1.4  | Control Input On Limit        | -32000 | 32000  |      | 0       |      | 1582 |                                                                                              |
| P2.11.1.5  | Control Output Off Value      | -32000 | 32000  |      | 0       |      | 1583 |                                                                                              |
| P2.11.1.6  | Control Output On Value       | -32000 | 32000  |      | 0       |      | 1584 |                                                                                              |
| P2.11.1.7  | Control Output Signal ID      | 0      | 10000  | ID   | 0       |      | 1585 |                                                                                              |
| P2.11.1.8  | Control Output Filtering time | 0,000  | 32,000 | s    | 0,000   |      | 1721 |                                                                                              |
| P2.11.1.9  | X Value 01                    | -32000 | 32000  |      | 0       |      | 1626 |                                                                                              |
| P2.11.1.10 | Y Value 01                    | -32000 | 32000  |      | 0       |      | 2001 |                                                                                              |
| P2.11.1.11 | X Value 02                    | -32000 | 32000  |      | 0       |      | 1627 |                                                                                              |
| P2.11.1.12 | Y Value 02                    | -32000 | 32000  |      | 0       |      | 2002 |                                                                                              |
| P2.11.1.13 | X Value 03                    | -32000 | 32000  |      | 0       |      | 1628 |                                                                                              |
| P2.11.1.14 | Y Value 03                    | -32000 | 32000  |      | 0       |      | 2003 |                                                                                              |
| P2.11.1.15 | X Value 04                    | -32000 | 32000  |      | 0       |      | 1629 |                                                                                              |
| P2.11.1.16 | Y Value 04                    | -32000 | 32000  |      | 0       |      | 2004 |                                                                                              |
| P2.11.1.17 | X Value 05                    | -32000 | 32000  |      | 0       |      | 1630 |                                                                                              |
| P2.11.1.18 | Y Value 05                    | -32000 | 32000  |      | 0       |      | 2005 |                                                                                              |
| P2.11.1.19 | X Value 06                    | -32000 | 32000  |      | 0       |      | 1631 |                                                                                              |
| P2.11.1.20 | Y Value 06                    | -32000 | 32000  |      | 0       |      | 2006 |                                                                                              |

Table 5-30. Power reference input signal selection

### 5.1.1.2 DIN ID CONTROL 1

| Code      | Parameter      | Min    | Max   | Unit | Default | Cust | ID   | Note                                          |
|-----------|----------------|--------|-------|------|---------|------|------|-----------------------------------------------|
| P2.11.2.1 | ID Control DIN | 0.1    | E.10  |      | 0.1     |      | 1570 | Slot . Board input No.                        |
| P2.11.2.2 | Controlled ID  | 0      | 10000 | ID   | 0       |      | 1571 | Select ID that is controlled by digital input |
| P2.11.2.3 | False value    | -32000 | 32000 |      | 0       |      | 1572 | Value when DI is low                          |
| P2.11.2.4 | True value     | -32000 | 32000 |      | 0       |      | 1573 | Value when DI is high                         |

Table 5-31. DIN ID Control parameters

**5.11.3 DIN ID CONTROL 2**

| Code      | Parameter      | Min    | Max   | Unit | Default | Cust | ID   | Note                                          |
|-----------|----------------|--------|-------|------|---------|------|------|-----------------------------------------------|
| P2.11.3.1 | ID Control DIN | 0.1    | E.10  |      | 0.1     |      | 1590 | Slot . Board input No.                        |
| P2.11.3.2 | Controlled ID  | 0      | 10000 | ID   | 0       |      | 1575 | Select ID that is controlled by digital input |
| P2.11.3.3 | False value    | -32000 | 32000 |      | 0       |      | 1592 | Value when DI is low                          |
| P2.11.3.4 | True value     | -32000 | 32000 |      | 0       |      | 1593 | Value when DI is high                         |

Table 5-32. DIN ID Control parameters

**5.11.4 DIN ID CONTROL 3**

| Code      | Parameter      | Min    | Max   | Unit | Default | Cust | ID   | Note                                          |
|-----------|----------------|--------|-------|------|---------|------|------|-----------------------------------------------|
| P2.11.4.1 | ID Control DIN | 0.1    | E.10  |      | 0.1     |      | 1578 | Slot . Board input No.                        |
| P2.11.4.2 | Controlled ID  | 0      | 10000 | ID   | 0       |      | 1579 | Select ID that is controlled by digital input |
| P2.11.4.3 | False value    | -32000 | 32000 |      | 0       |      | 1594 | Value when DI is low                          |
| P2.11.4.4 | True value     | -32000 | 32000 |      | 0       |      | 1596 | Value when DI is high                         |

Table 5-33. DIN ID Control parameters

**5.11.5 SIGNAL FAULT FUNCTION**

| Code      | Parameter        | Min    | Max   | Unit | Default | Cust | ID   | Description            |
|-----------|------------------|--------|-------|------|---------|------|------|------------------------|
| P2.11.5.1 | Fault Signal ID  | 0      | 10000 | ID   | 0       |      | 1941 | Signal to be monitored |
| P2.11.5.2 | Fault Mode       | 0      | 4     |      | 0       |      | 1942 |                        |
| P2.11.5.3 | High Fault Limit | -32000 | 32000 |      | 32000   |      | 1943 |                        |
| P2.11.5.4 | High Warn Limit  | -32000 | 32000 |      | 31000   |      | 1945 |                        |
| P2.11.5.5 | Low Warn Limit   | -32000 | 32000 |      | -31000  |      | 1946 |                        |
| P2.11.5.6 | Low Fault Limit  | -32000 | 32000 |      | -32000  |      | 1944 |                        |

Table 5-32. Signal Fault Function

### 5.12 KEYPAD CONTROL (CONTROL KEYPAD: MENU M3)

| Code | Parameter         | Min | Max | Unit  | Default | ID   | Description                                                         |
|------|-------------------|-----|-----|-------|---------|------|---------------------------------------------------------------------|
| P3.1 | Control place     | 1   | 3   |       | 2       | 125  | 0=PC Control<br>1=I/O terminal<br>2=Keypad (Default)<br>3= Fieldbus |
| P3.2 | License Key       | 0   | 0   | 65535 |         | 1995 |                                                                     |
| P3.3 | Multi-Monitor ID1 | 0   | 0   | 65535 |         | 2632 |                                                                     |
| P3.4 | Multi-Monitor ID2 | 0   | 0   | 65535 |         | 2633 |                                                                     |
| P3.5 | Multi-Monitor ID3 | 0   | 0   | 65535 |         | 2634 |                                                                     |

Table 5-34. Keypad control parameters M3

### 5.13 SYSTEM MENU (CONTROL KEYPAD: MENU M6)

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

### 5.14 EXPANDER BOARDS (CONTROL KEYPAD: MENU M7)

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

## 6. DESCRIPTION OF PARAMETERS

### 6.1 BASIC PARAMETERS

#### **P2.1.1      *Source Nom Current*                      *ID113***

This parameter defines current value that is used as 100 % current for e.g. charging current limit. Keep default when correctly sized filters are used.

#### **P2.1.2      *Source Nom Voltage*                      *ID110***

This parameter defines absolute voltage value that is used as 100 % voltage for e.g. voltage reference. Minimum nominal source voltage is 50 Vdc

#### **P2.1.3      *Source Nom Power*                      *ID116***

This parameter is used for scaling percentage power monitoring value and analogue output signals. When left zero drive uses nominal power based on Source Nom Current and Source Nom Voltage.

#### **P2.1.4      *Control Mode*                      *ID1858***

Selection if drive is current, voltage or power-controlled mode.

0 = Current control mode

1 = Voltage control mode

Cascade voltage control. Use in combination of P2.7.3 to activate direct voltage control.

2 = Power control mode (current reference is computed internally based on the source voltage)

#### **P2.1.5      *Voltage Reference*                      *ID1462***

Voltage reference in percentage of Source Nom Voltage.

#### **P2.1.6      *Current Reference*                      *ID1860***

Active current reference of the drive in percentage of Source Nominal Current parameter.

Active Curr. Ref > 0: Current flow from Drive DC-Link to Source.

Active Curr. Ref < 0: Current flow from Source to Drive DC-Link.

#### **P2.1.6      *Power Reference*                      *ID1869***

Power reference of the drive in per cent. 100,0 % equals 100.0 % Active Current and 100.0 % Source Voltage.

Power Reference > 0: Current flow from Drive DC-Link to Source.

Power Reference < 0: Current flow from Source to Drive DC-Link.

**P2.1.7      Identification      ID631**

Identification function will calibrate current measurement.

0 = No Action

1 = Current measurement offset

During identification drive needs to be connected to battery system (or the used DC power source) and DC-Link voltage needs to be higher than the battery voltage so that there is no power flow from batteries to DC-link.

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

## 6.2 REFERENCE HANDLING

### ***P2.2.1 IO Control Mode ID1856***

This parameter is used to select different control mode for IO control than the common control mode selection parameter P2.1.4

0 = Control Mode P2.1.4

IOControl place operation mode defined by ID1858 (P2.1.4) parameter

1 = Current control mode

When control place is IO, control mode is Current Control.

2 = Voltage control mode

When control place is IO, control mode is Voltage Control.

3 = Power control mode

When control place is IO, control mode is Power Control.

### ***P2.2.2 IO Voltage Ref Sel. ID117***

0 = Voltage Ref. ID1462

1 = FB Voltage Ref. ID875

### ***P2.2.3 IO Current Ref. Sel. ID131***

0 = Current Ref. ID1860

1 = FB Current Ref. ID1140

### ***P2.2.4 IO Power Ref. Sel. ID1620***

0 = Power Ref. ID1869

1 = FB Power Ref. ID1141

### ***P2.2.5 FB Control Mode ID1848***

When using forced control place this parameter can be used change control mode.

0 = Control Mode P2.1.4

FB Control place operation mode defined by ID1858 (P2.1.4) parameter

1 = Current control mode

When control place is FB, control mode is Current Control.

2 = Voltage control mode

When control place is FB, control mode is Voltage Control.

3 = Power control mode

When control place is IO, control mode is Power Control.

### ***P2.2.6 FB Voltage Ref Sel. ID112***

0 = Voltage Ref. ID1462

1 = FB Voltage Ref. ID875

### ***P2.2.7 FB Current Ref. Sel. ID641***

0 = Current Ref. ID1860

1 = FB Current Ref. ID1140

**P2.2.8    *FB Power Ref. Sel.*    ID1621**

0 = Power Ref. ID1869

1 = FB Power Ref. ID1141

**6.2.1 VOLTAGE REFERENCE HANDLING****P2.2.9.1    *Drooping*    ID620**

Drooping for Source DC Voltage. Used when parallel DC/DC converters are used.  
Per cent of Source Nom Voltage at Source Nom Current (at 100 % active current).

**P2.2.9.2    *Voltage Reference Ramp Rate*    ID1867**

Voltage reference ramp rate in %/s. Values below zero means no ramp in voltage reference.

**P2.2.9.3    *Direct Vdc Control*    ID1743**

Direct voltage control when voltage control mode selected.

Controls duty cycle of the converter directly instead of cascade control used in the standard voltage control mode. Use this control mode for DC-power supply applications where robustness against load steps is required.

0 = No, normal cascade control

1 = Yes, Direct voltage control

## 6.2.2 CURRENT REFERENCE HANDLING

### *P2.2.10.1 Curr.Ref.RampUp ID1810*

Current reference ramp rate when going away from zero reference.

### *P2.2.10.2 CurrRefRampDown ID1811*

Current reference ramp rate when going toward zero reference

### *P2.2.10.3 Phase Reference Mode ID1859*

Select if same current reference is used for all phases or current is controlled individually.

#### **0 = Average**

P2.2.4.1 Current Reference is used to control average current.

#### **1 = Individual phase control**

Each phase is controlled separately with G2.2.4.4 parameters.

Used when each phase have separate DC source.

#### **2 = Same**

P2.2.4.1 Current Reference is used to control every phase current to be same.

#### **3 = Same+**

P2.2.4.1 Current Reference is used to control every phase current to be same and division by 3 reminder is compensated in reference.

### *.6.2.2.1 Constant Current Reference*

Constant Current references, activated by digital input will also start the drive directly to the set reference. If other start commands are active, the constant references is not activated. If control mode is voltage by default, then it's recommend to use same input to change to control mode to current as is used from Enable Constant Current Reference.

#### ***P2.2.10.4 Constant Reference 1 ID1239***

Constant reference 1 activated by ID530 and ID532.

#### ***P2.2.10.5 Constant Reference 2 ID1240***

Constant reference 2 activated by ID530 and ID531.

### *.6.2.2.2 Individual phase current reference*

#### ***P2.2.10.3.2 IU Current Reference ID128***

U phase current reference on individual mode.

#### ***P2.2.10.3.3 IV Current Reference ID129***

V phase current reference on individual mode.

#### ***P2.2.10.3.4 IW Current Reference ID130***

W phase current reference on individual mode.

### 6.2.3 START REFERENCE HANDLING

#### ***P2.2.11.1 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 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 initial guess of 80 % of source voltage.

#### ***P2.2.11.2 Start Voltage Reference ID1865***

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

## 6.3 INPUT SIGNALS

### 6.3.1 BASIC SETTINGS

#### P2.3.1.1 Start/Stop Logic Selection ID300

This parameter defines the start/stop logic when using I/O control.

##### 0 Start – No Act – Start Drive – No Action

Start 1: closed contact = start command DI "Start 1"

##### 1 StartP-StopP – Start Pulse – Stop Pulse

3-wire connection (pulse control):

DIN1: closed contact = start pulse

DIN2: open contact = stop pulse, falling edge.

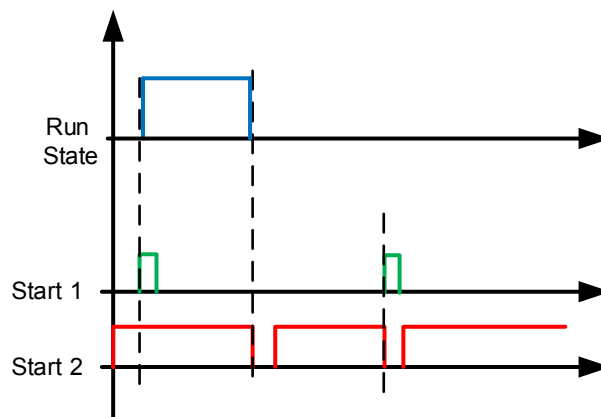


Figure 1. Start pulse/ Stop pulse.

