VACON® NX
AC DRIVES

ARF106
GRID CONVERTER
WITH GENERAL GRID CODES
APPLICATION MANUAL
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1. General

This application is not kept backwards compatible. See chapter Compatibility issues before you update the application. The Grid Converter application is used to make AC grids with a possibility to operate in parallel with other power sources. The Grid Converter application has 3 different operation modes:

- Standard AFE mode.
- Island mode.
- Micro Grid mode.

1.1 AFE Control

AFE function keeps constant DC voltage. AFE mode transfers power between DC and AC. AFE cannot create grid by itself, it needs to be connected to existing grid.

1.2 Island (Static Power Supply)

Island mode generates constant voltage and frequency. In island mode DC Voltage is not controlled. Island mode cannot operate in parallel with other power sources in AC side, because the drive will not balance reactive or active power with other power sources.

DC voltage level needs to be considered to have correct voltage on AC side in different load situations, considering voltage losses in LCL filter and in transformer.
1.3 Micro Grid

Micro Grid mode controls the grid voltage and frequency. It functions like an ordinary generator. Micro Grid mode does not control DC Voltage.

With the help of voltage droop and frequency droop, more than one Micro Grid and/or Generators can work together.

Figure 3.
1.3.1 **Operation principle: Droop Speed Control Mode**

When the power demand increases, all generators on the grid allow frequency to droop. This will balance the load between all the generators on the grid. Then the power management system gives all generators a command to increase frequency so that the grid frequency is maintained at its nominal value.

When the load is reducing on the grid, the frequency of the generators will increase, and the power management system gives a command to decrease frequency.

![Frequency Change Diagram](image)

*Figure 4.*

1.3.2 **Operation principle: Isochronous Speed Control Mode**

In the isochronous speed control mode, the Micro Grid frequency reference is kept the same as the grid frequency with help of OPT-D7. This will keep power at zero regardless of grid frequency. While drive operates in drooping mode, the actual power is controlled by base current reference. This reference needs to be controller by power management system (PMS) that will handle power sharing between different machines on the grid.
1.4 Commissioning

**NOTE!** Before you start the commissioning, read the safety instructions in the user manual of your product.

To use the Island, Micro Grid, or Shaft generator operation, you need a licence key. The AFE mode is available without a licence.

This application requires an NXP3 control board VB761 or newer.

The control place (P3.1) of the Grid Converter drive is Keypad as a default.

The basic I/O configuration of the Grid Converter drive consists of OPT-A1, OPT-A2, and OPT-D7 option boards. The basic I/O configuration is described in Table 1.

OPT-D7 is required when the Grid Converter unit is needed to start with zero power to the grid. If grid frequency is not monitored with OPT-D7, the unit may go generator side or directly to full power because different reference frequency and grid frequency.

The Grid Converter is utilised by using AFE hardware with special software. An external LC(L)-filter and charging circuit is needed. This unit is selected when low harmonics are required. The principle connection of AFE drive has been described in Figure 5.

The external 24 Vdc is recommended for control board(s). It enables the setting of parameters even when the power unit itself is not powered. This is important also when software updates are made. Some default I/O configuration of the application can cause unexpected DO operation. When the control board is powered, the drive can give information from the status of the system if, for example, the drive I/O is used for an overall system monitoring.

The external 24 Vdc is required for the drives in cases where the start command starts the control board-controlled precharging operation.

1.4.1 Quick Start Instructions

1. Connect the unit according to the Figure 5.
2. Power up the control unit with 24 Vdc.
3. Set the basic parameters (G2.1)
4. Check that the digital input parameters (G2.4.2) have been set according to the connections.
5. Change the control place according to the system requirements.
6. Charge the unit.

1.4.2 In case of parallel AFE:

1. Set P2.1.5 Parallel AFE to Yes. This will also set DC Drooping to 3.00% (Default).
Figure 5. Connection
1.5 Pre-Charging of DC

This AFE application has its own charging control, P2.5.1.13 DC Charge (24 Vdc required for control board) and charging protection in case the external charging cannot get DC voltage to required level within set time P2.9.1.6 Charge Max Time (provided that the DC Voltage reaches the under voltage fault level).

The charging function is activated when P2.5.1.13 DC Charge is A.1 or higher. When the control place is IO, Keypad or NCDrive, charging is started from the start command. Charging is not started if:

- Drive is in fault state.
- P2.4.2.26 Enable CB Close is FALSE
- P2.4.2.8 Run Enable is FALSE
- P2.4.2.19 Quick Stop is FALSE

Charging is also stopped if above conditions occur during charging or if the start command is removed.

For fieldbus control, charging is started with B0 of FB Control Word on the supporting FB profiles. Charging is also stopped if B0 goes low. Also MCB is opened if already closed.

DC Charge (F80) is given if 85 % of DC Nominal is not reached within P2.9.1.6 Charge Max Time and charging is stopped.

DC Charging is stopped when the drive receives feedback from P2.4.2.4 MCB Feedback.

**NOTE!** Use suitably sized DC Charging resistor. To select the correct size, check Pulse loadability for time duration set in for Max Charge Time parameter.
## 1.6 Main Circuit Breaker Control (MCB)

The Micro Grid application controls the circuit breaker of the system with the relay output RO2. When the DC bus is charged, the MCB will be closed. The status of the MCB is monitored via a digital input. The digital input used for monitoring is selected with parameter P2.3.1.3. Faults can be set to open the MCB by selecting a response to a fault to be $3=\text{Fault, DC OFF}$.

An external charging circuit is necessary to charge the DC bus but drive can control this circuit if 24 Vdc is provided for the control board.

Closing limit is 85% of the nominal DC Voltage. Opening limit is 75% of the nominal DC Voltage.

$$\text{Nominal DC Voltage} = \text{Grid Nom Voltage (P2.1.1) } \times 1.35.$$  

Over Current (F1), Hardware IGBT (F31) and Software IGBT (F41) faults will open MCB immediately to protect the drive.

**NOTE!** The MCB feedback is necessary for the correct operation of the Grid Converter application.

**NOTE!** Only the drive controls its own MCB. If additional interlocks or opening commands are needed, these commands must go through the drive.

**NOTE!** UPS may be needed during short circuit situation to keep MCB closed if control voltage is taken from the grid where the short circuit occurs.

**NOTE!** Missing feedback signal prevent drive going to ready state.

**NOTE!** If feedback is not used there will be three second forced delay on internally generated MCB feedback signal.
1.7 Start Sequence

Figure 6. AFE start sequence
1.8 Stop sequence

Figure 7. Stop sequence
1.9 Start Stop timing diagram

Above example when “Standard” state machine is used. With “Basic” state machine operation is like in IO Control.
1.10 Start Stop Timing Diagram with Grid Codes

- Start Request To Inverter
- Line Frequency and Voltage OK
- Main Circuit Breaker Close Control
- Main Circuit Breaker Feedback
- Ready State of Inverter
- Run (Modulating)
- Grid Code Trip
- Start Synchronization

Start Synchronization

P. Line OK Delay
P. Start Delay
P. ReConnect Time

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1.11 Voltage Compensation

Grid Converter system will have voltage losses. Depending on the system, the losses may be more than 50 Vac when operating close to Grid Converter nominal currents with low power factor between points U3 and U5. This voltage loss needs to be compensated so that the grid voltage stays at nominal. This also sets requirements for the needed DC link voltage.

The normal operation voltage range in a land-based grid is usually between 80% and 115% of the grid nominal voltage.

The voltage losses compensation is handled separately for Active power (kW) and Reactive power (kVar), the latter being more significant. The Active power voltage losses are compensated with Inductor Losses parameter (P2.2.6.6) and Reactive power voltage losses are compensated with Inductor Size parameter (P2.2.6.5).

Uncompensated system may result in unnecessary reactive power circulation in a grid between the different power sources and wrong grid voltage.

OPT-D7 can be used to compensate the voltage losses (closed loop voltage compensation) but it is recommended to do an open loop voltage compensation tuning in case of OPT-D7 failure. When the OPT-D7 measurements exceed the set limit values, the voltage compensation falls back to open loop control.

Inductor Size and Losses affect

Grid Nom. Voltage: 400 Vac, Reactive Current: 30%, Active Current 50%, Inductor Size: 15%, Inductor Losses: 15%, Voltage Correction: 0 Vac.

Reactive Increase: $400 \text{ Vac} \times 30\% \times 15\% = 18 \text{ Vac}$
Active Increase: $400 \text{ Vac} \times $ or Losses: $15\% 400 \text{ Vac} \times 50\% \times 15\% \times 15\% = 4.5 \text{ Vac}$
Total increase: $18 \text{ Vac} + 4.5 \text{ Vac} = 22.5 \text{ Vac}$

See also document: Voltage Compensation Vxxx.pdf.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
1.12 OPT-D7

OPTD7 is an AC sinusoidal voltage measurement board. Using this board, the drive measures the line voltage, the frequency and the voltage angle information.

The drive can compare this information with its output voltage angle when it runs. This feature can be used to make synchronisations to a grid that is measured. For example, for line synchronisation purposes you can use APF44 LineSynch II Application. That will work as a smooth starter.