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

##### 2 RPuls – RPuls – Rising pulse start – Rising pulse stop

Start 1: closed contact = Start command DI "Start 1"

Start 2: closed contact = Stop command DI "Start 1"

### 6.3.2 DIGITAL INPUTS

#### **P2.3.2.1    *Start Signal 1*                      *ID403***

Signal selection 1 for the start/stop logic. This parameter is used to select the input for Run Request signal.

#### **P2.3.2.2    *Start Signal 2*                      *ID404***

Signal selection 1 for the start/stop logic. This parameter is used to select the input for Stop Request signal.

#### **P2.3.2.3    *Run Enable*                              *ID407***

When the signal is low, the drive will lose READY status.

**Contact open:** the start of drive disabled.

**Contact closed:** the start of drive enabled.

#### **P2.3.2.4    *Fault Reset*                              *ID414***

Contact closed: all faults are reset. Rising edge will reset faults.

#### **P2.3.2.5    *External fault 1*                      *ID405***

Contact Closed: the fault is displayed, and the drive stopped. Fault 51.

#### **P2.3.2.6    *External fault 2*                      *ID406***

Contact open: the fault is displayed, and the drive stopped. Fault 51.

#### **P2.3.2.7    *Enable Constant Ref*              *ID532***

Digital input to enable constant reference operation. When reference digital input is given drive will also start.

#### **P2.3.2.8    *Constant Ref. 1*                      *ID530***

Activates constant reference 1 if constant reference function is enabled by digital input.

Note: Will start the drive without separate start command.

#### **P2.3.2.9    *Constant Ref. 2*                      *ID531***

Activates constant reference 2 if constant reference function is enabled by digital input.

Note: Will start the drive without separate start command.

#### **P2.3.2.10   *I/O Term Control*                      *ID409***

Forces Control place to IO.

#### **P2.3.2.11   *Keypad Control*                      *ID410***

Forces Control place to keypad.

#### **P2.3.2.12   *Fieldbus Control*                      *ID411***

Forces control place to fieldbus.

**P2.3.2.13 DC CB State ID1453**

Feedback from DC circuit breaker.

**P2.3.2.14 Thermal Switch ID1179**

Digital input information from any temperature monitoring. Low signal will make selected response.

**P2.3.2.15 Quick Stop ID1213**

Drive stops the modulation immediately.

**P2.3.2.16 Charge Limit 1 ID1500****P2.3.2.17 Charge Limit 2 ID1501**

Activates charge limit 1, ID1503 or charge limit 2, ID1625. If both are active at the same time limit is set to zero.

**P2.3.2.18 Discharge Limit 1 ID1506****P2.3.2.19 Discharge Limit 2 ID1624**

Activates discharge limit 1, ID1513 or discharge limit 2, ID1514. If both are active at the same time limit is set to zero.

**P2.3.2.20 Cooling monitor ID750 "Cooling Monitor"**

When using a liquid-cooled drive, connect this input to the *Cooling OK* signal from VACON® flow control application or any input that shows state of used cooling unit. See details of operation from G2.10.7 cooling parameters group.

**P2.3.2.21 Klixon In 1 ID780**

Klixon type temperature monitoring input 1. Low signal will generate warning W66 Klixon.

**P2.3.2.22 Klixon In 2 ID781**

Klixon type temperature monitoring input 2. Low signal will generate fault F66 Klixon.

**P2.3.2.23 Input Switch ID1209**

Selects the digital input for the status of input switch. The input switch is normally switch fuse unit or main contactor with which the power is fed to the drive. If the input switch feedback is missing, the drive trips on "F55 Input Switch" fault.

**P2.3.2.24 Ambient Temp ID783**

Ambient temperature monitoring input Low signal will generate warning W88 Ambient Temp.

## 6.3.3 ANALOGUE INPUTS 1-4

**2.3.3.1**    *AI1 signal selection*        **ID377** "AI1 Signal Sel"

**2.3.4.1**    *AI2 signal selection*        **ID388** "AI2 Signal Sel"

Connect the AI1/AI2 signal to the analogue input of your choice with this parameter.

**2.3.5.1**    *AI3 signal selection*        **ID141** "AI3 Signal Sel"

**2.3.6.1**    *AI4 signal selection*        **ID152** "AI4 Signal Sel"

Connect the AI3/AI4 signal to the analogue input of your choice with this parameter.

When analogue input selection parameter is set to 0.1 you can control analogue input monitoring variable from Fieldbus by assign process data input ID number to monitoring signal thus allowing making of scaling function in drive side to PLC input signals.

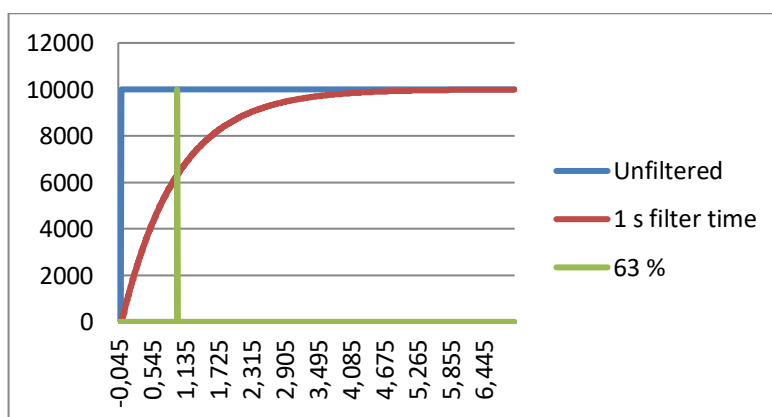
**2.3.3.2**    *Analogue input 1 signal filtering time* **ID324** "AI1 Filter Time"

**2.3.4.2**    *Analogue input 2 signal filtering time* **ID329** "AI2 Filter Time"

**2.3.5.2**    *Analogue input 3 signal filtering time* **ID142** "AI3 Filter Time"

**2.3.6.2**    *Analogue input 4 signal filtering time* **ID153** "AI3 Filter Time"

First order filtering is used for analogue inputs signals 3 and 4.



**2.3.3.3**    *AI1 custom setting minimum*        **ID321** "AI1 Custom Min"

**2.3.3.4**    *AI1 custom setting maximum*        **ID322** "AI1 Custom Max"

**2.3.4.3**    *AI2 custom setting minimum*        **ID326** "AI2 Custom Min"

**2.3.4.4**    *AI2 custom setting maximum*        **ID327** "AI2 Custom Max"

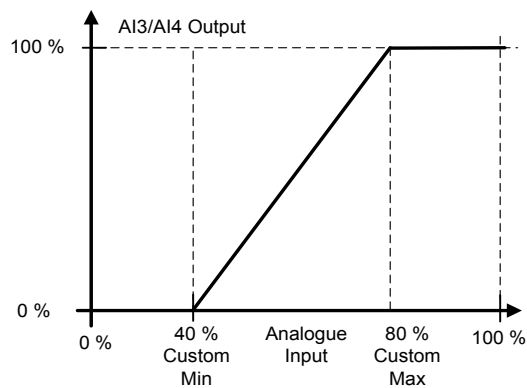
**2.3.5.3**    *AI3 custom setting minimum*        **ID144** "AI3 Custom Min"

**2.3.5.4**    *AI3 custom setting maximum*        **ID145** "AI3 Custom Max"

**2.3.6.3**    *AI4 custom setting minimum*        **ID155** "AI4 Custom Min"

**2.3.6.4**    *AI4 custom setting maximum*        **ID156** "AI4 Custom Max"

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



**2.3.3.5** *AI1 signal inversion* **ID387** "AI1 Signal Inv"

**2.3.4.5** *AI2 signal inversion* **ID398** "AI2 Signal Inv"

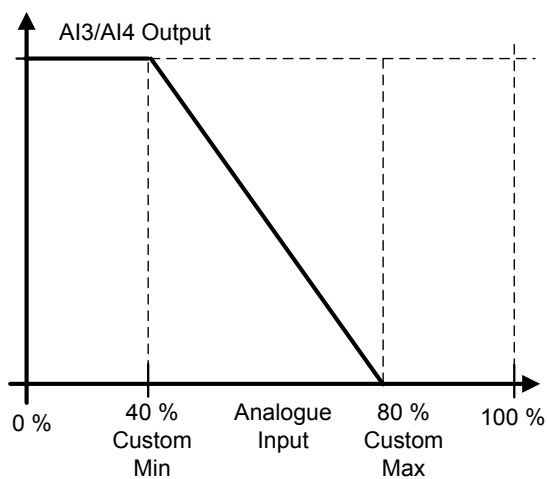
**2.3.5.5** *AI3 signal inversion* **ID151** "AI3 Signal Inv"

**2.3.6.5** *AI4 signal inversion* **ID162** "AI3 Signal Inv"

Signal inversion function is useful in situation when e.g. PLC is sending power limit to the drive by using analogue inputs, if PLC is unable to communicate to the drive power limit would be normally zero, by using inverted signal logic zero value from PLC would mean maximum power limit thus allowing drive running e.g. from keypad without changing power limit function parameters.

0 = No inversion

1 = Signal inverted



### .6.3.3.1 Analogue input to any parameter

This function allows control of any parameter by using analogue input. with parameters it is selected what will be range of control area and ID number for paramter that is controller

|                |                                               |                               |
|----------------|-----------------------------------------------|-------------------------------|
| <b>2.3.3.6</b> | <b><i>Analogue input 1, minimum value</i></b> | <b>ID303 "AI1 Scale Min"</b>  |
| <b>2.3.3.7</b> | <b><i>Analogue input 1, maximum value</i></b> | <b>ID304 "AI1 Scale Max"</b>  |
| <b>2.3.4.6</b> | <b><i>Analogue input 2, minimum value</i></b> | <b>ID393 "AI2 Scale Min"</b>  |
| <b>2.3.4.7</b> | <b><i>Analogue input 2, maximum value</i></b> | <b>ID394 "AI2 Scale Max"</b>  |
| <b>2.3.5.6</b> | <b><i>Analogue input 3, minimum value</i></b> | <b>ID1037 "AI3 Scale Min"</b> |
| <b>2.3.5.7</b> | <b><i>Analogue input 3, maximum value</i></b> | <b>ID1038 "AI3 Scale Max"</b> |
| <b>2.3.6.6</b> | <b><i>Analogue input 4, minimum value</i></b> | <b>ID1039 "AI4 Scale Min"</b> |
| <b>2.3.6.7</b> | <b><i>Analogue input 4, maximum value</i></b> | <b>ID1040 "AI4 Scale Max"</b> |

These parameters are defining range for controlled parameter. All the values are considered to be integers thus when controlling FWP as in example you need to set also numbers for decimals. e.g. FWP 100,00 needs to be set as 10000.

|                |                                 |                                 |
|----------------|---------------------------------|---------------------------------|
| <b>2.3.3.8</b> | <b><i>AI1 Controlled ID</i></b> | <b>ID1507 "AI1 Control. ID"</b> |
| <b>2.3.4.8</b> | <b><i>AI2 Controlled ID</i></b> | <b>ID1511 "AI2 Control. ID"</b> |
| <b>2.3.5.8</b> | <b><i>AI3 Controlled ID</i></b> | <b>ID1509 "AI3 Control. ID"</b> |
| <b>2.3.6.8</b> | <b><i>AI4 Controlled ID</i></b> | <b>ID1510 "AI4 Control. ID"</b> |

These parameters define what controller parameter is.

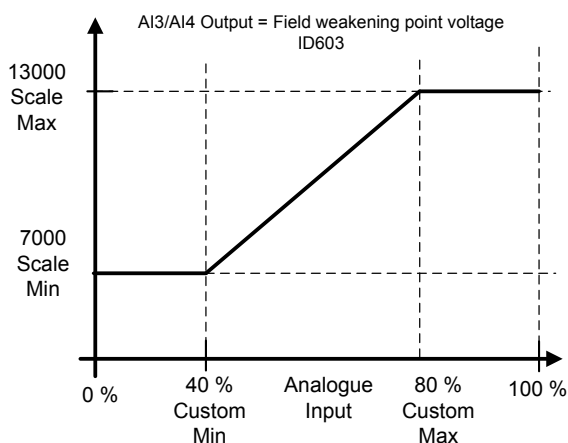
#### Example:

You want to control motor field weakening point voltage by analogue input from 70,00 % to 130,00 %.

Set Scale min to 7000 = 70,00 %

Set Scale max to 13000 = 130,00 %

Set Controlled ID to 603 Voltage at filed weakening point



Now analogue input 3 signal 0 V to 10 V (0 mA to 20 mA) will control field weakening point voltage between 70,00 % - 130,00 %. When setting value, decimals are handled as integer.

### 6.3.4 INPUT OPTIONS

#### *P2.3.7.1 DI Inversion ID1091*

Select the bit to activate inverted signal function.

**B00** = +1 = INV External Fault 1

**B01** = +2 = INV External Fault 2 (Inverted by default)

**B04** = +16 = INV Klixon input 1

**B05** = +32 = INV Klixon input 2

**B06** = +64 = INV High Ambient temperature

**B07** = +128 = INV Input Switch

**B08** = +256 = Invert charging limit digital inputs.

**B09** = +526 = Invert discharging limit digital inputs.

### 6.4 OUTPUT SIGNALS

#### 6.4.1 DIGITAL OUTPUTS

##### *2.4.1.1 Ready ID432*

The DC/DC drive is ready to operate.

##### *2.4.1.2 Running ID433*

The DC/DC drive operates (the drive is modulating).

##### *2.4.1.3 Fault ID 434*

Drive is in fault state

##### *2.4.1.4 Fault, Inverted ID 435*

No active faults.

##### *2.4.1.5 Warning ID 436*

Warning situation is active

|                 |                              |              |                         |
|-----------------|------------------------------|--------------|-------------------------|
| <b>2.4.1.6</b>  | <b>Fieldbus input data 1</b> | <b>ID455</b> | <b>"FB Dig Input 1"</b> |
| <b>2.4.1.8</b>  | <b>Fieldbus input data 2</b> | <b>ID456</b> | <b>"FB Dig Input 2"</b> |
| <b>2.4.1.10</b> | <b>Fieldbus input data 3</b> | <b>ID457</b> | <b>"FB Dig Input 3"</b> |
| <b>2.4.1.12</b> | <b>Fieldbus input data 4</b> | <b>ID169</b> | <b>"FB Dig Input 4"</b> |

The data from the fieldbus main control word can be led to the digital outputs of the drive. See the fieldbus board manual for the location of these bits.

|                 |                        |               |
|-----------------|------------------------|---------------|
| <b>2.4.1.7</b>  | <b>FB DIN 1 Par ID</b> | <b>ID 891</b> |
| <b>2.4.1.9</b>  | <b>FB DIN 2 Par ID</b> | <b>ID 892</b> |
| <b>2.4.1.11</b> | <b>FB DIN 3 Par ID</b> | <b>ID 893</b> |
| <b>2.4.1.13</b> | <b>FB DIN 4 Par ID</b> | <b>ID 894</b> |

With these parameters you can define the parameter to be controlled by using FB digital input.

Example:

All option board inputs are already in use, but you want to give a DI: External Fault 1 (ID405) and drive has a fieldbus board.

Set parameter ID892 (Fieldbus Digital Input 2) to 405. Now you are able to control External Fault 1 command from the fieldbus by Profibus control word (bit 11).

It is possible to control any parameter in the same way if values 0 = FALSE and 1 = TRUE are significant for that parameter. For example, P2.1.5 Parallel AFE (ID1501) can be switched on and off using this function (Parallel AFE: 0 = No, 1 = Yes).

#### **2.4.1.14 Charge DC ID1668**

Digital output for DC-Link charge control.

#### **2.4.1.15 DC Ready ID1218**

DC-Link voltage is high enough that drive internal charging switch has been closed. i.e. drive DC-Link has been charged. And also, DC-Link Voltage is higher than Measured Source Voltage.

See details and operation selections on P2.4.6.2 DC Ready Mode ID1607

**Note** that upper system needs to make other verification if breaker to battery can be closed. This output is just indication of charged CD-link-

#### **2.4.1.16 Charging ID1219**

Indication of direction of active current. When DO is high drive is charging the source more than a 0,5 %.

#### **2.4.1.17 Discharging ID1220**

Indication of direction of active current. When DO is high drive is discharging the source more than a 0,5 %.

### 6.4.2 ANALOGUE OUTPUTS 1 & 2

**P2.4.2.1** *lout 1 Signal* **ID464**

**P2.4.3.1** *lout 2 Signal* **ID471**

Connect the AO signal to the analogue output of your choice with this parameter.

**P2.4.2.2** *lout 1 Content* **ID307**

**P2.4.3.2** *lout 2 Content* **ID472**

0 = Not used

1 =  $\pm 2^*$  Active Current

Bidirectional active current. Default scaling 50 %.

2 = Source Voltage

Estimated Source Voltage. Shows zero voltage when drive is not modulating.

3 = Measured Source Voltage

Shows V1.12.11 Voltage Meas. ID1866

4 = DC Voltage Unfiltered

500 Vdc unit scaling 1000 Vdc and 690 Vac unit 1317 Vdc

5 = DC Current

Bidirectional active current. Default scaling 50 %.

6 = Power

Bidirectional active current. Default scaling 50 %.

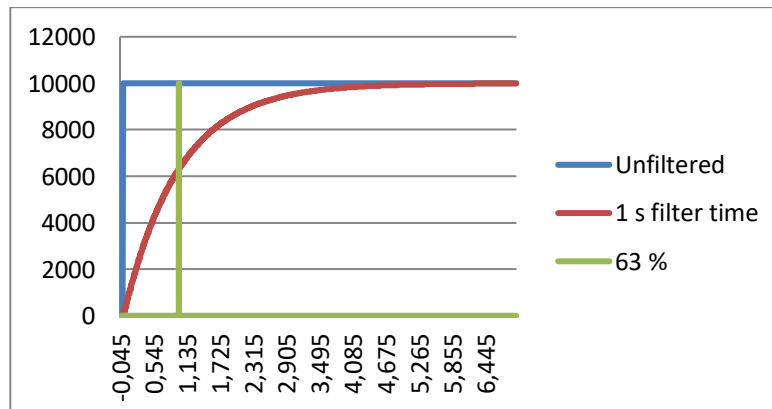
7 = FB Analogue Input ID48

8 = Value Control Output

**P2.4.2.3** *lout 1 Filter Time* **ID308**

**P2.4.3.3** *lout 2 Filter Time* **ID473**

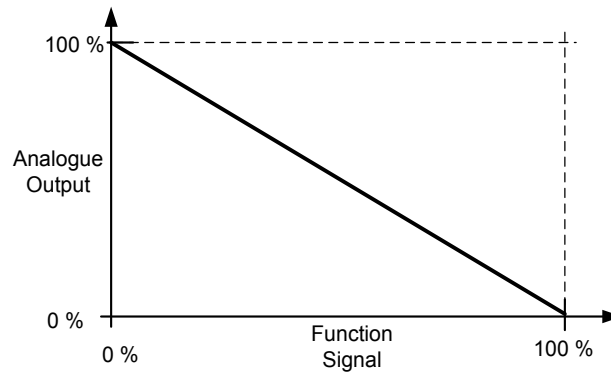
Defines the filtering time of the analogue output signal. Setting this parameter value 0 will deactivate the filtering. First order filtering is used for the analogue output signals.



**P2.4.2.4 lout 1 Invert ID309****P2.4.3.4 lout 2 Invert ID474**

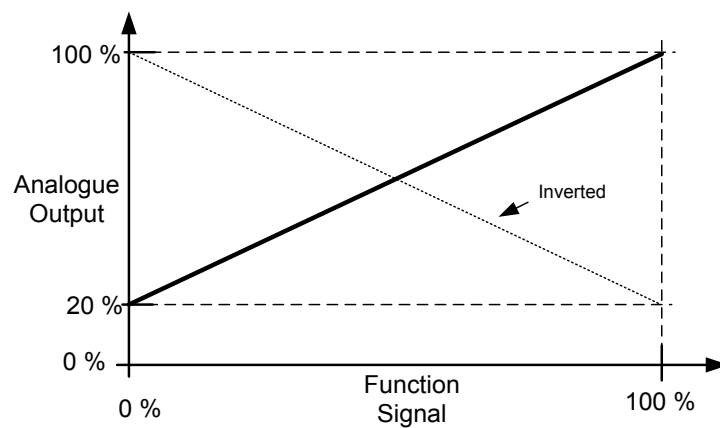
Inverts the analogue output signal:

- Maximum output signal = Minimum set value.
- Minimum output signal = Maximum set value.

**P2.4.2.5 lout 1 Minimum ID310****P2.4.3.5 lout 2 Minimum ID475**

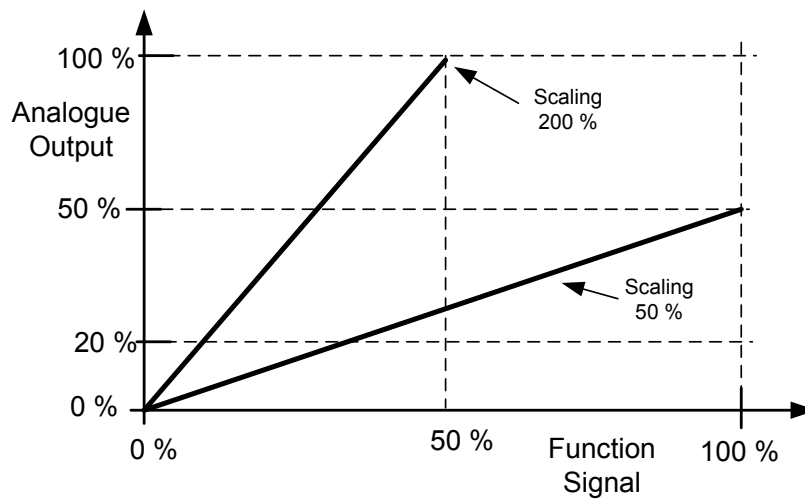
0 = Set minimum value to 0 mA (0%)

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

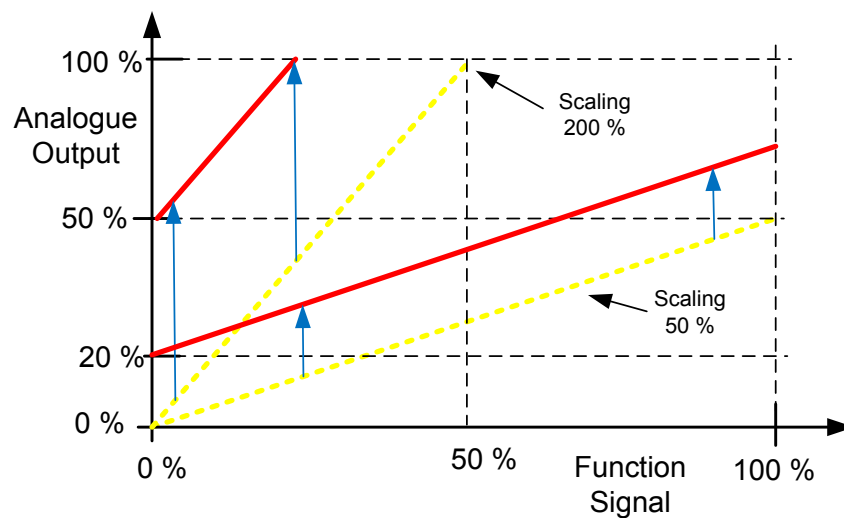


**P2.4.2.6 lout 1 Scale ID311****P2.4.3.6 lout 2 Scale ID476**

A scaling factor for an analogue output.

**P2.4.2.7 lout 1 Offset ID375****P2.4.3.7 lout 2 Offset ID477**

Add -100.0 to 100.0% to the analogue output.



### 6.4.3 DELAYED DIGITAL OUTPUTS 1 & 2

**P2.4.4.1**    *Digital output 1 signal selection*                      **ID486** "Dig.Out 1 Signal"

**P2.4.5.1**    *Digital output 2 signal selection*                      **ID489** "Dig.Out 2 Signal"

Connect the delayed digital output signal to the digital output of your choice with this parameter. For more information about the TTF programming method, see chapter Error! Reference source not found..

**P2.4.4.2**    *Digital output function*                                      **ID312** "D01 Content"

**P2.4.5.2**    *Digital output 2 function* **ID490** "D02 Content"

0 = "Not used"

1 = "Ready"

The AC drive is ready to operate.

Common reasons when 'Ready' signals are missing:

- Run enable signal is low
- DC Voltage is too low
- DC Voltage is too high

2 = "Run"

The AC drive is modulating.

3 = "Fault "

A fault trip has occurred

4 = "FaultInvert"

No active faults in the drive.

5 = "Warning"

Always if a warning is on

6 = "ThermFlt/Wrn"

Thermistor fault or warning

The thermistor input of option board indicates overtemperature. Fault or warning depending on the response parameter.

7 = "FB DigInput1"

Fieldbus digital input data 1

8 = "FB DigInput2"

Fieldbus digital input data 2

9 = "FB DigInput3"

Fieldbus digital input data 3

10 = "ID.Bit"

Select the signal for controlling the DO. The parameter has to be set in format xxxx.yy where xxxx is the ID number of a signal and yy is the bit number. For example, the value for DO control is 1174.02. 1174 is the ID number of Warning Word 1. So the digital output is ON when bit number 02 of the warning word (ID no. 1174) i.e. Motor underload is high.

11 = "Charging"

Active current is more than 0,5 %.

12 = "Dischrging"

Active current is less than -0,5 %.

|                 |                                   |              |                        |
|-----------------|-----------------------------------|--------------|------------------------|
| <b>P2.4.4.3</b> | <b>Digital output 1 on-delay</b>  | <b>ID487</b> | <b>"D01 ON Delay"</b>  |
| <b>P2.4.5.4</b> | <b>Digital output 1 off-delay</b> | <b>ID488</b> | <b>"D01 OFF Delay"</b> |
| <b>P2.4.4.3</b> | <b>Digital output 2 on-delay</b>  | <b>ID491</b> | <b>"D02 ON Delay"</b>  |
| <b>P2.4.5.4</b> | <b>Digital output 2 off-delay</b> | <b>ID492</b> | <b>"D02 OFF Delay"</b> |

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

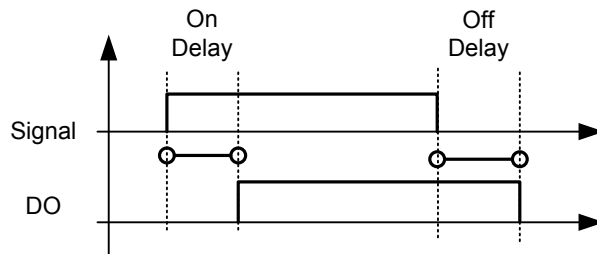


Figure 6-1. Digital outputs 1 and 2, on- and off-delays

|                 |                         |               |
|-----------------|-------------------------|---------------|
| <b>P2.4.4.5</b> | <b>ID.Bit Free DO 1</b> | <b>ID1217</b> |
| <b>P2.4.5.5</b> | <b>ID.Bit Free DO 2</b> | <b>ID1385</b> |

Select the signal for controlling the DO. The parameter has to be set in format xxxx.yy where xxxx is the ID number of a signal and yy is the bit number. For example, the value for DOcontrol is 1174.02. 1174 is the ID number of Warning Word 1. So the digital output is ON when bit number 02 of the warning word (ID no. 1174) i.e. *Motor underload* is high.

#### 6.4.4 OUTPUT OPTIONS

##### **P2.4.6.1 Output Inversion ID1808**

Invert selected digital output functions.

**B2** =+4= Invert Digital Output 1

**B3** =+8= Invert Digital Output 2

##### **P2.4.6.2 DC Ready Mode ID1607**

Select operation mode for DC Ready status indication. Selection 1 / "AFE Ready" selection is the operation that was in version V108 and older. Recommended selection for indicate DC Ready is the selection 3 / "DC Ready". Selection 1 and 2 are basically indicating status correctly on rising edge only after that status is kept even if the conditions change.

###### **0=Not used**

Default.

###### **1=AFE Ready**

Compatibility mode. Indicates state correctly only in rising edge. Status is reset when DC-Link voltage falls below charge switch opening level or FB Control Word.B0 DC Charge bit falls zero. State is set when DC-Link Voltage is above Measured Source Voltage and charge switch state is closed.