In Micro Grid application this can be used:
- To synchronise to existing external grid while the drive is running to enable bumpless transfer from a generator operation to a shore powered operation in a ship.
- To control the grid voltage (Voltage losses compensation).
- To enable a zero power connection to an existing grid.
- To help in the commissioning of drive active power and reactive power voltage losses compensation when the actual grid voltage is visible in NCDrive.

The OPT-D7 board is delivered with the transformer which is suitable for a voltage range up to 690 Vac. The transformer cannot be used with a pulse width modulated (PWM) voltage input.

It is possible to use a customised transformer when the input voltage to be measured is not within the OPT-D7 transformer voltage range. The transformation ratio parameter can be adjusted according to the transformer primary to secondary ratio. See details in the OPT-D7 user manual.

Synchronisation to the grid can be made without the OPT-D7 when the drive operates in the AFE or the Micro Grid mode. This requires that the output terminals of the drive are connected to the existing grid when the drive is in the STOP state. When a start command has been given in AFE or Micro Grid mode, the drive will make standard AFE synchronisation. Depending on the operation mode, the drive will start to keep constant DC voltage (AFE) or start to share power based on grid frequency (Micro Grid). Using OPT-D7 for synchronisation will make the start of the drive smoother.

If the drive does not detect an existing line voltage or frequency in Micro Grid mode, the output voltage is raised defined time (VoltageRiseTime). In the Island mode, the detection of the grid is not made and the voltage is raised from zero in the set time (VoltageRiseTime).

NOTE: The OPT-D7 board (in slot C) is mandatory for the Grid Converter unit.
1.13 Compatibility issues in parameters between versions

Update 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.

Update 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.

Latest released and previous versions from below link
http://drivesliterature.danfoss.com/performCachedSearch.action
# 2. Control I/O

Table 1. Minimum recommended I/O configuration.

<table>
<thead>
<tr>
<th>OPT-A1</th>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>+10V_{ref}</td>
<td>Reference voltage output</td>
<td>Voltage for potentiometer, etc.</td>
</tr>
<tr>
<td>2</td>
<td>AI1+</td>
<td>Analogue input 1. Range 0-10V, R_i = 200Ω</td>
<td>Input range selected by jumpers. Default range: Voltage 0 - 10V</td>
</tr>
<tr>
<td>3</td>
<td>AI1-</td>
<td>I/O Ground</td>
<td>Ground for reference and controls</td>
</tr>
<tr>
<td>4</td>
<td>AI2+</td>
<td>Analogue input 2. Range 0-10V, R_i = 200Ω</td>
<td>Input range selected by jumpers. Default range: Current 0 .. 20 mA</td>
</tr>
<tr>
<td>5</td>
<td>AI2-</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>+24V</td>
<td>Control voltage output</td>
<td>Voltage for switches, etc. max 0.1 A</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DIN1</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>DIN2</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>DIN3</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CMA</td>
<td>Common for DIN 1..DIN 3</td>
<td>Connect to GND or +24V</td>
</tr>
<tr>
<td>12</td>
<td>+24V</td>
<td>Control voltage output</td>
<td>Voltage for switches (see #6)</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>DIN4</td>
<td>MCB Feedback Programmable G2.2.1</td>
<td>0 = MCB open 1 = MCB closed</td>
</tr>
<tr>
<td>15</td>
<td>DIN5</td>
<td>Quick Stop Programmable G2.2.1</td>
<td>0 = Quick Stop Active 1 = No Quick Stop</td>
</tr>
<tr>
<td>16</td>
<td>DIN6</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>CMB</td>
<td>Common for DIN4..DIN6</td>
<td>Connect to GND or +24V</td>
</tr>
<tr>
<td>18</td>
<td>AO1+</td>
<td>Analogue output 1</td>
<td>Programmable Range 0 - 20 mA/R_L, max. 500Ω</td>
</tr>
<tr>
<td>19</td>
<td>AO1-</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>DO1</td>
<td>Digital output READY</td>
<td>Programmable P2.3.1.1 Open collector, I_≤ 50mA, U_≤ 48 VDC</td>
</tr>
<tr>
<td>OPT-A2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>RO1</td>
<td>Relay output 1 Programmable P2.3.1.2</td>
<td>Switching capacity 24 VDC / 8 A 250 VAC / 8A 125 VDC / 0.4 A</td>
</tr>
<tr>
<td>22</td>
<td>RO1</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>RO1</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>RO2</td>
<td>Relay output 2 Programmable P2.3.1.1</td>
<td>This RO is not programmable. Fixed for MCB Control (Close)</td>
</tr>
<tr>
<td>25</td>
<td>RO2</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>RO2</td>
<td>Ground for reference and controls</td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
3. Monitoring Signals

The menu M1 (Monitoring) has all the monitoring values. Values are only for monitoring, and cannot be altered on the control panel.

3.1 Monitoring Value Tables

3.1.1 Monitoring Values 1 (Control Panel: Menu M1.1)

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.1.1</td>
<td>DC-Link Voltage</td>
<td>V</td>
<td>#</td>
<td>1108</td>
<td>Measured DC Link voltage in volts, filtered.</td>
</tr>
<tr>
<td>V1.1.2</td>
<td>DC Voltage Ref.</td>
<td>%</td>
<td>#,#</td>
<td>1200</td>
<td>Used DC voltage reference by the regenerative unit in % of Nominal DC voltage. Nominal DC voltage = 1.35 * supply voltage</td>
</tr>
<tr>
<td>V1.1.3</td>
<td>DC Voltage Act.</td>
<td>%</td>
<td>#,#</td>
<td>7</td>
<td>Same scaling as DC Voltage Ref.</td>
</tr>
<tr>
<td>V1.1.4</td>
<td>Total Current</td>
<td>A</td>
<td>Varies</td>
<td>1104</td>
<td>Filtered current</td>
</tr>
<tr>
<td>V1.1.5</td>
<td>Active Current</td>
<td>%</td>
<td>#,#</td>
<td>1125</td>
<td>&gt;0 power from AC side to DC side</td>
</tr>
<tr>
<td>V1.1.6</td>
<td>Reactive Current</td>
<td>%</td>
<td>#,#</td>
<td>1157</td>
<td>&lt;0 power from DC side to AC side</td>
</tr>
<tr>
<td>V1.1.7</td>
<td>Power kW</td>
<td>kW</td>
<td>Varies</td>
<td>1508</td>
<td>&gt;0 power from AC side to DC side</td>
</tr>
<tr>
<td>V1.1.8</td>
<td>Power %</td>
<td>%</td>
<td>#,#</td>
<td>5</td>
<td>&lt;0 power from DC side to AC side</td>
</tr>
<tr>
<td>V1.1.9</td>
<td>Status Word</td>
<td>#</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>V1.1.10</td>
<td>Supply Frequency</td>
<td>Hz</td>
<td>#,#</td>
<td>1</td>
<td>Drive output frequency</td>
</tr>
<tr>
<td>V1.1.11</td>
<td>Supply Voltage</td>
<td>V</td>
<td>#,#</td>
<td>1107</td>
<td>Drive output voltage</td>
</tr>
<tr>
<td>V1.1.12</td>
<td>Line Frequency D7</td>
<td>Hz</td>
<td>#,#</td>
<td>1654</td>
<td>Measured line frequency</td>
</tr>
<tr>
<td>V1.1.13</td>
<td>Line Voltage D7</td>
<td>V</td>
<td>#</td>
<td>1650</td>
<td>Measured line voltage</td>
</tr>
<tr>
<td>V1.1.14</td>
<td>AC Voltage Reference</td>
<td>V</td>
<td>#</td>
<td>1556</td>
<td>Used AC Voltage Reference</td>
</tr>
<tr>
<td>V1.1.15</td>
<td>DC Ref Max Lim</td>
<td>%</td>
<td>#,#</td>
<td>1606</td>
<td>Internal limit for DC Voltage Ref.</td>
</tr>
</tbody>
</table>
### 3.1.2 Monitoring values 2 (Control panel: menu M1.2)

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.2.1</td>
<td>DC Voltage</td>
<td>V</td>
<td>#</td>
<td>44</td>
<td>Measured DC Link voltage in volts, unfiltered.</td>
</tr>
</tbody>
</table>
| V1.2.2| Operation Mode          |      | #     | 1615 | 0 = AFE  
1 = Island  
2 = Micro Grid                                                                                                                            |
| V1.2.3| Used Current Ref        | %    | #.#   | 1704 | Used current reference is negated to parameter value. Made to compare values in NC-Drive easier to Active current.                        |
| V1.2.4| D7 Synch. Error         |      | #     | 1659 | Synchronisation error to external grid                                                                                                    |
| V1.2.5| Cos Phi Actual          |      | #####| 1706 |                                                                                                                                            |
| V1.2.6| Unit Temperature        | °C   | #     | 1109 |                                                                                                                                            |
| V1.2.7| Freq. Reference         | Hz   | #.#   | 1725 | Used line frequency reference                                                                                                               |
| V1.2.8| Current Varies          | A    |       | 1113 | Unfiltered current                                                                                                                        |
| V1.2.9| Operation Hours         | h    | #.#   | 1856 |                                                                                                                                            |
| V1.2.10| Reactive Current Reference | % | #.# | 1389 |                                                                                                                                            |
| V1.2.11| Grid State              |      | #     | 1882 |                                                                                                                                            |
| V1.2.12| Mindex                  | %    | #.#   | 1874 | Modulation Index                                                                                                                          |
| V1.2.13| IU rms                  | A    | Varies | 39 |                                                                                                                                            |
| V1.2.14| IV rms                  | A    | Varies | 40 |                                                                                                                                            |
| V1.2.15| IW rms                  | A    | Varies | 41 |                                                                                                                                            |
| V1.2.16| DC-Link Current         | A    | Varies | 72 |                                                                                                                                            |
| V1.2.17| DC-Link ActCurr         | %    | #.#   | 1158 |                                                                                                                                            |

### 3.1.3 Fieldbus monitoring values (Control panel: menu M1.3)

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.3.1</td>
<td>FB Control Word</td>
<td></td>
<td>#</td>
<td>1160</td>
<td>Control word from fieldbus</td>
</tr>
<tr>
<td>V1.3.2</td>
<td>FB Status Word</td>
<td></td>
<td>#</td>
<td>68</td>
<td>Status word to fieldbus</td>
</tr>
<tr>
<td>V1.3.3</td>
<td>Fault Word 1</td>
<td></td>
<td>#</td>
<td>1172</td>
<td></td>
</tr>
<tr>
<td>V1.3.4</td>
<td>Fault Word 2</td>
<td></td>
<td>#</td>
<td>1173</td>
<td></td>
</tr>
<tr>
<td>V1.3.5</td>
<td>Warning Word 1</td>
<td></td>
<td>#</td>
<td>1174</td>
<td></td>
</tr>
<tr>
<td>V1.3.6</td>
<td>FB Micro Grid CW1</td>
<td></td>
<td>#</td>
<td>1700</td>
<td>Control for Micro Grid operations</td>
</tr>
<tr>
<td>V1.3.7</td>
<td>FB Micro Grid SW1</td>
<td></td>
<td>#</td>
<td>1701</td>
<td>Status of Micro Grid operations</td>
</tr>
<tr>
<td>V1.3.8</td>
<td>Last Active Warning</td>
<td></td>
<td>#</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>V1.3.9</td>
<td>Last Active Fault</td>
<td></td>
<td>#</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>V1.3.10</td>
<td>MC Status</td>
<td></td>
<td>#</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>V1.3.11</td>
<td>FB Analogue Out</td>
<td>%</td>
<td>#.#</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>
### 3.1.4 I/O monitoring values (control panel: menu M1.4)

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.4.1</td>
<td>DIN1, DIN2, DIN3</td>
<td></td>
<td>#</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>V1.4.2</td>
<td>DIN4, DIN5, DIN6</td>
<td></td>
<td>#</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>V1.4.3</td>
<td>DIN Status 1</td>
<td></td>
<td>#</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>V1.4.4</td>
<td>DIN Status 2</td>
<td></td>
<td>#</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>V1.4.5</td>
<td>Analogue Input 1</td>
<td>%</td>
<td>#,##</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>V1.4.6</td>
<td>Analogue Input 2</td>
<td>%</td>
<td>#,##</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>V1.4.7</td>
<td>Analogue input 3</td>
<td>%</td>
<td>#,##</td>
<td>27</td>
<td>AI3, unfiltered.</td>
</tr>
<tr>
<td>V1.4.8</td>
<td>Analogue input 4</td>
<td>%</td>
<td>#,##</td>
<td>28</td>
<td>AI4, unfiltered.</td>
</tr>
<tr>
<td>V1.4.9</td>
<td>Analogue Out 1</td>
<td>%</td>
<td>#,##</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>V1.4.10</td>
<td>Analogue Out 2</td>
<td>%</td>
<td>#,##</td>
<td>50</td>
<td>AO2</td>
</tr>
<tr>
<td>V1.4.11</td>
<td>Analogue Out 3</td>
<td>%</td>
<td>#,##</td>
<td>51</td>
<td>AO3</td>
</tr>
<tr>
<td>V1.4.12</td>
<td>PT100 Temp</td>
<td>°C</td>
<td>#,#</td>
<td>42</td>
<td>Maxim temperature</td>
</tr>
<tr>
<td>V1.4.13</td>
<td>PT100 Temp. 1</td>
<td>°C</td>
<td>#,#</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>V1.4.14</td>
<td>PT100 Temp. 2</td>
<td>°C</td>
<td>#,#</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>V1.4.15</td>
<td>PT100 Temp. 3</td>
<td>°C</td>
<td>#,#</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>V1.4.16</td>
<td>PT100 Temp. 4</td>
<td>°C</td>
<td>#,#</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>V1.4.17</td>
<td>PT100 Temp. 5</td>
<td>°C</td>
<td>#,#</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>V1.4.18</td>
<td>PT100 Temp. 6</td>
<td>°C</td>
<td>#,#</td>
<td>71</td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.5 Licence key activation

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.6.1</td>
<td>Serial Number Key</td>
<td></td>
<td>#</td>
<td>1997</td>
<td>Give this number to the technical support of the manufacturer in case of licence key problems.</td>
</tr>
<tr>
<td>V1.6.2</td>
<td>Licence Status</td>
<td></td>
<td>#</td>
<td>1996</td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.6 Grid Code

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.7.1</td>
<td>Line State</td>
<td></td>
<td>#</td>
<td>2202</td>
<td></td>
</tr>
<tr>
<td>V1.7.2</td>
<td>Line Voltage GC</td>
<td>%</td>
<td>#,##</td>
<td>1912</td>
<td>Line Voltage used by Grid Code</td>
</tr>
<tr>
<td>V1.7.3</td>
<td>Line Frequency GC</td>
<td>%</td>
<td>#,##</td>
<td>1913</td>
<td>Line Frequency used by Grid Code</td>
</tr>
<tr>
<td>V1.7.4</td>
<td>Line Voltage L1-L2</td>
<td>%</td>
<td>#,##</td>
<td>3203</td>
<td></td>
</tr>
<tr>
<td>V1.7.5</td>
<td>Line Voltage L2-L3</td>
<td>%</td>
<td>#,##</td>
<td>3204</td>
<td></td>
</tr>
<tr>
<td>V1.7.6</td>
<td>Line Voltage L3-L1</td>
<td>%</td>
<td>#,##</td>
<td>3205</td>
<td></td>
</tr>
<tr>
<td>V1.7.7</td>
<td>Trip State</td>
<td></td>
<td></td>
<td>2206</td>
<td></td>
</tr>
<tr>
<td>V1.7.8</td>
<td>Line Voltage GC2</td>
<td>%</td>
<td>#,##</td>
<td>4500</td>
<td></td>
</tr>
<tr>
<td>V1.7.9</td>
<td>Line Freq. GC0</td>
<td>%</td>
<td>#,##</td>
<td>4501</td>
<td></td>
</tr>
<tr>
<td>V1.7.10</td>
<td>Grid Code State</td>
<td></td>
<td></td>
<td>2203</td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.7 PI Power Controller

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.8.1</td>
<td>PID Reference</td>
<td>#.#</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>V1.8.2</td>
<td>PID Actual Value</td>
<td>#.#</td>
<td></td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>V1.8.3</td>
<td>PID Output</td>
<td>#.#</td>
<td></td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>
### 3.1.8 Active Limits

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.9.1</td>
<td>Output Power Limit</td>
<td>%</td>
<td>#.#</td>
<td>1953</td>
<td></td>
</tr>
<tr>
<td>V1.9.2</td>
<td>Current Limit</td>
<td>A</td>
<td>Varies</td>
<td>1954</td>
<td></td>
</tr>
</tbody>
</table>

### 3.1.9 Line Monitoring

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.10.1</td>
<td>Line Voltage D7</td>
<td>V</td>
<td>#</td>
<td>1650</td>
<td>Measured line voltage</td>
</tr>
<tr>
<td>V1.10.2</td>
<td>Line Frequency D7</td>
<td>Hz</td>
<td>#.##</td>
<td>1654</td>
<td>Measured line frequency</td>
</tr>
<tr>
<td>V1.10.3</td>
<td>Line Voltage THD</td>
<td>%</td>
<td>#.##</td>
<td>1670</td>
<td></td>
</tr>
<tr>
<td>V1.10.4</td>
<td>LineVoltageHFrms</td>
<td>V</td>
<td>#.#</td>
<td>1671</td>
<td></td>
</tr>
</tbody>
</table>
3.2 Description of Monitoring Values

3.2.1 Monitoring 1 Values

V1.1.1 DC-Link Voltage V \( (\text{ID}1108) \)
The measured DC voltage, filtered.

V1.1.2 DC Voltage Ref. % \( (\text{ID}1200) \)
The DC voltage reference. Compared to given supply voltage.

\[
DC\ \text{Voltage} = \text{Grid Nom Voltage (P2.1.1)} \times 1.35 \times DC\ \text{Voltage Ref.}
\]

\[
1025 \ \text{Vdc} = 690 \ \text{Vac} \times 1.35 \times 1.10
\]

V1.1.3 DC Voltage Act. % \( (\text{ID}7) \)
The actual DC Voltage, measured DC Voltage scaled to % value.
Percentage value of System Nom. DC.