**Note!** Does not open if measured source voltage becomes higher than DC-Link voltage once DC Ready signal is given.

###### **2=Charge Switch**

Same as selection 1 / AFE Ready but FB Control Word.B0 DC Charge bit does not affect operation.

**Note!** Does not open if measured source voltage becomes higher than DC-Link voltage once DC Ready signal is given.

###### **3=DC Ready**

Indicates DC Ready state also after ready level is reached once.

State is set when DC-Link Voltage is above Measured Source Voltage and charge switch state is closed. But also state goes false if DC-Link Voltage falls below Measured Source Voltage while P2.3.2.13 DC CB State is false. DC Ready state is kept high while DC CB State is high even if DC-Link Voltage fall below measured source voltage.

## 6.5 LIMIT SETTINGS

### 6.5.1 CURRENT LIMIT

#### ***P2.5.1.1 Current Limit A ID107***

Current limit in amps.

#### ***P2.5.1.2 Charging Limit % ID1290***

Charging current limit in percentage of Source Nom Current. On start current limit is ramped from zero to set current limit. Decreasing limit will be done without ramp.

#### ***P2.5.1.2 Discharge Limit % ID1289***

Discharging current limit in percentage of Source Nom Current. On start current limit is ramped from zero to set current limit. Decreasing limit will be done without ramp.

#### ***P2.5.1.4 Charge Ramp Up ID1502***

Charging limit ramp up rate.

#### ***P2.5.1.5 Discharge Ramp Up ID1532***

Discharging ramp up rate

#### ***P2.5.1.6 Charge Limit 1 ID1503***

Charge limit activated by digital input ID1500.

#### ***P2.5.1.7 Charge Limit 2 ID1625***

Charge limit activated by digital input ID1501.

#### ***P2.5.1.8 Discharge Limit 1 ID1513***

Discharge limit activated by digital input ID1506.

#### ***P2.5.1.9 Discharge Limit 2 ID1514***

Discharge limit activated by digital input ID1624.

### 6.5.2 UNDER VOLTAGE CONTROL

Under voltage controller starts to feed DC-Link when undervoltage limit/reference is reached. Discharging is limited by discharge current limit and minimum source voltage limit.

#### ***P2.5.2.1 Under Voltage Reference ID1567***

Under voltage reference, % of unit nominal DC Voltage.

500 Vac unit nominal DC: 675 Vdc

690 Vac unit nominal DC: 931 Vdc

690 Vac NX8 unit nominal DC: 963 Vdc

#### ***P2.5.2.2 Under Voltage Droop ID1863***

Under voltage reference drooping, set droop is reached when active current is 100 %.

#### ***P2.5.2.3 Under Voltage Kp ID1468***

#### ***P2.5.2.4 Under Voltage Ti ID1409***

#### ***P2.5.2.5 Under Voltage Kp Add ID1425***

#### ***P2.5.2.6 Enable Black Start ID1813***

This parameter enables low DC-Link ready level. Any value above zero will enable function. i.e. previous license codes will enable function even the license is no longer needed.

### 6.5.3 OVER VOLTAGE CONTROLLER

When discharging battery, over voltage controller starts to limit discharge current when over voltage limit/reference is reached.

When DC-Link voltage rises to over voltage level from external power, drive will start to charge, until charging current limit is reached or maximum source voltage.

#### ***P2.5.2.1 Over Voltage Reference ID1528***

Over voltage reference, % of unit nominal DC Voltage. Default and maximum 118 %

500 Vac unit nominal DC: 675 Vdc. 118 % = 797 Vdc

690 Vac unit nominal DC: 931 Vdc. 118 % = 1098 Vdc

690 Vac NX8 unit nominal DC: 963 Vdc. 118 % = 1136 Vdc

Units maximum Ready level is higher than the operation level to allow starting the unit in case higher no-load DC-Link Voltage.

Maximum DC Voltage level where drive stays in ready state in stop state:

500 Vac unit: 844 Vdc

690 Vac unit: 1164 Vdc

690 Vac NX8 Unit: 1203 Vdc

Once unit is started voltage is controlled back to 118 % level. Note that this may cause current flow to battery even in zero current reference while over voltage controller tries to bring voltage to correct level.

#### ***P2.5.2.2 Over Voltage Droop ID1862***

Over voltage reference drooping, set droop is reached when active current is 100 %.

#### ***P2.5.2.3 Over Voltage Kp ID699***

#### ***P2.5.2.4 Over Voltage Ti ID698***

#### ***P2.5.2.5 Over Voltage Kp Add ID697***

#### 6.5.4 SOURCE DC VOLTAGE LIMITS

##### **P2.5.4.1 Source Min Voltage ID1893**

If Source DC voltage reaches this minimum value while in current reference mode the source voltage limit controllers start to adjust the current reference to keep correct voltage in source.

In Voltage control mode this will limit the reference, if given higher value than battery actual voltage drive will start to charge source until set new limit is reached.

Closed Loop Voltage control is not started before Source Voltage is above this limit if starting voltage were lower.

##### **P2.5.4.2 Source Max Voltage ID1895**

If Source DC voltage reaches this maximum value while in current reference mode the source voltage limit controllers start to adjust the current reference to keep correct voltage in source.

In Voltage control mode this will limit the reference, if given lower value than battery actual voltage drive will start to discharge source until set new limit is reached.

##### **P2.5.4.3 Source Voltage Hysteresis ID1896**

Hysteresis for Status Word Charging Allowed and discharging allowed status bits.

##### **P2.5.4.4 Reverse Current Limit % ID1539**

This parameter defined how much current reference can be reversed to keep the voltage at correct level. Due to current measurement errors in current control mode the voltage may start to creep slowly. By allowing voltage limit controller charge or discharge source while at zero current reference, the drive can keep the source voltage at correct level.

#### 6.5.5 POWER LIMIT

##### **P2.5.5.1 Charge Power Limit ID1287**

Charging power limit. 100 % equals nominal current at nominal voltage.

##### **P2.5.5.2 Discharge Power Limit ID1288**

Discharging power limit. 100 % equals nominal current at nominal voltage.

## 6.6 DC CONTROL

### *P2.6.1 DC Control Mode ID600*

**0 = Open Loop**

External feedbacks are not used for control,

**1 = Closed Loop**

Voltage feedback is used for voltage controller.

### 6.6.1 INNER CONTROL LOOP

Parameters for adjusting current and voltage controllers. No need to adjust unless recommended by factory.

#### *P2.6.2.1 Current Control Kp ID617*

This parameter sets the gain of the current PI controller in current controller mode.

#### *P2.6.2.2 Current Control Ti ID657*

This parameter sets the integration time constant of the current PI controller in current control mode.

#### *P2.6.2.3 Voltage Control Kp ID1870*

This parameter sets the gain for the PI voltage controller in voltage control mode.

#### *P2.6.2.4 Voltage Control Ki ID1871*

This parameter sets the integration time constant in ms of the PI controller in voltage control mode.

### 6.6.2 CLOSED LOOP

Voltage controller loop using analogue input as feedback signal. PI controller will make correction to final voltage reference within allowed maximum adjust.

**P2.6.3.1 DC Control Kp ID613**

Gain for feedback control loop for voltage.

**P2.6.3.2 DC Control Ti ID614**

Integration for feedback control loop for voltage.

**P2.6.3.3 DC PI Max Adjust ID1906**

Maximum adjustment to voltage that PI controller can do. If Measured voltage and open loop calculated voltage difference is more that this drive will trip to F81 Closed Loop.

**P2.6.3.4 CL Feed Back Loos response ID752**

Response when feedback goes outside ID1906, regardless of response selection Closed Loop PI controlled will be disabled.

0 = No response

1 = Warning

2 = Fault

### 6.6.3 VOLTAGE FEEDBACK

#### ***P2.6.4.1 Feedback AnIN ID1595***

Select analogue input that is used for feedback signal. When this input is not selected actual value can be given through fieldbus by connecting FB Process Data In 1 to monitoring signal ID1866

#### ***P2.6.4.2 Feedback Filter TC ID618***

Set filtering time constant for feedback signal.

#### ***P2.6.4.3 Nom Vdc Signal Level ID337***

Set here signal level when raw analogue input signal will be at Source Nom Voltage level.

$$\left( \frac{P2.1.2 \text{ SNV [Vdc]}}{\text{SVAMS (20 mA) [Vdc]}} * (100\% - P2.6.4.4 \text{ ZVSL}[\%]) \right) + P2.6.4.4 \text{ ZVSL}[\%] = \text{Nom Vdc Signal Level}$$

SNV = Source Nom Voltage

SVAMS = Source Voltage At Max Signal

ZVSL = Zero Vdc Signal Level

Source Voltage At MaxSignal (20 mA) : Sensor signal in Vdc at 20 mA

#### ***P2.6.4.4 Zero Vdc Signal Level ID320***

Set here analogue input signal level where Vdc will be zero Vdc.

## 6.7 DRIVE CONTROL

### *P2.7.1      Switching frequency      ID601*

Default 5,0 kHz, recommended to keep default. When all phases are connected to source, source side will see 15 kHz switching frequency.

Maximum switching frequency is 6kHz for frame sizes FR/FR4-8 and 5kHz for FI/FR9-14 and the liquid cooled units. Lower switching frequency can be used to reduce derating, but filter inductance needs to be higher.

### *P2.7.2      Control Options 1      ID1707*

**B10 = +1024** = Reserved

**B12 = +4096** = Reserved

### *P2.7.3      DC/DC Options      ID1463*

**B12 = +4096** = Direct voltage control when voltage control mode selected.

Controls duty cycle of the converter directly instead of cascade control used in the standard voltage control mode. Use this control mode for DC-power supply applications where robustness against load steps is required.

**Note:** Recommended to use P2.2.9.3 DirectVdcControl ID1743 parameter instead.

### 6.7.1 IDENTIFICATION

#### **P2.7.4.1**    *IU Offset*    **ID668**

Identified U phase current measurement offset, identified during identification run.

#### **P2.7.4.2**    *IV Offset*    **ID669**

Identified U phase current measurement offset, identified during identification run.

#### **P2.7.4.3**    *IW Offset*    **ID670**

Identified W phase current measurement offset, identified during identification run.

#### **P2.7.4.4**    *Charge Resistance*    **ID662**

Resistance when charging, used for source voltage estimation after the filter. This parameter needs to be tuned manually. Tune the resistance higher or lower when comparing the actual battery voltage and Source Voltage. Tuning must be done when some amount of current is flowing to correct directions.

#### **P2.7.4.5**    *Discharge Resistance*    **ID665**

Resistance when discharging, used for source voltage estimation after the filter. This parameter needs to be tuned manually. Tune the resistance higher or lower when comparing the actual battery voltage and Source Voltage. Tuning must be done when some amount of current is flowing to correct directions.

#### **P2.7.4.6**    *DCLinkMeasCalib*    %    **ID549**

To increase the DC-voltage accuracy you may use ID549 to adjust the DC-link voltage measurement shown by the converter. This parameter will add a small gain offset to the measured DC-link voltage value. This feature helps to balance the load sharing for parallel converters.

### 6.7.2 SYSTEM TEST

This parameter group is reserved for internal testing purposes.  
Do not edit parameters in this group is not instructed to do so.

#### ***P2.7.5.1 Modulation Limit ID1515***

This parameter can be used to limit maximum modulation voltage on source side.

#### ***P2.7.5.2 Advanced Options 1 ID1560***

B10 = +1024 = Fast DC-Link ripple compensation

B11+B10 = +3072 = Fast DC-Link ripple compensation + 300 Hz ripple compensation

#### ***P2.7.5.3 Advanced Options 2 ID1561***

Reserved

#### ***P2.7.5.4 Inverse Synch ID1857***

#### ***P2.7.5.5 DC Ripple Compensation Kp ID1897***

Gain for DC-Link ripple compensation.

#### ***P2.7.5.6 DC Ripple Compensation Phase ID1898***

Phase for DC-Ripple compensation.

#### ***P2.7.5.7 DC Ripple Compensation Frequency ID1899***

Frequency for DC-Link ripple compensation.

#### ***P2.7.5.8 DC/DC Options 2 ID1464***

### 6.7.3 BATTERY EMULATOR/SIMULATOR

The DC/DC converter can be used as a current source and sink like a battery. The battery model in the converter emulates the battery voltage behavior. The model includes series resistance of the battery and no load voltage model. The voltage will drop according to series resistance when discharged and increase when charged. The voltage increase is simulated with negative resistance. Battery no load voltage changes as a function of state of charge according to parameters of the model. Power flow in the DC-link needs to be handled by AFE or other source and load.

There is also a simulation mode to show the emulated voltage without actually loading the converter. Danfoss provides a tool to calculate the model parameters based on the battery cell datasheet. Use the tool to parametrize the converter.

Battery model is given by equations:

1.  $V_{battery} = E - R_{DC} * i$
2.  $E = Source\ nominal\ voltage * (1 - K * (\frac{Q}{Q-it} - 1)) + A * e^{-B*it}$

Make sure P2.5.4.1 SourceMinVoltage and P.2.5.2 SourceMaxVoltage is not limiting the model voltage unintentionally.

#### **P 2.7.6.1 EmulatorMode** **ID3501**

##### **0 = Disabled**

DC/DC converter operates without battery emulation

##### **1 = Emulator Mode**

Battery emulation is active. Source voltage is defined by the model parameters. Note: P2.1.4 needs to be in voltage control mode to activate emulator mode.

##### **2 = Simulator Mode**

Battery emulation is running in simulation mode. NCDrive can be used to show the model voltage without applying the voltage at the output of the converter. Use P2.1.6 Current Reference to charge and discharge the battery. Battery is charged and discharged ten times faster than actual(?)

#### **P 2.7.6.2 Model A** **% ID3502**

Defines voltage increase in the exponential zone of the battery voltage

#### **P 2.7.6.3 Model B** **% ID3503**

Defines shape of the exponential zone of the battery voltage

#### **P 2.7.6.4 Model K** **% ID3504**

Defines slope of the voltage change in the nominal zone

#### **P 2.7.6.5 Model Q** **% ID3505**

Defines virtual total capacity of the battery (zero voltage)

**P 2.7.6.6 Model Qnomh** % ID3506

Defines nominal capacity of the battery. Defines 100% SoC capacity.

*P 2.7.6.7 Model R* % *ID3507*

Battery internal resistance.