V1.1.4 Total Current A \( (\text{ID}1104) \)
The filtered current of the drive.

V1.1.5 Active Current % \( (\text{ID}1125) \)
The active current in % of System Rated Current.
A negative value means that the current is flowing to AC side from DC side.

V1.1.6 Reactive Current % \( (\text{ID}1157) \)
The reactive current of the regenerative drive in % of System Rated Current.

V1.1.7 Power kW \( (\text{ID}1508) \)
The output power of the drive in kW.
A negative value means that the current is flowing to AC side from DC side.

V1.1.8 Power % % \( (\text{ID}5) \)
The output power of the drive in %. 100.0 % equals 100.0 % Active Current and 100.0 % Supply Voltage.
A negative value means that the current is flowing to AC side from DC side.
V1.1.9 **Status Word (Application) ID 43**

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

<table>
<thead>
<tr>
<th>Status Word (Application) ID43</th>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Charging Control Not Active</td>
<td>Charging Control Active</td>
</tr>
<tr>
<td>b1</td>
<td>Not in Ready state</td>
<td>Ready</td>
</tr>
<tr>
<td>b2</td>
<td>Not Running</td>
<td>Running</td>
</tr>
<tr>
<td>b3</td>
<td>No Fault</td>
<td>Fault</td>
</tr>
<tr>
<td>b4</td>
<td>No Start Request</td>
<td>Start Request</td>
</tr>
<tr>
<td>b5</td>
<td>Quick stop active</td>
<td>Quick stop not active</td>
</tr>
<tr>
<td>b6</td>
<td>Run Disabled</td>
<td>Run Enable</td>
</tr>
<tr>
<td>b7</td>
<td>No Warning</td>
<td>Warning</td>
</tr>
<tr>
<td>b8</td>
<td>Charging Switch Open</td>
<td>Charging Switch closed (internal)</td>
</tr>
<tr>
<td>b9</td>
<td>MCB Control Open</td>
<td>MCB Control</td>
</tr>
<tr>
<td>b10</td>
<td>MCB Feedback; Open</td>
<td>MCB Feedback; Closed</td>
</tr>
<tr>
<td>b11</td>
<td>Short Circuit Mode Not Active</td>
<td>Short Circuit Mode Active</td>
</tr>
<tr>
<td>b12</td>
<td>No Run Request</td>
<td>Run Request</td>
</tr>
<tr>
<td>b13</td>
<td>Not At Current Limit</td>
<td>At Current Limit</td>
</tr>
<tr>
<td>b14</td>
<td>AFE Mode Active</td>
<td>Island Mode Active</td>
</tr>
<tr>
<td>b15</td>
<td>uGrid Mode Active</td>
<td></td>
</tr>
</tbody>
</table>

V1.1.10 **Supply Frequency Hz ID 1**

The drive output frequency. Updated in the STOP state when Regen Option B9 is activated.

V1.1.11 **Supply Voltage V ID 1107**

The drive output voltage.

V1.1.12 **Line Frequency D7 Hz ID 1654**

The measured line voltage frequency when using the OPT-D7 option board in slot C.

When the OPT-D7 board is not used, it is possible to use Analogue Input 3 and 4 ID write function to give the grid the Line Frequency and Line Voltage. This enables use of grid PI voltage controller without the OPT-D7 board. Note that both line frequency and line voltages needs to be given. By activating Control Options 2 B2 these analogue inputs can be used also to grid protection.

V1.1.13 **Line Voltage D7 V ID 1650**

The measured line voltage rms value when using the OPT-D7 option board in slot C.

When the OPT-D7 board is not used, it is possible to use Analogue Input 3 and 4 ID write function to give the grid the Line Frequency and Line Voltage. This enables use of grid PI voltage controller without the OPT-D7 board. Note that both line frequency and line voltages needs to be given. By activating Control Options 2 B2 these analogue inputs can be used also to grid protection.
61.14 AC Voltage Reference V ID1556
The used AC voltage reference.

61.15 DC Voltage Max Limit ID1606
The drive will limit the DC reference to inside drive specification, but allows higher reference if lower supply voltage. This shows the final limit of the DC reference.
3.2.2 Monitoring 2 Values

V1.2.1 DC Voltage V ID44
The measured DC voltage, unfiltered.

V1.2.2 Operation Mode ID1615
The active Grid Converter operation mode. Operation mode is also included in Status Word.
0 = AFE operation
1 = Island operation
2 = Micro Grid Operation

V1.2.3 Used Current Ref % ID 1704
The used current reference. The value is negative to the set parameter to make the monitoring easier in NCDrive since Active Current shows negative value when power direction is from DC-Link to AC Line. When the Current Reference mode is not used this will show Active Current.

V1.2.4 D7 Synch. Error ID 1659
An error on voltage angles between the drive and the measurement taken by OPT-D7.
-3072...+3071 = -180...180 degrees.
If the value is not near to zero when running in AFE mode, the phase order may be wrong even if the OPT-D7 frequency is correct (Error about 2047 = 120 degrees). If the measurement is after the Dyn11 transformer, the error is usually about 512 (30.0 Degrees).

V1.2.5 CosPhiActual ID 1706
The calculated Cos Phi.

V1.2.6 Unit Temperature °C ID 1109
The heatsink temperature of the drive.

V1.2.7 Frequency Reference Hz ID1752
The used frequency reference. In AFE mode, the frequency reference is determined internally when the synchronisation is made. In Island and Micro Grid mode, the reference is used for a static power supply, and a power drooping in Micro Grid mode.

V1.2.8 Current A ID 1113
The unfiltered current of the drive.
V1.2.9 Operation Hours h ID1856
This shows operation hours of the drive. G2.7 Operation Time is used to enter old value if the software is updated.

V1.2.10 Reactive Current Reference % ID1389
The final reactive current reference.

V1.2.11 Grid State ID1882
The Status Word for the grid.

<table>
<thead>
<tr>
<th>Grid State ID1882</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
</tr>
<tr>
<td>b1</td>
</tr>
<tr>
<td>b2</td>
</tr>
<tr>
<td>b3</td>
</tr>
<tr>
<td>b4</td>
</tr>
<tr>
<td>b5</td>
</tr>
<tr>
<td>b6</td>
</tr>
<tr>
<td>b7</td>
</tr>
<tr>
<td>b8</td>
</tr>
<tr>
<td>b9</td>
</tr>
<tr>
<td>b10</td>
</tr>
<tr>
<td>b11</td>
</tr>
<tr>
<td>b12</td>
</tr>
<tr>
<td>b13</td>
</tr>
<tr>
<td>b14</td>
</tr>
<tr>
<td>b15</td>
</tr>
</tbody>
</table>

V1.2.12 Mindex % ID1874
This value can be used to recognize low Dc-Link voltage when operating in island and uGrid modes. If the value is above 90%, the drive is in limits to make correct voltage to the AC side.

V1.2.13 IU rms A ID39
V1.2.14 IV rms A ID40
V1.2.15 IW rms A ID41
Phase currents. 1 second linear filtering.

V1.2.16 DC-Link Current A ID72
Calculated DC-Link Current in Amps.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
VI.2.17 DC-Link ActCurr %  #,# ID1158

Calculated DC-Link Current in %.
3.2.3  Fieldbus monitoring values

V1.3.1  FB Control Word  ID 1160

The control word from fieldbus. The table below is for ”2 / Vacon AFE 1” Selection (P2.10.35) in bypass operation for such fieldbus board that natively supports this or can be parameterised to bypass mode. See other profile selections from chapter Status and Control Word.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0  DC Charge</td>
<td>0 = Open MCB. 1 = Close DC charge contactor, MCB closed automatically.</td>
</tr>
<tr>
<td>b1  b2</td>
<td></td>
</tr>
<tr>
<td>b3  Start</td>
<td>0 = Stop Command 1 = Start Command</td>
</tr>
<tr>
<td>b4  b5 b6</td>
<td></td>
</tr>
<tr>
<td>b7  Reset</td>
<td>0 = 0 Reset fault.</td>
</tr>
<tr>
<td>b8  b9</td>
<td></td>
</tr>
<tr>
<td>b10 Fieldbus Control</td>
<td>0 = No control from fieldbus 1 = Control from fieldbus</td>
</tr>
<tr>
<td>b11 Watchdog</td>
<td>0&gt;1&gt;0&gt;1...0.5 s square wave clock. This is used to check data communication between the fieldbus master and the drive.</td>
</tr>
<tr>
<td>b12 FB DIN2</td>
<td>Can be used to control RO or the parameter directly by ID number. G2.4.1</td>
</tr>
<tr>
<td>b13 FB DIN3</td>
<td>Can be used to control RO or the parameter directly by ID number. G2.4.1</td>
</tr>
<tr>
<td>b14 FB DIN4</td>
<td>Can be used to control RO or the parameter directly by ID number. G2.4.1</td>
</tr>
<tr>
<td>b15</td>
<td></td>
</tr>
</tbody>
</table>
VI.3.2  **FB Status Word  ID 68**

This is referred as GeneralStatusWord in the fieldbus manual. See details in the fieldbus manual.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Ready On 0 = Drive not ready to charge 1 = Drive ready to charge</td>
</tr>
<tr>
<td>b1</td>
<td>Ready Run 0 = Drive not ready to run 1 = Drive ready to run and MCB is ON</td>
</tr>
<tr>
<td>b2</td>
<td>Running 0 = Drive not running 1 = Drive running with regenerative control ON</td>
</tr>
<tr>
<td>b3</td>
<td>Fault 0 = No active fault 1 = Fault is active</td>
</tr>
<tr>
<td>b4</td>
<td>Run Enabled 0 = Run Disabled by I/O Commands 1 = Run Enabled by I/O Commands</td>
</tr>
<tr>
<td>b5</td>
<td>Quick Stop 0 = Quick Stop Active 1 = Quick Stop Not Active</td>
</tr>
<tr>
<td>b6</td>
<td>Switch On Inhibit 0 = CB Control OK 1 = CB Requested open but DC is high</td>
</tr>
<tr>
<td>b7</td>
<td>Warning 0 = No warning 1 = Warning active</td>
</tr>
<tr>
<td>b8</td>
<td>At Reference 0 = DC Voltage Ref and Act DC Voltage are not same. 1 = DC Voltage Ref and Act DC Voltage are same.</td>
</tr>
<tr>
<td>b9</td>
<td>Fieldbus Control Active 0 = Fieldbus control not active 1 = Fieldbus control active</td>
</tr>
<tr>
<td>b10</td>
<td>Above Limit 0 = DC voltage is below the level specified by P2.5.7.4 1 = DC voltage is above the level specified by P2.5.7.4</td>
</tr>
<tr>
<td>b11</td>
<td>FB_SW_B11 Select bit in G2.10 Fieldbus</td>
</tr>
<tr>
<td>b12</td>
<td>FB_SW_B12 Select bit in G2.10 Fieldbus</td>
</tr>
<tr>
<td>b13</td>
<td>FB_SW_B13 Select bit in G2.10 Fieldbus</td>
</tr>
<tr>
<td>b14</td>
<td>FB_SW_B14 Select bit in G2.10 Fieldbus</td>
</tr>
<tr>
<td>b15</td>
<td>Watchdog</td>
</tr>
</tbody>
</table>
### V1.3.3 Fault Word 1  ID 1172

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>F1 Over current, F31 IGBT, F41 IGBT</td>
</tr>
<tr>
<td>b1</td>
<td>F2 Over Voltage</td>
</tr>
<tr>
<td>b2</td>
<td>F9 Under Voltage</td>
</tr>
<tr>
<td>b3</td>
<td>F91 Short Circuit</td>
</tr>
<tr>
<td>b4</td>
<td>F3 Earth Fault</td>
</tr>
<tr>
<td>b5</td>
<td>F14 Unit Over temperature</td>
</tr>
<tr>
<td>b6</td>
<td>Temperature fault from measurements F56 PT100, F29 Thermistor</td>
</tr>
<tr>
<td>b7</td>
<td>F10 Line Synch Fault</td>
</tr>
<tr>
<td>b8</td>
<td>F52 Keypad or OC communication fault</td>
</tr>
<tr>
<td>b9</td>
<td>F53 Fieldbus fault</td>
</tr>
<tr>
<td>b10</td>
<td>F59 System bus fault</td>
</tr>
<tr>
<td>b11</td>
<td>F54 Slot Communication fault</td>
</tr>
<tr>
<td>b12</td>
<td>F50 4mA fault</td>
</tr>
</tbody>
</table>

### V1.3.4 Fault Word 2  ID 1173

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>F11 Output Phase Fault</td>
</tr>
<tr>
<td>b1</td>
<td>F51 External fault</td>
</tr>
<tr>
<td>b6</td>
<td>F31 IGBT, F41 IGBT</td>
</tr>
<tr>
<td>b7</td>
<td>F55 MCB State fault</td>
</tr>
<tr>
<td>b9</td>
<td>F64 MCB State fault</td>
</tr>
<tr>
<td>b10</td>
<td>F54 Slot Communication fault</td>
</tr>
<tr>
<td>b14</td>
<td>F50 4mA fault</td>
</tr>
</tbody>
</table>
## VI.3.5 Warning Word 1  ID 1174

<table>
<thead>
<tr>
<th>Warning</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>W91 Short Circuit</td>
</tr>
<tr>
<td></td>
<td>Triggered when current has reached current limit</td>
</tr>
<tr>
<td>b1</td>
<td>W29 Thermistor</td>
</tr>
<tr>
<td></td>
<td>Not implemented</td>
</tr>
<tr>
<td>b2</td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td></td>
</tr>
<tr>
<td>b4</td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td>F53_FB_Warning_Slot_D</td>
</tr>
<tr>
<td>b7</td>
<td>F67_FB_Warning_Slot_E</td>
</tr>
<tr>
<td>b8</td>
<td>W14 Unit Temperature</td>
</tr>
<tr>
<td>b9</td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td></td>
</tr>
<tr>
<td>b12</td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td></td>
</tr>
</tbody>
</table>

## VI.3.6 FB Micro Grid CW1  ID 1700

Control for the Micro Grid operations.

<table>
<thead>
<tr>
<th>Signal</th>
<th>FB Micro Grid CW1 ID1700</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Start As Island</td>
</tr>
<tr>
<td></td>
<td>If B11 = False, mode changed in STOP state.</td>
</tr>
<tr>
<td>b1</td>
<td>Start As Micro Grid</td>
</tr>
<tr>
<td></td>
<td>If B11 = False, mode changed in STOP state.</td>
</tr>
<tr>
<td>b2</td>
<td>Start synchronisation D7</td>
</tr>
<tr>
<td></td>
<td>Synchronization to external grid with OPT-D7</td>
</tr>
<tr>
<td>b3</td>
<td></td>
</tr>
<tr>
<td>b4</td>
<td>Power Down</td>
</tr>
<tr>
<td></td>
<td>Same as P2.2.6.2</td>
</tr>
<tr>
<td>b5</td>
<td>Power Up</td>
</tr>
<tr>
<td></td>
<td>Same as P2.2.6.3</td>
</tr>
<tr>
<td>b6</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td>Enable FB Control Mode</td>
</tr>
<tr>
<td></td>
<td>B0 and B1, is controllable from FB otherwise parameter</td>
</tr>
<tr>
<td>b11</td>
<td>Live Mode Control</td>
</tr>
<tr>
<td></td>
<td>Operation mode is changed in Run State</td>
</tr>
<tr>
<td>b12</td>
<td>P2.10.27 uCW B12</td>
</tr>
<tr>
<td>b13</td>
<td>P2.10.28 uCW B12</td>
</tr>
<tr>
<td>b14</td>
<td>P2.10.29 uCW B12</td>
</tr>
<tr>
<td>b15</td>
<td>P2.10.30 uCW B12</td>
</tr>
</tbody>
</table>
V1.3.7  **FB Micro Grid SW1 ID 1701**

Status of the Micro Grid operations.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Charge Control active</td>
</tr>
<tr>
<td>b1</td>
<td>Internal Charging switch status</td>
</tr>
<tr>
<td>b2</td>
<td>MCB control</td>
</tr>
<tr>
<td>b3</td>
<td>MCB status</td>
</tr>
<tr>
<td>b4</td>
<td>Run Enabled</td>
</tr>
<tr>
<td>b5</td>
<td>Drive Ready</td>
</tr>
<tr>
<td>b6</td>
<td>AFE mode active</td>
</tr>
<tr>
<td>b7</td>
<td>Island mode active</td>
</tr>
<tr>
<td>b8</td>
<td>Micro Grid mode active</td>
</tr>
<tr>
<td>b9</td>
<td>Run Request active</td>
</tr>
<tr>
<td>b10</td>
<td>Drive in run state</td>
</tr>
<tr>
<td>b11</td>
<td>Fault Active</td>
</tr>
<tr>
<td>b12</td>
<td>SynchronizedToD7</td>
</tr>
<tr>
<td>b13</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td>D7 measurements OK</td>
</tr>
<tr>
<td>b15</td>
<td></td>
</tr>
</tbody>
</table>

V1.3.8  **Warning ID74**

The number of the last active warning.

V1.3.9  **Last Active Fault ID37**

The number of the last active fault.
VI.3.10  **MC Status ID 64**

For the fieldbuses that do not have their own state machine, this value is sent to fieldbus.