**P 2.7.6.8 Model Set SoC** % **ID3508**

User can initialize the state of charge of the battery model.

**V2.7.6.9 Model Voltage** % ID3509

Model voltage monitoring variable.

**V2.7.6.10 Model SoC** % **ID3510**

*Model state of charge monitoring variable.*

## 6.8 MASTER-FOLLOWER PARAMETERS

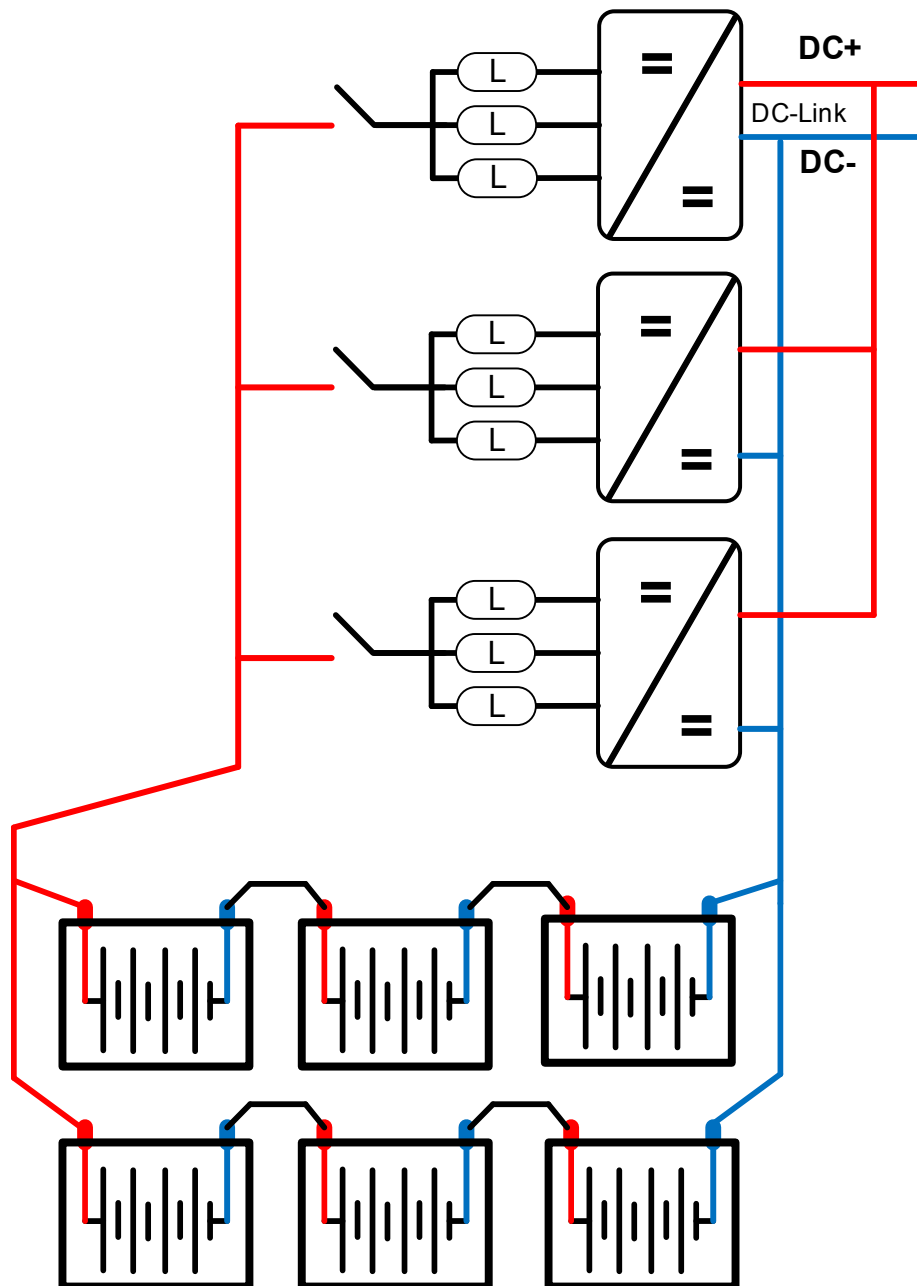
These parameters are used to set up parallel operation of DC/DC converter drives. When activated drives will interleave modulation between unit additionally to phase modulation interleaving to reduce voltage and current ripple.

Master drive control mode will be used in follower drives regardless of follower drive settings.

Master drive references will be used in follower drives regardless of follower drive settings.

Limit controllers are operational in follower drives.

Follower drives are "ramp" followers, i.e. follower drives are using e.g. ramp times set in master drive assuming limit controllers are not active.



### 6.8.1 MASTER FOLLOWER CONFIGURATION

The OPTD2 board in the Master has default jumper selection, X5:1-2. For the followers, the jumper positions have to be changed: **X5:2-3**. This board also has a CAN communication option that is useful for multiple drive monitoring with NCDrive PC software when commissioning Master Follower functions or line systems. Older boards has X6, leave this to ON (X6:1-2).

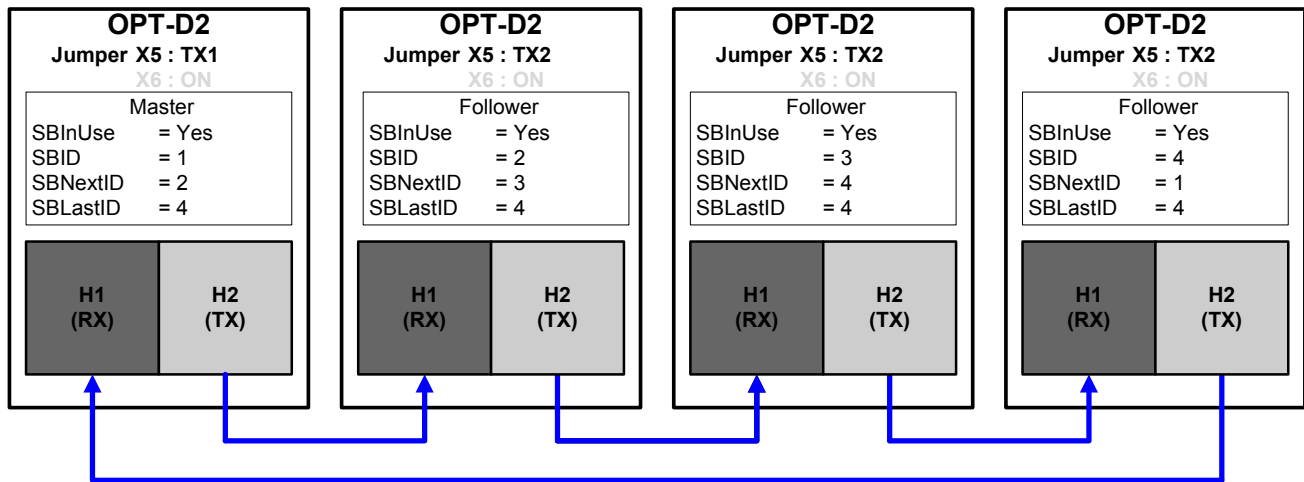


Figure 6-2. System bus physical connections with the OPT-D2 board

#### P2.8.1 Master/Follower selection ID1324 "MF Mode"

Select the Master Follower mode. When the drive is a follower, the Run Request command is monitored from Master and in case of DC/DC Converter all references are also received from master.

0 = Single drive

System bus is deactivated

1 = Master

Drive sends Master CW, Current Reference and Voltage Reference to follower drives.

2 = Follower

Drive receives control word from Master and references and sends some diagnostic information to the Master drive.

#### P2.8.2 SystemBus communication fault response ID1082 "SB Comm Fault"

Defines the action when the System Bus heartbeat is missing.

The master drive sends a heartbeat signal to all follower drives and this heartbeat is sent back to the master drive.

0 = No response

1 = Warning

2 = Fault

#### P2.8.3 SystemBus fault delay ID1352 "SB fault Delay"

Defines the delay before fault generation when heartbeat is missing.

**P2.8.4**     ***SynchFaultResponse***     **ID1701**     ***"SynchFaultResp"***

Defines response when interleaving modulation is not in synch

0 = No response

1 = Warning

2 = Fault

**P2.8.5**     ***Follower Fault***     **ID1536**     ***"Follower Fault"***

Defines the response in the Master drive when a fault occurs in any of the follower drives. When one of the drives trips to fault the master drive will send a command to trigger the Data Logger in all the drives for diagnostic purposes.

0 = No response

1 = Warning

2 = Fault, stop mode after fault according to Stop function

## 6.9 FIELDBUS PARAMETERS

### ***P2.9.1      FB Actual Value Selector                      ID1853***

Select signal ID that is used as “FB Actual speed / Actual Value 1” from the drive.

### ***P2.9.2      GSWID                                              ID897***

Select the value for “FBGeneralStausWord”

### ***P2.9.3 -      Fieldbus data out 1-8 selection                      ID852-ID859*** ***P2.9.10***

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

### ***P2.9.11 -      Fieldbus data out 9- 16 selection                      ID558-ID565*** ***P2.9.18***

These are similar parameters as *P2.9.3- 10*.

Note that these parameters are visible only if a Fieldbus board with support for 16 process data variables is inserted in slot D or E. By default, these parameters are not used.

### ***P2.9.19      FB Reference Selector                                      ID1850***

Select where the fieldbus “FBSpeedReference / Reference 1” signal is connected in the application. Use only in ByPass mode.

### ***P2.9.20 -      Fieldbus data in 1-8 selection                                      ID876-ID883*** ***P2.9.27***

Using these parameters, you can control any parameter from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters.

### ***P2.9.28 -      Fieldbus data in 9- 16 selection ID550-ID557*** ***P2.9.35***

These are similar parameters as *P2.9.20-27*.

Note that these parameters are visible only if a Fieldbus board with support for 16 process data variables is inserted in slot D or E. By default, these parameters are not used.

**P2.9.36 Control Slot Selector ID1440**

This parameter defines which slot is used as the main control place when two fieldbus boards have been installed in the drive. When values 6 or 7 are selected, the drive can use a Fast fieldbus profile, if a fieldbus board with support for the Fast profile is inserted in slot D or E. When values 8 or 9 are selected the drive can use 16 process data variables if the used fieldbus board hardware and firmware support it. See the Fieldbus-board manual for further details.

- 0 = Not Sel.
- 4 = Slot D, Normal (8 process data variables)
- 5 = Slot E, Normal (8 process data variables)
- 6 = Slot D, Fast fieldbus support
- 7 = Slot E, Fast fieldbus support
- 8 = Slot D, Extended (16 process data variables)
- 9 = Slot E, Extended (16 process data variables)

**P2.9.37 State Machine ID896**

**0 = Basic:** This mode makes fieldbus control behaves as in explained in used fieldbus board manual.

**1 = Standard:** Simple control word that is used in modes where control word from fieldbus is used as such, for some fieldbus board this requires bypass operation.

**P2.10.38 SWID.Bit selection B11 ID 1907****P2.10.39 SWID.Bit selection B12 ID 1908****P2.10.40 SWID.Bit selection B13 ID 1909****P2.10.41 SWID.Bit selection B14 ID 1910**

Select the bit that used in FB Status Word Bit 11, 12, 13 and 14.

## 6.10 PROTECTIONS

### 6.10.1 GENERAL

#### P2.10.1.1 Max Charge Time ID1522

When drive charging options is used this parameter defines maximum time limit for charging. Use suitably sized DC Charging resistor by checking Pulse loadability for time duration set in for Max Charge Time parameter.

##### *.6.10.1.1 4mA fault protection*

The 4 mA protection monitors the analogue input signal level from Analogue input 1 and Analogue input 2. The monitoring function is active when signal is below minimum and there is a start request. A fault or warning is generated when the signal falls below 80 % of minimum for 5 seconds or below 50 % of minimum 0.5 seconds.

#### *P2.10.1.2 Response to the 4mA reference fault ID700 "4mA Input Fault"*

0 = No response

1 = Warning

2 = Fault.

#### *P2.10.1.3 FaultWarnIndicat ID1940*

With this parameter its possible to select how warning and fault indication as handled to digital outputs and to fieldbus

0 = Static

Static signal, as long as warning or fault is active

1 = Toggle

New fault or warning toggles signal for one second.

2 = Marine

Signal toggles in new fault or warning and status needs to be reset to get signal down.

#### *P2.10.1.4 Input Ph. Supervision ID730*

Select the response for input phase supervision function.

#### *P2.10.1.5 Quick Stop Indication ID1543*

Select the response for Quick Stop, regardless what is selected response drive will always stop modulation.

**P2.10.1.6 Run Enable Indication ID1177**

Select the response for Run Enable, regardless what is selected response drive will always stop modulation.

**P2.10.1.7 Klixon Response ID782**

Select the response for klaxon inputs.

**0** = No Action

**1** = Warning, Warning

Both klaxon inputs give a warning

**2** = Warning, Fault

Klaxon input 1 will generate warning and klaxon input 2 will generate fault

**3** = Fault, Fault

Both klaxon inputs give a fault

**P2.10.1.8 Ambient Temp Response ID784**

Select the response for ambient temperature digital input.

**P2.10.1.9 Input Switch Response ID785**

Select the response for input switch digital input.

### 6.10.2 TEMPERATURE SENSORS

The temperature protection function is used to measure temperatures and issue warnings and/or faults when the set limits are exceeded. The DC/DC Converter application supports two OPT-BH and OPT-B8 board simultaneously.

#### ***P2.10.2.1 Number of used inputs in board 1 ID739 "Board1 Channels"***

Select used temperature sensor combination with this parameter. See also the Vacon I/O boards manual.

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

**Note:** If the selected value is greater than the actual number of used sensor inputs, the display will read 200°C. If the input is short-circuited the displayed value is -30°C.

#### ***P2.10.2.2 Board 1 Temperature response ID740 "Board1 Response"***

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

#### ***P2.10.2.3 Board 1 warning limit ID741 "Board1Warn.Limit"***

Set here the limit at which the PT100 warning will be activated.  
When individual warning and fault limits are activated this is first board first channel (1A).

#### ***P2.10.2.4 Board 1 fault limit ID742 "Board1 Fault Lim."***

Set here the limit at which the PT100 fault (F56) will be activated.  
When individual warning and fault limits are activated this is first board first channel (1A).