<table>
<thead>
<tr>
<th>Motor Control Status Word</th>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Not in Ready state</td>
<td>Ready</td>
</tr>
<tr>
<td>b1</td>
<td>Not Running</td>
<td>Running</td>
</tr>
<tr>
<td>b2</td>
<td>Direction Clockwise</td>
<td>Counter clockwise</td>
</tr>
<tr>
<td>b3</td>
<td>No Fault</td>
<td>Fault</td>
</tr>
<tr>
<td>b4</td>
<td>No Warning</td>
<td>Warning</td>
</tr>
<tr>
<td>b5</td>
<td>At reference speed</td>
<td>At Zero Speed</td>
</tr>
<tr>
<td>b6</td>
<td>At Zero Speed</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>Flux Ready</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td>TC Speed Limiter Active</td>
<td>Counter clockwise</td>
</tr>
<tr>
<td>b9</td>
<td>Encoder Direction</td>
<td>Counter clockwise</td>
</tr>
<tr>
<td>b10</td>
<td>Under Voltage Fast stop</td>
<td>Under Voltage Fast stop</td>
</tr>
<tr>
<td>b11</td>
<td>No DC brake</td>
<td>DC Brake is active</td>
</tr>
<tr>
<td>b12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td></td>
<td>Restart delay active</td>
</tr>
<tr>
<td>b14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VI.3.11  **FB Analogue Output ID 48**

Signal to control analogue output from fieldbus.
3.2.4 I/O monitoring values

V1.4.1 DIN1, DIN2, DIN3 ID 15
V1.4.2 DIN4, DIN5, DIN6 ID 16

<table>
<thead>
<tr>
<th>DIN1/DIN2/DIN3 status</th>
<th>DIN4/DIN5/DIN6 status</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 DIN3</td>
<td>DIN6</td>
</tr>
<tr>
<td>b1 DIN2</td>
<td>DIN5</td>
</tr>
<tr>
<td>b2 DIN1</td>
<td>DIN4</td>
</tr>
</tbody>
</table>

V1.4.3 DIN Status 1 ID 56
V1.4.4 DIN Status 2 ID 57

<table>
<thead>
<tr>
<th>DIN StatusWord 1</th>
<th>DIN StatusWord 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 DIN: A.1</td>
<td>DIN: C.5</td>
</tr>
<tr>
<td>b1 DIN: A.2</td>
<td>DIN: C.6</td>
</tr>
<tr>
<td>b2 DIN: A.3</td>
<td>DIN: D.1</td>
</tr>
<tr>
<td>b3 DIN: A.4</td>
<td>DIN: D.2</td>
</tr>
<tr>
<td>b4 DIN: A.5</td>
<td>DIN: D.3</td>
</tr>
<tr>
<td>b5 DIN: A.6</td>
<td>DIN: D.4</td>
</tr>
<tr>
<td>b6 DIN: B.1</td>
<td>DIN: D.5</td>
</tr>
<tr>
<td>b7 DIN: B.2</td>
<td>DIN: D.6</td>
</tr>
<tr>
<td>b8 DIN: B.3</td>
<td>DIN: E.1</td>
</tr>
<tr>
<td>b9 DIN: B.4</td>
<td>DIN: E.2</td>
</tr>
<tr>
<td>b10 DIN: B.5</td>
<td>DIN: E.3</td>
</tr>
<tr>
<td>b11 DIN: B.6</td>
<td>DIN: E.4</td>
</tr>
<tr>
<td>b12 DIN: C.1</td>
<td>DIN: E.5</td>
</tr>
<tr>
<td>b13 DIN: C.2</td>
<td>DIN: E.6</td>
</tr>
<tr>
<td>b14 DIN: C.3</td>
<td></td>
</tr>
<tr>
<td>b15 DIN: C.4</td>
<td></td>
</tr>
</tbody>
</table>

V1.4.5 Analogue Input 1 % ID13
V1.4.6 Analogue Input 2 % ID14
V1.4.7 Analogue Input 3 % ID27
V1.4.8 Analogue Input 4 % ID28

The 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. 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 the analogue input functions available for fieldbus process data.

V1.4.9 Analogue Out 1 % ID 26
V1.4.10 Analogue Out 2 % ID 50
V1.4.11 Analogue Out 3 % ID 51

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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.4.12</td>
<td>PT100 MaxTemp °C</td>
<td>42</td>
</tr>
<tr>
<td>V1.4.13</td>
<td>PT100 Temp. 1 °C</td>
<td>50</td>
</tr>
<tr>
<td>V1.4.14</td>
<td>PT100 Temp. 2 °C</td>
<td>51</td>
</tr>
<tr>
<td>V1.4.15</td>
<td>PT100 Temp. 3 °C</td>
<td>52</td>
</tr>
<tr>
<td>V1.4.16</td>
<td>PT100 Temp. 4 °C</td>
<td>69</td>
</tr>
<tr>
<td>V1.4.17</td>
<td>PT100 Temp. 5 °C</td>
<td>70</td>
</tr>
<tr>
<td>V1.4.18</td>
<td>PT100 Temp. 6 °C</td>
<td>71</td>
</tr>
</tbody>
</table>

A separate measurement from two PT100 board. The signal has a 4 s filtering time.
3.2.5 Activation status

V1.6.1 Serial Number Key  ID1997
Give this number to the technical support of the manufacturer when there is a problem in the activation of a function. The drive shows a licence fault.

V1.6.2 Licence Status  ID1996
This value indicates the status of the licence key activation.

0 / No Function
If PLC receives this number from this ID, it is likely that the Micro Grid application is not loaded on the drive.

1 / No Code
Correct application in the drive, but the licence key has not been given.

2 / Code Given, not possible to verify, no connection to power unit
The licence key has been given, but there is no connection to power unit to verify it.
Charge the DC at least for 20 s.
NOTE! It is possible that the drive gives a licence fault in this state. Power up the power unit, so that the control board can read the drive serial number.

3 / Code Wrong
The code that was entered is wrong.

4 / Licence Key entered too many times
A wrong licence key has been entered three times. Power down the drive before trying to enter a new code.

5 / Code Accepted
The correct key has been entered, and all functions of Micro Grid application are available.

6 / Unknown Error
The licence key calculation has detected an internal error. Take the service information and the parameter file from the drive when the power unit is powered. Send these files to the technical support.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 3.2.6 Grid Code

#### V1.7.1 Line State ID2202

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Line Voltage above High Limit</td>
</tr>
<tr>
<td>b1</td>
<td>Line Voltage below Low Limit</td>
</tr>
<tr>
<td>b2</td>
<td>Line Frequency above High Limit</td>
</tr>
<tr>
<td>b3</td>
<td>Line Frequency below Low Limit</td>
</tr>
<tr>
<td>b4</td>
<td>By Phase Voltage Above Low or High Limits</td>
</tr>
<tr>
<td>b5</td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td>FRT Timer Start</td>
</tr>
<tr>
<td>b9</td>
<td>FRT Bi Phase Timer Start</td>
</tr>
<tr>
<td>b10</td>
<td>FreqHigh_DL</td>
</tr>
<tr>
<td>b11</td>
<td>LF_OK</td>
</tr>
<tr>
<td>b12</td>
<td>LV_OK</td>
</tr>
<tr>
<td>b13</td>
<td>FRT Active</td>
</tr>
<tr>
<td>b14</td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td>Grid Code Trip Active</td>
</tr>
</tbody>
</table>

#### V1.7.2 Line Voltage GC % #,# 1912

Scaled line voltage from OPT-D7.

#### V1.7.3 Line Frequency GC % #,# 1913

Scaled line frequency from OPT-D7.

#### V1.7.4 Line Voltage L1-L2 % #,# 3203

#### V1.7.5 Line Voltage L2-L3 % #,# 3204

#### V1.7.6 Line Voltage L3-L1 % #,# 3205
V1.7.7  Trip State  ID2206

This is same as the F95 Grid code sub code

0: No Trip
1: Grid Code license wrong or not give.
2: Line Voltage High Level 1
3: Line Voltage High Level 2
4: Line Voltage Low Level 1
5: Line Voltage Low Level 2
6: Line Frequency High Level 1
7: Line Frequency High Level 2
8: Line Frequency Low Level 1
9: Line Frequency Low Level 2
10: LVRT Three Phase trip.
11: LVRT Bi-Phase trip
12: Separate limits or forded trip
13: Line Frequency change rate trip.
14: 10 Min Average high voltage trip
15: Grid Code enabled but no OPT-D7 installed.
16: Line Voltage High 3
17: Line Voltage Low 3
18: Line Frequency High 3
19: Line Frequency Low 3
20: Anti-Islanding
21: BiPhase High Voltage 1 Trip
22: BiPhase High Voltage 2 Trip
23: BiPhase High Voltage 3 Trip
24: BiPhase Low Voltage 1 Trip
25: BiPhase Low Voltage 2 Trip
26: BiPhase Low Voltage 3 Trip
A27: Line Voltage Low 4 Trip
A28. Bi-Phase Low Voltage 4 Trip

V1.7.8  Line Voltage GC2 % #,## 4500
Scaled line voltage, high filtered.

V1.7.9  Line Freq. GC0 % #,## 4501
Scaled Line Frequency, low filtering.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### VI.7.10 Grid Code State

<table>
<thead>
<tr>
<th>Line State ID2202</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>GridCodeRunning</td>
</tr>
<tr>
<td>b1</td>
<td>RREnable</td>
</tr>
<tr>
<td>b2</td>
<td>FRT_Active</td>
</tr>
<tr>
<td>b3</td>
<td>LineVoltageHighFast_Act</td>
</tr>
<tr>
<td>b4</td>
<td>LineVoltageHighSlow_Act</td>
</tr>
<tr>
<td>b5</td>
<td>LineVoltageHigh3_Act</td>
</tr>
<tr>
<td>b6</td>
<td>LineVoltageLowSlow_Act</td>
</tr>
<tr>
<td>b7</td>
<td>LineVoltageLowFast_Act</td>
</tr>
<tr>
<td>b8</td>
<td>LineVoltageLow3_Act</td>
</tr>
<tr>
<td>b9</td>
<td>LineVoltageLow4_Act</td>
</tr>
<tr>
<td>b10</td>
<td>LineFreqHighFast_Act</td>
</tr>
<tr>
<td>b11</td>
<td>LineFreqHighSlow_Act</td>
</tr>
<tr>
<td>b12</td>
<td>LineFreqHigh3_Act</td>
</tr>
<tr>
<td>b13</td>
<td>LineFreqLowSlow_Act</td>
</tr>
<tr>
<td>b14</td>
<td>LineFreqLowFast_Act</td>
</tr>
<tr>
<td>b15</td>
<td>LineFreqLow3_Act</td>
</tr>
<tr>
<td>b16</td>
<td>LF_OK</td>
</tr>
<tr>
<td>b17</td>
<td>LV_OK</td>
</tr>
<tr>
<td>b18</td>
<td>TripRequest</td>
</tr>
<tr>
<td>b19</td>
<td>LVRTTimerStart</td>
</tr>
<tr>
<td>b20</td>
<td>LVRTBiTimerStart</td>
</tr>
<tr>
<td>b21</td>
<td>FreqHigh_DL</td>
</tr>
<tr>
<td>b22</td>
<td>LowFreqPower_Act</td>
</tr>
<tr>
<td>b23</td>
<td>ReConnection</td>
</tr>
<tr>
<td>b24</td>
<td>VoltageHigh</td>
</tr>
<tr>
<td>b25</td>
<td>FreqLow</td>
</tr>
<tr>
<td>b26</td>
<td>GC_10MinAveTripAct</td>
</tr>
<tr>
<td>b27</td>
<td>AntiIsland_Act</td>
</tr>
<tr>
<td>b28</td>
<td>LVBiPhase_Act</td>
</tr>
<tr>
<td>b29</td>
<td>FALSE</td>
</tr>
<tr>
<td>b30</td>
<td>FALSE</td>
</tr>
<tr>
<td>b31</td>
<td>FALSE</td>
</tr>
</tbody>
</table>
3.2.7 **PI Power Controller**
Monitoring values for power controller in AFE mode

**V1.8.1 PID Reference**
Active Current reference

**V1.8.2 PID Actual Value**
Active current

**V1.8.3 PID Output**
PID controller output for DC Voltage reference, gives an offset for DC Voltage Reference.

3.2.8 **Active Limits**

**V1.9.1 Output Power Limit**
ID1953

**V1.9.2 Current Limit**
ID1954

3.2.9 **Line Monitoring**

**V1.10.1 Line Voltage D7**
ID 1650
The measured line voltage rms value when using the OPT-D7 option board in slot C.

**V1.10.2 Line Frequency D7**
Hz ID 1654
The measured line voltage frequency when using the OPT-D7 option board in slot C.

**V1.10.3 Line Voltage THD**
% ID 1670
Total Harmonic Distortion of the line voltage measurement when using the OPT-D7 option board in slot C.

**V1.10.4 Line Voltage HF RMS**
V ID 1671
Root Mean Square value of high frequency components in the line voltage measurement when using the OPT-D7 option board in slot C.
4. Parameter List

In this chapter you will find the lists of parameters that are available in this application.

4.1 Basic parameters

Table 2. Basic parameters, G2.1

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.1.1</td>
<td>Grid Nom Voltage</td>
<td>AFE: 500V: 380V</td>
<td>AFE: 500V: 690V</td>
<td>Vac</td>
<td>500V:400 Vdc</td>
<td>110</td>
<td>Set the nominal voltage of the grid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>690V: 525V</td>
<td>690V: 690V</td>
<td></td>
<td>690V:690 Vdc</td>
<td></td>
<td>Set System Nominal DC P2.1.7</td>
</tr>
<tr>
<td>P2.1.2</td>
<td>Grid Nom. Frequency</td>
<td>0</td>
<td>320</td>
<td>Hz</td>
<td>50.00</td>
<td>1532</td>
<td>Micro Grid and Island mode:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grid Nominal Frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>AFE Mode:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Initial start frequency.</td>
</tr>
<tr>
<td>P2.1.3</td>
<td>System Rated Current</td>
<td>0.0</td>
<td>II</td>
<td>A</td>
<td>Ih</td>
<td>113</td>
<td>Used to scale % values.</td>
</tr>
<tr>
<td>P2.1.4</td>
<td>System Cos Phi</td>
<td>0.10</td>
<td>1.00</td>
<td>A</td>
<td>0.80</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>P2.1.5</td>
<td>System Rated kVA</td>
<td>0</td>
<td>32000</td>
<td>kVA</td>
<td>0</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>P2.1.6</td>
<td>System Rated kW</td>
<td>0</td>
<td>32000</td>
<td>kW</td>
<td>0</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>P2.1.7</td>
<td>System Nominal DC</td>
<td>0</td>
<td>1300</td>
<td>Vdc</td>
<td>500V:675 Vdc</td>
<td>1805</td>
<td>Used for DC Voltage reference and for MCB close limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>690V:931 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.8</td>
<td>Parallel AFE</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1501</td>
<td>0 =Single AFE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 =Parallel AFE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Activation will set DC Drooping to 3%.</td>
</tr>
<tr>
<td>P2.1.9</td>
<td>Transformer: Grid Converter Side U</td>
<td>0</td>
<td>3200</td>
<td>Vac</td>
<td>1000</td>
<td>1850</td>
<td></td>
</tr>
<tr>
<td>P2.1.10</td>
<td>Transformer: Grid Side</td>
<td>0</td>
<td>3200</td>
<td>Vac</td>
<td>1000</td>
<td>1851</td>
<td></td>
</tr>
<tr>
<td>P2.1.11</td>
<td>Transformer: Phase Shift</td>
<td>-360</td>
<td>360</td>
<td>Deg</td>
<td>0.0</td>
<td>1852</td>
<td>e.g. Dyn11 = 30.0 Degree</td>
</tr>
<tr>
<td>P2.1.12</td>
<td>Identification</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>631</td>
<td>0 =No Action</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 =Current Offset</td>
</tr>
</tbody>
</table>

4.2 Reference handling

Table 3. Reference handling

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.1</td>
<td>DC Voltage Ref.</td>
<td>500V: 105%</td>
<td>500V: 1099 Vdc</td>
<td>%</td>
<td>110.00</td>
<td>1462</td>
<td>DC Voltage reference as % of Nominal DC voltage = 1.35 * Grid Nominal Voltage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>690V: 105%</td>
<td>690V: 1099 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.2</td>
<td>Reactive Current Reference</td>
<td>-170</td>
<td>170</td>
<td>%</td>
<td>0</td>
<td>1459</td>
<td>Regenerative reactive current reference 100.0 = Nominal current. Positive =Inductive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Negative =Capacitive</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.2.1 DC Reference

Table 4.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.3.1</td>
<td>DC Voltage Dropping</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>0</td>
<td>620</td>
<td>AFE drooping DC-voltage.</td>
</tr>
<tr>
<td>P2.2.3.2</td>
<td>DC Voltage Reference Rate</td>
<td>0</td>
<td>10000</td>
<td>%/s</td>
<td>1000</td>
<td>1199</td>
<td></td>
</tr>
<tr>
<td>P2.2.3.3</td>
<td>DC Voltage Reference Filtering time</td>
<td>0</td>
<td>15.00</td>
<td>s</td>
<td>0.00</td>
<td>1760</td>
<td></td>
</tr>
<tr>
<td>P2.2.3.4</td>
<td>DC Reference Offset</td>
<td>-15</td>
<td>15</td>
<td>%</td>
<td>0.00</td>
<td>1776</td>
<td></td>
</tr>
</tbody>
</table>

### 4.2.2 Power / Frequency reference

Table 5.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.4.1</td>
<td>Freq Drop Offset</td>
<td>-5.00</td>
<td>5.00</td>
<td>Hz</td>
<td>0.00</td>
<td>1791</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.2</td>
<td>Freq. Down</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>417</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.3</td>
<td>Freq. Up</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>418</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.4</td>
<td>Freq. Adjust Rate</td>
<td>0.001</td>
<td>20.00</td>
<td>Hz/s</td>
<td>0.100</td>
<td>331</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.5</td>
<td>Freq. Max Adjust</td>
<td>0.00</td>
<td>25.00</td>
<td>Hz</td>
<td>2.50</td>
<td>1558</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.6</td>
<td>Base current Ref.</td>
<td>-170.0</td>
<td>170.0</td>
<td>%</td>
<td>0.00</td>
<td>1533</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.7</td>
<td>Base reference increase rate</td>
<td>0</td>
<td>10000</td>
<td>%/s</td>
<td>100.00</td>
<td>1536</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.8</td>
<td>Base Ref To Zero</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>0</td>
<td>1537</td>
<td>0 = No Action, 1 = At Stop State, 2 = When AFE, 3 = Stop &amp; AFE</td>
</tr>
<tr>
<td>P2.2.4.9</td>
<td>Base Reference At Stop</td>
<td>0</td>
<td>170.0</td>
<td>%</td>
<td>5.00</td>
<td>1538</td>
<td>0 = No Action, 1 = At Stop State, 2 = When AFE, 3 = Stop &amp; AFE</td>
</tr>
<tr>
<td>P2.2.4.10</td>
<td>FreqMotPotReset</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>1</td>
<td>367</td>
<td></td>
</tr>
<tr>
<td>P2.2.4.11</td>
<td>Reference Mode</td>
<td>0</td>
<td>1</td>
<td>%</td>
<td>0</td>
<td>1914</td>
<td>0 = Pure Iq Ref, 1 = Voltage Comp. Iq Ref</td>
</tr>
</tbody>
</table>