#### ***P2.10.2.5 Number of used inputs in board 2 ID743 "Board2 Channels"***

If you have two temperature sensor boards installed in your AC drive you can choose here the combination inputs in use in the second board. See also the VACON® I/O boards manual.

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

**P2.10.2.6 Board 2 Temperature response ID766 "Board2 Response"**

0 = No response

1 = Warning

2 = Fault, stop mode after fault according to Stop Function

3 = Fault, stop mode after fault always by coasting

**P2.10.2.7 Board 2 warning limit ID745 "Board2 Warn. Lim"**

Set here the limit at which the second temperature sensor board warning will be activated. When individual warning and fault limits are activated this is second board first channel (2A).

**P2.10.2.8 Board2 fault limit ID746 "Board2 FaultLim"**

Set here the limit at which the second temperature sensor board fault (F61) will be activated. When individual warning and fault limits are activated this is second board first channel (2A).

**.6.10.2.1 Individual channel monitoring**

Individual channel monitoring is activated by setting one of the warning limits (per board) different than zero. Common limits in above parameters will be channel A warning and fault limits. Channel B and C limits are set with below parameters.

**P2.10.2.9.1 Channel 1B Warn ID764****P2.10.2.9.2 Channel 1B Fault ID765**

First board second (1B) channel warning and fault limits.

**P2.10.2.9.3 Channel 1C Warn ID768****P2.10.2.9.4 Channel 1C Fault ID769**

First board third (1C) channel warning and fault limits.

**P2.10.2.9.5 Channel 2B Warn ID770****P2.10.2.9.6 Channel 2B Fault ID771**

Second board second (2B) channel warning and fault limits.

**P2.10.2.9.7 Channel 2C Warn ID772****P2.10.2.9.8 Channel 2C Fault ID773**

Second board third (2C) channel warning and fault limits.

**6.10.3 THERMAL PROTECTION*****P2.10.3.1 Response to thermistor fault ID732***

- 0 = No response
- 1 = Warning
- 2 = Fault

Setting the parameter to 0 will deactivate the protection.

***P2.10.3.2 Thermal Fault Delay ID707***

Delay parameter before fault is triggered when switch type thermal inputs are used.

**6.10.4 FIELDBUS PROTECTION*****P2.10.4.1 Response to fieldbus fault ID733 "FBComm.FaultResp"***

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

- 0 = No response
- 1 = Warning
- 2 = Fault.

***P2.10.4.2 Fieldbus Watch Dog delay ID1354 "FB WD Delay"***

Defines delay when fault is generated when watch dog pulse is missing from fieldbus. Set the time to zero to disable watchdog monitoring.

**6.10.5 EXTERNAL FAULTS*****P2.10.5.1 Response to external fault 1 ID701******P2.10.5.2 Response to external fault 2 ID1504***

This parameter defines a response to external fault. If the drive monitors the state of external fault input and a fault occurs the drive can be set to respond to the fault. External fault 1 gives F51 and External fault 2 gives F82.

- 0 = No response
- 1 = Warning
- 2 = Fault

#### 6.10.6 REFERENCE ERROR

These function monitors if reference is follower or if actual source Vdc is exceeding set limits.

##### ***P2.10.6.1 Ref Error Response ID735***

Select the response when current reference and actual current has error of ID753 and time ID754 has passed.

##### ***P2.10.6.2 Ref Error Hysteresis ID753***

This parameter defined acceptable error for active current compared to current reference.

##### ***P2.10.6.3 Ref Error Delay ID754***

Delay to action selected by ID735 when active current is outside of set hysteresis.

##### ***P2.10.6.4 Source Vdc Lim Response ID1012***

Select response when Source Voltage has exceeded low of high limit set by ID1893 and 1895, SourceMinVoltage and SourceMaxVoltage respectively.

##### ***P2.10.6.5 Source Vdc Lim Delay ID737***

Delay to selected action selected by ID1012.

#### 6.10.7 COOLING PROTECTION

Protection for liquid cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating.

##### ***P2.10.7.1 Cooling fault delay ID751 "Cooling F Delay"***

This parameter defines the delay after which the drive goes to fault state when 'Cooling OK' signal is missing.

##### ***P2.10.7.2 Cooling fault response ID762 "CoolingFaultREsp"***

In some cases it is more important to allow the drive to run even if the cooling liquid is not circulating. Then it is possible to select warning as the response. The drive will then continue running until its internal protection will stop it. If cooling signal loss happens on stop state indication is not stored to fault history if previous fault is already Cooling Fault. In Run State indication is always stored to fault history

0 = Stop State: No Action, Run State: Warning

1 = Stop State: Warning, Run State: Warning

2 = Stop State: Warning, Run State: Fault

3 = Stop State: No Action, Run State: Fault

**6.10.8 CURRENT MONITORING**

This function can monitor set limit for Active Current and give warning or fault depending on active current level. Can be used e.g. secondary monitor for upper system current reference.

***P2.10.8.1 Fault Mode ID3511***

Select response when signal exceeds set low or high limit.

0 = No Action

1 = Warning generated in Run state

2 = Fault generated in Run state

3 = Warning generated in stop and run state

4 = Fault generated in stop and run state.

***P2.10.8.1 High Fault Limit ID3512***

Positive active current fault limit

***P2.10.8.1 High Warn Limit ID3513***

Positive active current warning limit

***P2.10.8.1 Low Warn Limit ID3514***

Negative active current warning limit

***P2.10.8.1 Low Fault Limit ID3515***

Negative active current fault limit

## 6.10.9 EXTRA

**P2.10.5** *Fault Simulation* **ID1569** "Fault Simulation"

With this parameter it is possible to simulate different faults without actually making, for example, an over current situation. In the point of view of the drive interface, the operation is identical to actual fault situation.

**B00** = +1 = Simulates an over current fault (F1)

**B01** = +2 = Simulates an over voltage fault (F2)

**B02** = +4 = Simulates an under voltage fault (F9)

**B03** = +8 = Reserved

**B04** = +16 = Simulates an earth fault (F3)

**B05** = +32 = Reserved

**B06** = +64 = Reserved

**B07** = +128 = Simulates an over temperature warning (W14)

**B08** = +256 = Simulates an over temperature fault (F14)

The warning bit must be active for a fault to appear in simulation. If the fault bit is left active, the drive will go FAULT state at warning limit when the drive temperature rises to the warning level.

**B09** = +512 = Reserved

**P2.10.6** *Reset Datalogger* **UD1849**

Parameter to reset data logger to its defaults. Recommended to reset settings after initial commissioning if changed.

## 6.1.1 ID FUNCTION

Listed here are the functions that use the parameter ID number to control and monitor the signal.

### 6.1.1.1 VALUE CONTROL

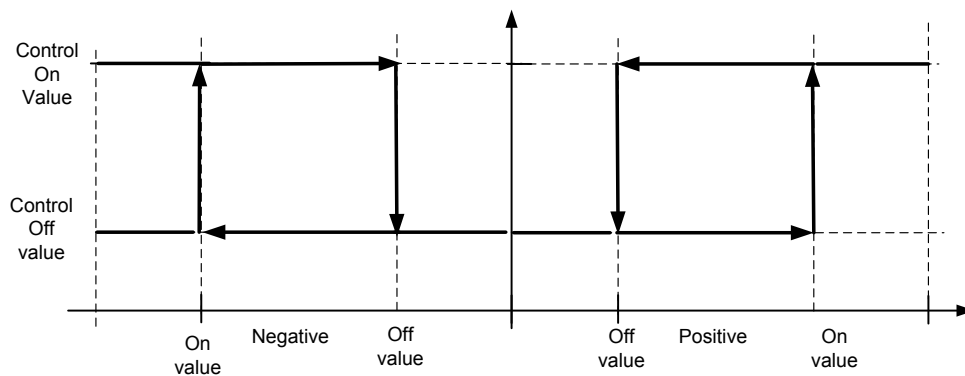
The value control parameters are used to control an input signal parameter.

#### *P2.11.1.1 Control Mode* *ID1586* "Control Mode"

This parameter defines how the value control output behaves.

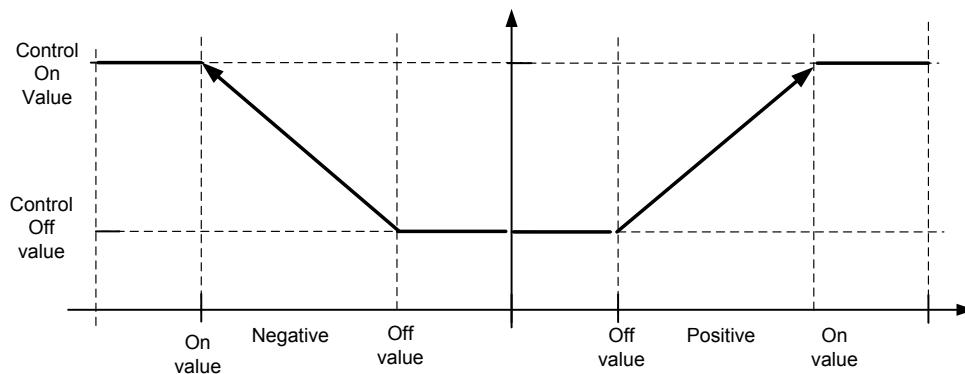
##### 0 = SR ABS

Absolute input value is used to make a step change in the output between On and Off values.



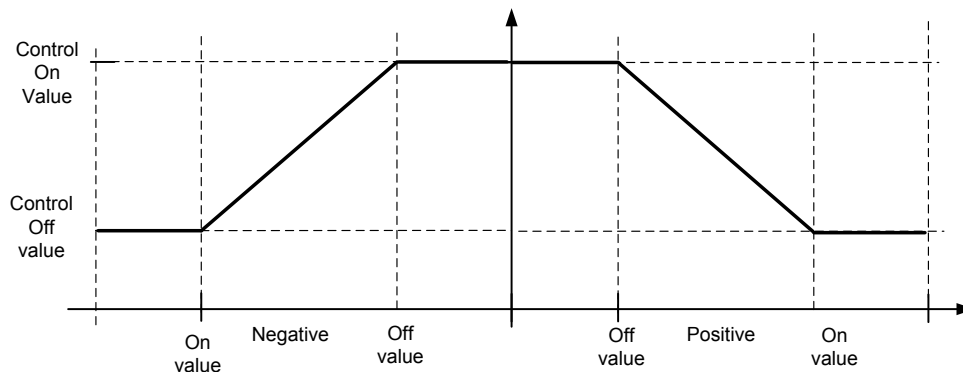
##### 1 = Scale ABS

Absolute input value is scaled linearly between On and Off values.



**2 = Scale ABS Inverted**

Inverted absolute value is scaled linearly between On and Off values.

**3 = SR**

Input value is used to make a step change in the output between On and Off values.

**4 = Scale**

Input value is scaled linearly between On and Off values.

**5 = Scale Inverted**

Inverted value is scaled linearly between On and Off values

**P2.11.1.2 Control Input Signal ID**      **ID1580**      **"ContrInSignal ID"**

With this parameter you can select what signal is used to control selected parameter.

**P2.11.1.3 Control Off Limit**      **ID1581**      **"Contrl Off Limit"**

This parameter defines the limit when the selected parameter value is forced to Off value.

**P2.11.1.4 Control On Limit**      **ID1582**      **"Contrl On Limit"**

This parameter defines the limit when the selected parameter value is forced to On value.

**P2.11.1.5 Control Off Value**      **ID1583**      **"Contrl Off Value"**

This parameter defines the value that is used when the used input signal is below Off limit.

**P2.11.1.6 Control On Value**      **ID1584**      **"Contrl On Value"**

This parameter defines the value that is used when the used input signal is above On limit.

**P2.11.1.7 Control Output Signal ID**      **ID1585**      **"ContrlOutSignalID"**

This parameter defines which parameter is forced to On and Off values when selected input signal exceeds the set limits.

**P2.11.1.8 Control Signal Filtering TC ID1586 "Control Filt TC"**

This parameter is used to filter the scaling function output. Used e.g. when unfiltered torque is used to control a parameter that needs stabilization.

**.6.11.1.1 XY-Blot**

With this function is possible to make own curve. e.g. selecting DC-Link voltage and make the points to control Current reference based on DC-Link voltage level. X-Values are input values and Y-values are outputs.

**P2.11.1.9 XValue 01 ID1626**

**P2.11.1.10 YValue 01 ID2001**

**P2.11.1.11 XValue 02 ID1627**

**P2.11.1.12 YValue 02 ID2002**

**P2.11.1.13 XValue 03 ID1628**

**P2.11.1.14 YValue 03 ID2003**

**P2.11.1.15 XValue 04 ID1629**

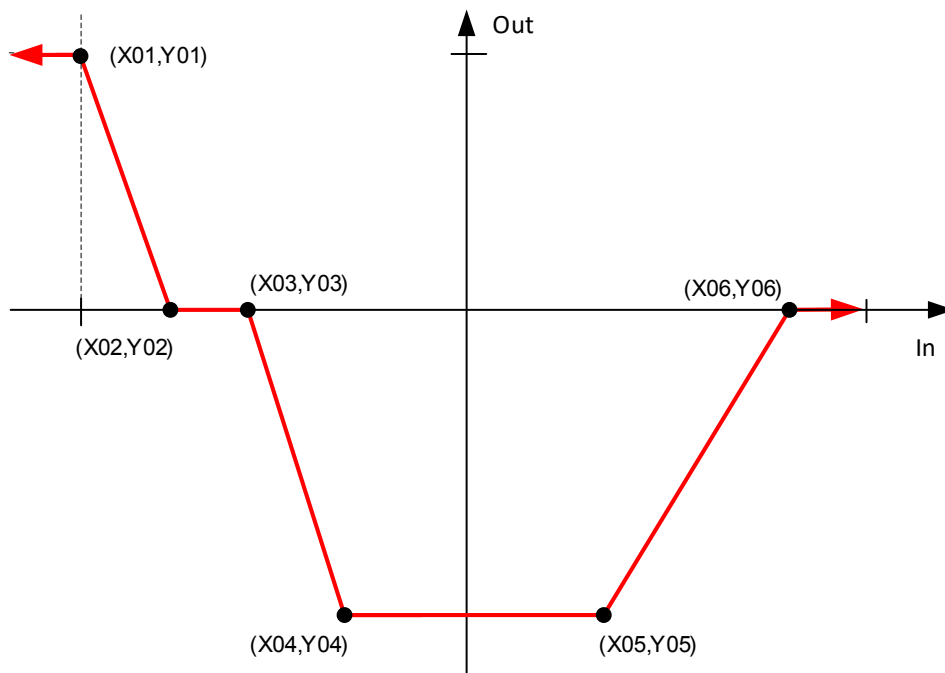
**P2.11.1.16 YValue 04 ID2004**

**P2.11.1.17 XValue 05 ID1630**

**P2.11.1.18 YValue 05 ID2005**

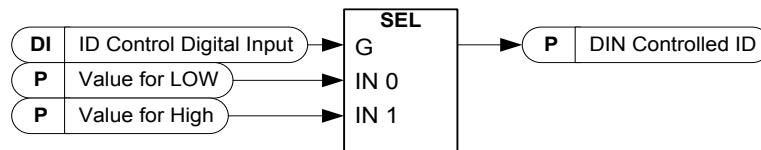
**P2.11.1.19 XValue 06 ID1631**

**P2.11.1.20 YValue 06 ID2006**



### 6.11.2 DIN ID CONTROL

This function is used to control any parameter between two different values with a digital input. Different values are given for DI 'low' and DI 'high'.



**P2.11.2.1 ID Control Digital Input ID1570** "ID Control DIN"

**P2.11.3.1 ID Control Digital Input ID1590** "ID Control DIN"

**P2.11.4.1 ID Control Digital Input ID1578** "ID Control DIN"

Select digital input to be used for controlling the parameter selected by ID1571, ID1575 and 1579.

**P2.11.2.2 DIN Controlled ID ID1571** "Controlled ID"

**P2.11.3.2 DIN Controlled ID ID1575** "Controlled ID"

**P2.11.4.2 DIN Controlled ID ID1579** "Controlled ID"

Select parameter ID controlled by ID1570.

**P2.11.2.3 Value for Low digital input (FALSE) ID1572** "FALSE Value"

**P2.11.3.3 Value for Low digital input (FALSE) ID1592** "FALSE Value"

**P2.11.4.3 Value for Low digital input (FALSE) ID1594** "FALSE Value"

Set here the controlled parameter value when the digital input (ID1570) is LOW for the parameter selected by ID1571. The function does not recognize decimals. Give, therefore, e.g. 10.00 Hz as '1000'.

**P2.11.2.4 Value for High digital input (TRUE) ID1573** "TRUE Value"

**P2.11.3.4 Value for High digital input (TRUE) ID1593** "TRUE Value"

**P2.11.4.4 Value for High digital input (TRUE) ID1596** "TRUE Value"

Set here the controlled parameter value when the digital input (ID1570) is HIGH for the parameter selected by ID1571. The function does not recognize decimals. Give, therefore, e.g. 10.00 Hz as '1000'.

### 6.11.3 SIGNAL FAULT FUNCTION

Signal fault function will monitor selected signal for high and low limits. Response is generated when drive is Run state.

#### ***P2.11.5.1 Fault Signal ID ID1941***

Select signal by ID number to be monitored for exceeding high or low limit.

#### ***P2.11.5.2 Fault Mode ID1942***

Select response when signal exceeds set low or high limit.

0 = No Action

1 = Warning generated in Run state

2 = Fault generated in Run state

3 = Warning generated in stop and run state

4 = Fault generated in stop and run state.

#### ***P2.11.5.3 High Fault Limit ID1943***

Set here the signal high limit when trigger is made for fault. note the decimals are also needed from original signal. e.g. frequency limit 50,25 Hz is set as 5025.

#### ***P2.11.5.3 High Warn Limit ID1945***

Set here the signal high limit when trigger is made for warning. note the decimals are also needed from original signal. e.g. frequency limit 50,25 Hz is set as 5025.

#### ***P2.11.5.4 Low Warn Limit ID1946***

Set here the signal low limit when trigger is made for warning. Note the decimals are also needed from original signal. e.g. frequency limit 50,25 Hz is set as 5025.

#### ***P2.11.5.5 Low Fault Limit ID1944***

Set here the signal low limit when trigger is made for fault. Note the decimals are also needed from original signal. e.g. frequency limit 50,25 Hz is set as 5025.

## 6.1.2 KEYPAD CONTROL

### ***P3.1      Control place      ID1403***

The active control place can be changed with this parameter.

NOTE! Keypad is the default control place.

0 = PC Control  
1 = I/O terminal  
2 = Keypad (Default)  
3 = Fieldbus

### ***P3.2      License Key      ID1995***

Set here license key to activate DC/DC Converter operation. FR4 unit size will operate without license key.

### ***P3.3      Multi-Monitor ID1      ID2632***

### ***P3.4      Multi-Monitor ID2      ID2633***

### ***P3.5      Multi-Monitor ID3      ID2634***

Select ID number of the signal to be shown in multimonitor page.

## 7. CONTROL AND STATUS WORDS

|                       |                                                                                                                                                     |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| P2.9.20 State machine |                                                                                                                                                     |
| 0 / Basic             | This mode makes fieldbus control behave as in explained in used fieldbus board manual.                                                              |
| 1 / Standard          | Simple control word that is used in modes where control word from fieldbus is used as such, for some fieldbus board this requires bypass operation. |

### 7.1 FB CONTROL WORD WITH BASIC IN BYPASS

|     | FB Control Word ID1160 |                                                                      |
|-----|------------------------|----------------------------------------------------------------------|
|     | Signal                 | Comment                                                              |
| B00 | Run                    | 0= DC/DC Drive is stopped<br>1= DC/DC Drive is started               |
| B01 |                        |                                                                      |
| B02 | Fault Reset            | 0>1 Reset fault.                                                     |
| B03 | FB DIN1                | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B04 | FB DIN2                | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B05 | FB DIN3                | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B06 | FB DIN4                | Can be used to control RO or directly parameter by ID number. G2.4.1 |
| B07 |                        |                                                                      |
| B08 |                        |                                                                      |
| B09 |                        |                                                                      |
| B10 |                        |                                                                      |
| B11 |                        |                                                                      |
| B12 |                        |                                                                      |
| B13 |                        |                                                                      |
| B14 |                        |                                                                      |
| B15 |                        |                                                                      |

## 7.2 FB CONTROL WORD WITH STANDARD

| FB Control Word ID1160 |             |                                                                                                                          |
|------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------|
|                        | Signal      | Comment                                                                                                                  |
| B00                    | DC Charge   | 0= Stop the drive and/or charging<br>1= Charge DC                                                                        |
| B01                    |             |                                                                                                                          |
| B02                    |             |                                                                                                                          |
| B03                    | Run         | 0= DC/DC is stopped<br>1= DC/DC is started                                                                               |
| B04                    |             |                                                                                                                          |
| B05                    |             |                                                                                                                          |
| B06                    | Reset       |                                                                                                                          |
| B07                    |             | 0>1 Reset fault.                                                                                                         |
| B08                    |             |                                                                                                                          |
| B09                    | PLC Control |                                                                                                                          |
| B10                    |             | 0= Disable FB Control<br>1= Enable FB Control                                                                            |
| B11                    |             | Can be used to control RO or directly parameter by ID number. G2.4.1<br>This bit is connected also to FB Status Word B15 |
| B12                    | FB DIN2     | Can be used to control RO or directly parameter by ID number. G2.4.1                                                     |
| B13                    | FB DIN3     | Can be used to control RO or directly parameter by ID number. G2.4.1                                                     |
| B14                    | FB DIN4     | Can be used to control RO or directly parameter by ID number. G2.4.1                                                     |
| B15                    |             | This bit is connected                                                                                                    |

B00: FALSE = Stop Charging, TRUE = Charge DC

**Stop Charging:** Stop charging and/or Stops the drive.

**Charge DC:** Activates charging DO, will charge maximum 10 second, will stop earlier if DC CB feedback is received. Needs to be high even if charging option is not used.

B03: FALSE = Stop Request, TRUE = Start Request

**Stop Request:** Drive will stop .

**Start Request:** Start Command to the drive. Rising edge needed for start.

B07: FALSE = No significance, TRUE = Fault Acknowledge

**Fault Acknowledge:** The group signal is acknowledged with a positive edge.

B10: FALSE = Disable FB Control, TRUE = Enable FB Control

**Disable FB Control:** Drive will stop.

**Enable FB Control:** Start Command is monitored from fieldbus if control place fieldbus.

### 7.3 FB STATUS WORD

| FB Status Word ID68 |                         |                                                                               |
|---------------------|-------------------------|-------------------------------------------------------------------------------|
|                     | Signal                  | Comment                                                                       |
| b0                  | Ready On                | 0=Drive not ready to switch on<br>1=Drive ready to start charging             |
| b1                  | Ready Run               | 0=Drive not ready to run<br>1=Drive ready and Main Contactor is ON            |
| b2                  | Running                 | 0=Drive not running<br>1=Drive in Run state (Modulating)                      |
| b3                  | Fault                   | 0=No active fault<br>1=Fault is active                                        |
| b4                  | Run Enable Status       | 0= Run Disabled. Drive in stop state<br>1= Run Enabled. Drive can be started. |
| b5                  | TRUE                    |                                                                               |
| b6                  | Inhibit                 | 0= Drive in operating condition.<br>1= Run disabled or fault state.           |
| b7                  | Warning                 | 0= No active warnings<br>1= Warning active                                    |
| b8                  |                         |                                                                               |
| b9                  | Fieldbus Control Active | 0=Fieldbus control not active<br>1=Fieldbus control active                    |
| b10                 | FALSE                   |                                                                               |
| b11                 | FALSE                   |                                                                               |
| b12                 | FALSE                   |                                                                               |
| b13                 | FALSE                   |                                                                               |
| b14                 | FALSE                   |                                                                               |
| b15                 | Watchdog                | Same as received on bit 11 of the main control word.                          |

B00: FALSE = Not Ready to Switch On, TRUE = Ready to Switch On

**Not Ready to Switch On:** Fault active, DI: Run Enable low,

**Ready to Switch On:** No Faults, DI: Run Enabled,

B01: FALSE = Not Ready To Operate, TRUE = Ready To Operate

**Not Ready To Operate:** CW.B0 = FALSE, DC Not Ready,.

**Ready To Operate:** CW.B0 = TRUE, DC Ready,

B02: FALSE = Drive is not operating, TRUE = Drive is operational

**Drive is not operating:** Drive is not run state (modulating)

**Drive is operational:** Drive is in run state and modulating.

B03: FALSE = No Fault, TRUE = Fault Present

**No Fault:** Drive is not on fault state.

**Fault Present:** Drive is in fault state.

B04: FALSE = Run Disabled, TRUE = Run Enabled

**Run Disabled:** DI: Run Enable False,

**Run Enabled:** Running Enabled

B06: FALSE = Run not inhibited, TRUE = Run inhibited

**Run not inhibited:** No faults and Run Enabled

**Run Inhibited:** Fault Active or Run Disabled.

B07: FALSE = No Warning, TRUE = Warning Present

**No Warning:** There is no warning or the warning has disappeared again.

**Warning Present:** Drive still works; warning in the service/maintenance parameter; no acknowledgement.

B09: FALSE = No Control Requested, TRUE = Control Requested

**No Control Requested:** Control by the automation system is not possible.

**Control Requested:** The automation system is controlling.

B15: FALSE = FB DW Feedback Low, TRUE = FB DW Feedback High

**FB DW Feedback:** FB Control Word B11 is echoed back to the Fieldbus. Can be used to monitor communication status from the drive.

## 7.4 STATUS WORD (APPLICATION) ID 43

Application Status Word combines different drive statuses to one data word.

| Application Status Word ID43 |                                   |                                   |
|------------------------------|-----------------------------------|-----------------------------------|
|                              | FALSE                             | TRUE                              |
| b0                           | Closed Loop Control not active    | Closed Loop Control active        |
| b1                           | Not in Ready state                | Ready                             |
| b2                           | Not Running                       | Running                           |
| b3                           | No Fault                          | Fault                             |
| b4                           | Discharging disabled, low voltage | Discharging Allowed               |
| b5                           | Charging Disabled, high voltage   | Charging Allowed                  |
| b6                           | Run Disabled                      | Run Enable                        |
| b7                           | No Warning                        | Warning                           |
| b8                           |                                   | Charging Switch closed (internal) |
| b9                           |                                   | Over Voltage Regulator Active     |
| b10                          |                                   | Under Voltage regulator active.   |
| b11                          |                                   |                                   |
| b12                          | No Run Request                    | Run Request                       |
| b13                          |                                   | One or more regulators active     |
| b14                          | Current/Power Control Mode        | Voltage Control Mode.             |
| b15                          |                                   |                                   |

B01: FALSE = Not Ready, TRUE = Ready

**Not Ready:** DC Voltage low, Fault active

**Ready:** Drive in ready state, start command can be given.

B02: FALSE = Not Running, TRUE = Running

**Not Running:** Drive is not modulating

**Running:** Drive is modulating.

B03: FALSE = No Fault, TRUE = Fault Active

**No Faults:** Drive do not have active faults.

**Fault:** Drive has an active faults.

B04: FALSE = Discharging disabled, TRUE = Discharging allowed

**Discharging disabled:**

**Discharging allowed:**

B05: FALSE = Charging disabled, TRUE = Charging allowed

**Charging disabled:**

**Charging allowed:**

B06: FALSE = Run Enable Low, TRUE = Run Enable High

**Run Enable Low:** Run Enable command to motor control is low

**Run Enable High:** Run Enable command to motor control is high.

B07: FALSE = No Warning, TRUE = Warning Active

**No Warning:** No warning signals active in the drive

**Warning:** Drive has active warning signal. Warning signal not stop the operation.

B08: FALSE = Charging Switch Open, TRUE = Charging Switch closed

**Charging Switch Open:** DC voltage level is not reached closing level or has drop below the opening level. This information is from drive motor control.

**Charging switch Closed:** DC voltage level is above closing limit and no interlock active internally.

B09: FALSE = OV Control not active, TRUE = OV Control active

**OV Control not Active:** x.

**OV Control Active:** x.

B10: FALSE = UV Control not active, TRUE = UV Control active

**UV Control not active:** x.

**UV Control active:** x.

B12: FALSE = No Run Request, TRUE = Run Request

**No Run Request:** Final Run Request command has not been given to motor control.

**Run Request:** Final Run Request command has been given to motor control.

## 8. PROBLEM SOLVING

While proper information is needed from the problem, it's also recommended to try with latest application- and system software versions available. Software is continuously developed and default settings are improved (See Chapter 1.13 Compatibility issues in parameters between versions).

Recommended signals for NCDrive

| Type  | Signal Name      | Actual | Unit | Min    | Max    |
|-------|------------------|--------|------|--------|--------|
| Value | Status Word      | 4470   |      | 0      | 65535  |
| Value | DC Voltage       | 595    | V    | 0      | 1100   |
| Value | Active Current   | -55    | %    | -120,0 | 120,0  |
| Value | Active Curr.Ref. | -55    | %    | -120,0 | 120,0  |
| Value | Source DC Act.   | 101,97 | %    | 50,00  | 150,00 |
| Value | Source Ref.Final | 101,97 | %    | 0,00   | 150,00 |
| Value | Power kW         | -58    | kW   | -100   | 100    |
| Value | Source Voltage   | 407,9  | V    | 0,0    | 500,0  |

Use the fastest communication speed (Baudrate: 57 600) and a 50 ms update interval for signals for the RS232 communication.

For the CAN communication, use a 1 Mbit communication speed and 7 ms update interval for signals.

When you contact the support, send the \*.trn, \*.par and Service info (\*.txt) files with a description of the situation. If the situation is caused by a fault, take also the Datalogger data from the drive.

Note that Datalogger settings can be changed to catch correct situation and it's also possible to make manual force trig for Datalogger.

Before storing the parameter file, upload the parameters from the drive and save when NCDrive is in the ON-LINE state. If it is possible, do this while the problem is active.

It's also helpful to have single line diagram from the system where problem is faced.

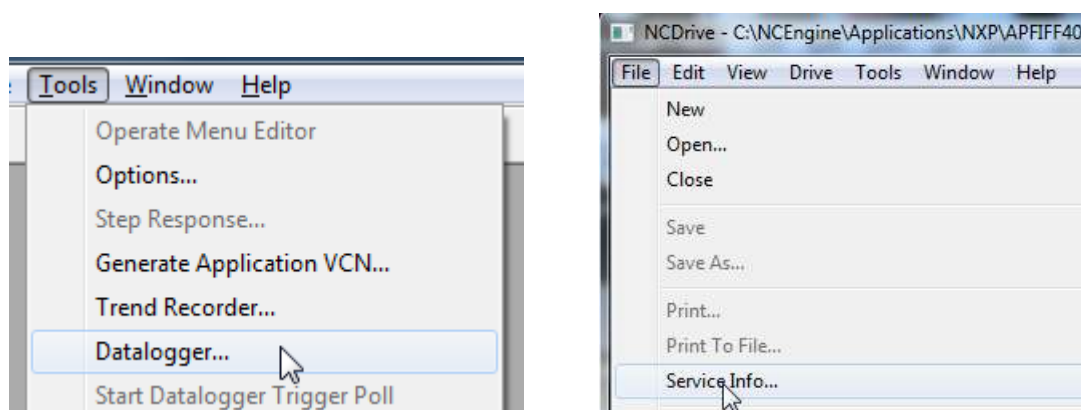


Figure 2. Datalogger window opening and Service Info upload.

## 9. FAULT CODES

The fault codes, their causes and correcting actions are presented below.

Note: When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display. Best way is to send parameter file and service info to Vacon technical support

This chapter includes all fault codes that are possible. but some faults are not possible in AFE application. And some faults description may be different when compared to standard frequency converter.

### ***F1 Over current fault***

Drive has detected a high current in the output phase.

**S1 = Hardware trip:**

Current above 4\* I<sub>h</sub>

#### **Possible cause and solutions**

1. Sudden increase in load
  - Check motor load.
2. Short circuit in cables
  - Check cables.

### ***F2 Overvoltage fault***

DC-link voltage has exceeded the drive protection limits.

**S1 = Hardware trip.**

500 Vac unit DC voltage above 911 V<sub>dc</sub>

690 Vac unit DC voltage above 1200 V<sub>dc</sub>

**S2 = Overvoltage control supervision (only 690 Vac unit).**

DC voltage has been above 1100 V<sub>dc</sub> for too long.

#### **Possible cause and solutions**

1. Too short a deceleration time
  - Increase deceleration time.
  - Use brake chopper and brake resistor.
  - Use Brake chopper unit.
2. High overvoltage spikes in supply
  - Check input voltage.

**F3    *Earth fault***

Earth fault protection ensures that the sum of the phase currents is zero. The over current protection is always working and protects the frequency converter from earth faults with high currents.

**S1 = Sum of output phase current is not zero**

**Possible cause and solutions**

1. Insulation failure in cables
2. On DC/DC Converter HW failure, DC/DC converter cant monitor earth fault.

**F5    *Charge switch***

Charge switch status is not correct when start command is given.

**S1 = Charge switch was open when START command was given.**

**Possible cause and solutions**

3. Charge switch was open when the START command was given.
  - Check connection of the feedback from charging relay
4. Reset the fault and restart.

Should the fault re- occur, contact your local distributor.

**F7    *Saturation fault*****S1 = Hardware failure**

- Cannot be reset from the keypad.
- Switch off power.
- DO NOT RE- CONNECT POWER!
- Contact your local distributor.

## ***F8    System Fault***

A system fault indicates several different fault situations in drive operation.

### **S1 = Reserved**

- Disturbance. Reset the unit and try again.
- If there is star coupler in the unit, check the fibre connections and phase order.
- Driver board or IGBT broken.
- FR9 and the bigger size drives, which includes not star coupler, ASIC board (VB00451) is broken.
- FR8 and smaller size drives: control board broken.
- FR8 and smaller size drives: if there is boards VB00449 / VB00450 in use, failure might be in there.

### **S2 = Reserved**

### **S3 = Reserved**

### **S4 = Reserved**

### **S5 = Reserved**

### **S6 = Reserved**

### **S7 = Charge switch**

### **S8 = No power to driver card**

### **S9 = Power unit communication (TX)**

### **S10 = Power unit communication (Trip)**

### **S11 = Power unit comm. (Measurement)**

### **S12 = SystemBus synchronization has failed in DriveSynch operation**

### **S30 = Safe disable inputs are in different state (OPT-AF)**

### **S31 = Thermistor short circuit detected (OPT-AF)**

### **S32 = OPT-AF board has been removed**

### **S33 = OPT-AF board EEPROM error**

**F9 Undervoltage fault**

DC-link voltage is below the fault voltage limit of the drive.

**S1 = DC-link too low during run**

**S2 = No data from power unit**

**S3 = Undervoltage control supervision**

**Possible cause**

1. Too low a supply voltage
2. Frequency converter internal fault
3. One of the input fuses is broken.
4. External charge switch has not been closed.

**Correcting measures**

1. In case of temporary supply voltage break, reset the fault and restart the frequency converter.
2. Check supply voltage.
3. Check function of DC charge.
4. Contact your local distributor.

**F10 Line Synchronization Fault**

**S1 = Phase supervision diode supply**

**S2 = Phase supervision active front end**

**Possible cause:**

1. Input line phase is missing.

**Correcting measures**

1. Check supply voltage, fuses and cable.

**F11 Line phase supervision**

Current measurement has detected that there is no current in one phase or one phase current is considerably different from other phases.

**Correcting measures**

1. Check cables

**F13 Drive under temperature fault****Possible cause:**

1. Heatsink temperature is under  $-10^{\circ}\text{C}$

**F14 Drive over temperature fault****Possible cause:**

1. Heatsink temperature is over acceptable limits. See user's manual for the temperature limit. Overtemperature warning is issued before actual trip limit is reached.

**Correcting measures**

1. Check correct amount and flow of cooling air.
2. Check the heatsink for dust.
3. Check ambient temperature.
4. Make sure that switching frequency is not too high in relation to ambient temperature and motor load.

**F22 EEPROM checksum fault****Possible cause:**

1. Parameter save fault
2. Faulty operation
3. Component failure

**Correcting measures:**

1. Should the fault re-occur, contact your local distributor.

**F24 Counter fault****Possible cause:**

1. Values displayed on counters are incorrect

**Correcting measures:**

1. Have a critical attitude towards values shown on counters.

**F25 Microprocessor watchdog fault****Possible cause:**

1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to the drive.

**Correcting measures:**

1. Reset the fault and restart.
2. Should the fault re-occur, contact your local distributor.

**F26 Start-Up prevention****Possible cause:**

1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to drive

**Correcting measures:**

1. Cancel prevention of start-up if this can be done safely.
2. Remove Run Request.

**F29 Thermistor fault**

The thermistor input of the option board has detected too high a motor temperature.

**Possible cause:**

1. Motor is overheated.
2. Thermistor cable is broken.

**Correcting measures:**

1. Check motor cooling and load
2. Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited).

**F31 IGBT temperature**

IGBT Inverter Bridge over temperature protection has detected too high a short term overload current.

**Possible cause:**

1. Too high load
2. Identification run has not been made which causes the motor to start under magnetized.

**Correcting measures:**

1. Check load.
2. Check motor size.
3. Make identification Run.

**F32 Fan cooling****Possible cause:**

1. Cooling fan of the frequency converter does not start when ON command is given.

**Correcting measures:**

1. Contact your local distributor.

**F37 Device change**

Option board or power unit changed.

**Possible cause:**

1. New device of same type and rating.

**Correcting measures:**

1. Reset. Device is ready for use.

**F38 Device added**

Option board added.

**Correcting measures:**

1. Reset. Device is ready for use. Old board settings will be used.

**F39 Device removed**

Option board removed.

**Correcting measures:**

1. Reset. Device no longer available.

**F40 Device unknown**

Unknown option board or drive.

S1 = Unknown device

S2 = Power1 not same type as Power2

**Correcting measures:**

1. Contact the distributor near to you.

**F41 IGBT temperature**

IGBT inverter bridge overtemperature protection has detected too high a short term overload current.

**Correcting measures:**

1. Check load.

**F44 Device changed (Default param.)****Possible cause:**

1. Option board or power unit changed.
2. New device of different type or different rating from the previous one.

**Correcting measures:**

1. Reset
2. Set the option board parameters again if option board was changed. Set converter parameters again if power unit was changed.

**F45 Device added (default param.)****Possible cause:**

1. Option board of different type added.

**Correcting measures:**

1. Reset
2. Set the option board parameters again.

**F50 4mA supervision****Possible cause:**

1. Current at the analogue input is below 4mA.
2. Signal source has failed
3. Control cable is broken or loose

**Correcting measures:**

1. Check the current loop circuitry.

***F51 External fault*****Possible cause:**

1. Digital input fault.

**Correcting measures:**

1. Remove fault situation from external device.

***F52 Keypad communication*****Possible cause:**

1. The connection between the control keypad or NCDrive and the AC drive is broken.

**Correcting measures:**

1. Check keypad connection and possible keypad cable.

***F53 Fieldbus communication*****Possible cause:**

1. The data connection between the fieldbus Master and the fieldbus board is broken.

**Correcting measures:**

1. Check installation.
2. If installation is correct contact the nearest Vacon distributor.

***F54 Slot fault*****Possible cause:**

1. Defective option board or slot

**Correcting measures:**

1. Check board and slot.
2. Contact the nearest Vacon distributor.

***F56 PT100 temperature fault***

PT100 protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. Marine application supports two PT100 boards. One can be used for the motor winding and the other for the motor bearings.

**Possible cause:**

1. Temperature limit values set for the PT100 board parameters have been exceeded

**Correcting measures:**

1. Find the cause of temperature rise

**F59 SB Heart Beat (SystemBus communication)**

The master drive sends pulses to all follower drives. If the pulses are missing a system bus communication fault is generated. The master drive also receives pulses back from the follower drives (max. four drives) and generates warnings if pulses are missing.

SystemBus communication is broken between master and follower.

Correcting measures:

- Check expander board parameters.
- Check optical fibre.
- Check option board jumpers.

**F60 Cooling**

Protection for the liquid-cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating. If the drive is in Stop state only a warning is issued. In Run state a fault is issued and the drive makes a coast stop.

**Possible cause:**

1. Liquid cooled drive cooling circulation have been failed

**Correcting measures:**

1. Check reason for cooling failure from external system.

**F61 Reference Error**

Actual current is not within current reference hysteresis. See parameter group G2.10.6 Reference Error

**F62 Run Disabled**

Run Disable warning signal is issued when Run Enable signal has been removed from the IO.

**F63 Quick stop**

**Possible cause:**

1. A command has been given from a digital input or the fieldbus to make a quick stop.

**Correcting measures:**

2. A new run command is accepted after the quick stop is reset.

**F65 PT100 board 2**

PT100 protection function is used to measure temperature and give a warning and/or a fault when the set limits are exceeded. Marine application supports two PT100 boards. One can be used for the motor winding and the other for the motor bearings.

**Possible cause:**

1. Temperature limit values set for the PT100 board parameters have been exceeded.
2. The number of inputs selected is higher than what is actually connected.
3. PT100 cable is broken

***F72 Enter License code***

License code has not been given or license code is wrong.

**Correcting measures:**

1. Check that correct serial number has been given to Vacon Key
2. Contact support with Service Info

***F74 Follower fault***

When using the normal master follower function this fault code is given if one or more follower drives trip to fault. This fault is visible also when fault is in master drive. See also what other faults may be active in master drive.

**Possible cause:**

1. Fault in follower drive or in Master drive.

**Correcting measures:**

- Identify original fault and problem.

***F76 Synchronization fault***

Interleaving modulation is not synchronized between the drives.

**Possible cause:**

1. Different settings between the drives.
- 2.

**Correcting measures:**

1. Compare drive settings to be same.

***F80 Charging Fault***

The drive has not reached need DC voltage at set time.

**Possible cause:**

3. Charging circuit not operational.
4. High load in DC link.
5. Low voltage in supply for charging circuit.

**Correcting measures:**

2. Check charging current

***F81 Closed Loop***

Feedback signal deviate from calculated source voltage more than set limits.

**Possible cause:**

1. Set limits too narrow for used source.
2. Wire brake.

***F82 External Fault 2***

Digital input fault.

**Possible cause:**

**Correcting measures:**

1. Remove fault situation from external device.

***F84 Source Vdc Limit***

Source voltage has exceeded source Min or Max voltage.

***F97 Signal Trip***

Freely selectable signal monitoring value has exceeded set limit levels.

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