### 4.2.3 PID Power Controller for AFE

Table 6.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.4.12.1</td>
<td>PID Power Activation</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1905</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.2</td>
<td>PID Kp</td>
<td>0.00</td>
<td>1e6</td>
<td>%</td>
<td>100.00</td>
<td>1911</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.3</td>
<td>PID Ti</td>
<td>0</td>
<td>1e5</td>
<td>ms</td>
<td>1000</td>
<td>1906</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.4</td>
<td>PID DC Low</td>
<td>-50.00</td>
<td>50.00</td>
<td>%</td>
<td>-5.00</td>
<td>1903</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.5</td>
<td>PID DC High</td>
<td>-50.00</td>
<td>50.00</td>
<td>%</td>
<td>5.00</td>
<td>1904</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.6</td>
<td>Reference Down Rate</td>
<td>-1.00</td>
<td>320</td>
<td>%/s</td>
<td>-1.00</td>
<td>1810</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.7</td>
<td>Reference Up Rate</td>
<td>-1.00</td>
<td>320</td>
<td>%/s</td>
<td>-1.00</td>
<td>1811</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.8</td>
<td>PI LimHystToRef</td>
<td>0.0</td>
<td>20.0</td>
<td>%</td>
<td>6.0</td>
<td>1842</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.9</td>
<td>PI RefHystToLim</td>
<td>0.0</td>
<td>20.0</td>
<td>%</td>
<td>0.0</td>
<td>1844</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.10</td>
<td>ZeroErrorLimit</td>
<td>0.0</td>
<td>20.0</td>
<td>%</td>
<td>1.5</td>
<td>1843</td>
<td></td>
</tr>
<tr>
<td>2.2.4.12.11</td>
<td>PI Start Delay</td>
<td>0.0</td>
<td>32000</td>
<td>ms</td>
<td>200</td>
<td>1845</td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.2.4 Reference Adjust

Table 7.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.5.1</td>
<td>Reactive Adjust Rate</td>
<td>0.0</td>
<td>1000.0</td>
<td>%/s</td>
<td>1.0</td>
<td>1557</td>
<td></td>
</tr>
<tr>
<td>P2.2.5.2</td>
<td>Reactive Ref Up</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1553</td>
<td></td>
</tr>
<tr>
<td>P2.2.5.3</td>
<td>Reactive Ref Down</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1554</td>
<td></td>
</tr>
<tr>
<td>P2.2.5.4</td>
<td>Max Reactive Adjust</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>25.0</td>
<td>1559</td>
<td></td>
</tr>
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</table>

### 4.2.5 AC Voltage Reference

Table 8.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.6.1</td>
<td>Voltage at field weakening point</td>
<td>10.00</td>
<td>200.00</td>
<td>%</td>
<td>100.00</td>
<td>603</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.2</td>
<td>Field weakening point</td>
<td>8.00</td>
<td>320.00</td>
<td>Hz</td>
<td>45.00</td>
<td>602</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.3</td>
<td>Voltage Correction</td>
<td>-50</td>
<td>50</td>
<td>V</td>
<td>0</td>
<td>1790</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.4</td>
<td>Capacitor Size</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>5.0</td>
<td>1460</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.5</td>
<td>Inductor Size</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>15.0</td>
<td>1461</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.6</td>
<td>Inductor Losses</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>15.0</td>
<td>1465</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.7</td>
<td>Voltage Down</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1551</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.8</td>
<td>Voltage Up</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1550</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.9</td>
<td>Voltage Adjust Rate</td>
<td>0.0</td>
<td>1000.0</td>
<td>%/s</td>
<td>1.0</td>
<td>1555</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.10</td>
<td>Voltage Maximum Adjust</td>
<td>0</td>
<td>20</td>
<td>%</td>
<td>20</td>
<td>1639</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.11</td>
<td>Start Voltage Mode</td>
<td>0</td>
<td>2</td>
<td>%</td>
<td>1</td>
<td>1641</td>
<td>0 = Zero Q Start 1 = Drooping 2 = Reactive Ref</td>
</tr>
<tr>
<td>P2.2.6.12</td>
<td>Reset Zero Q Delay</td>
<td>0.00</td>
<td>120.00</td>
<td>Hz</td>
<td>0.00</td>
<td>1642</td>
<td>0,00 = No Reset</td>
</tr>
<tr>
<td>P2.2.6.13</td>
<td>Capacitor Size 2nd</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>0.0</td>
<td>3330</td>
<td></td>
</tr>
<tr>
<td>P2.2.6.14</td>
<td>Capacitor Size 2nd Voltage</td>
<td>0.0</td>
<td>1100.0</td>
<td>%</td>
<td>0.0</td>
<td>3331</td>
<td></td>
</tr>
</tbody>
</table>

### 4.3 Ramp Control

Table 9.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.3.1</td>
<td>Ramp Time</td>
<td>0.1</td>
<td>3200.0</td>
<td>s</td>
<td>25.0</td>
<td>103</td>
<td>2.00 Hz/s if Range 50 Hz</td>
</tr>
<tr>
<td>P2.3.2</td>
<td>Ramp Range</td>
<td>0.01</td>
<td>100.00</td>
<td>Hz</td>
<td>50.00</td>
<td>1980</td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
4.4 Input signals

4.4.1 Basic settings

Table 10.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
</table>
| P2.4.1.1 | Start/Stop Logic     | 0   | 3     |      | 0       | 300 | 0 = Start- No Act  
1 = R Pulser- F Pulser  
2 = R Pulser- R Pulser  
3 = IO Toggle (Testing) |
| P2.4.1.2 | Input Inversion      | 0   | 65535 |      | 4       | 1091| Inversion control of the input I/O signals.  
B0 = INV Open Contactor  
B1 = INV Ext. Fault 1  
B2 = INV Ext. Fault 2  
B3 = INV Enable MCB Close  
B4 = INV DC Ground Fault |
| P2.4.1.3 | IOStopDelToggle      | 0   | 320   | s    | 15      | 4001| Testing Purposes                                  |
| P2.4.1.4 | IOStartDelToggle     | 0   | 320   | s    | 15      | 4000| Testing Purposes                                  |
## 4.4.2 Digital inputs

Table 11. Digital inputs, G2.2.1

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.2.1</td>
<td>Start Signal 1</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>A.1</td>
<td>403</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.2</td>
<td>Start Signal 2</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>404</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.3</td>
<td>Open MCB</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1600</td>
<td>Forced open command</td>
</tr>
<tr>
<td>P2.4.2.4</td>
<td>CB Feed Back</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>A.4</td>
<td>1453</td>
<td>AFE MCB feedback (MCB 1)</td>
</tr>
<tr>
<td>P2.4.2.5</td>
<td>Fault Reset</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>414</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.6</td>
<td>Ext Fault 1</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.7</td>
<td>Ext Fault 2</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>406</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.8</td>
<td>Run Enable</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>407</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.9</td>
<td>NET Synchronisation</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1602</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.10</td>
<td>NET Close Enabled</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1705</td>
<td>Interlock for shore connection</td>
</tr>
<tr>
<td>P2.4.2.11</td>
<td>NET Close Request</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1604</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.12</td>
<td>NET Contactor FB</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1660</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.13</td>
<td>Forced AFE Mode</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1540</td>
<td>Force mode to AFE</td>
</tr>
<tr>
<td>P2.4.2.14</td>
<td>Cooling Monitor</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>750</td>
<td>OK input from the cooling unit</td>
</tr>
<tr>
<td>P2.4.2.15</td>
<td>Use CB 2</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1708</td>
<td>Second AFE contactor coming from second grid to have 2 different supplies</td>
</tr>
<tr>
<td>P2.4.2.16</td>
<td>CB 2 Status</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1710</td>
<td>Feedback signal from second AFE contactor</td>
</tr>
<tr>
<td>P2.4.2.17</td>
<td>AFE Mode 2</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1711</td>
<td>Only active when P2.11.1 is in 6/FRselect</td>
</tr>
<tr>
<td>P2.4.2.18</td>
<td>AFE Mode 3</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1712</td>
<td>Only active when P2.11.1 is in 6/FRselect</td>
</tr>
<tr>
<td>P2.4.2.19</td>
<td>Quick Stop</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>1213</td>
<td>Stop and opens MCB</td>
</tr>
<tr>
<td>P2.4.2.20</td>
<td>LCL Temperature</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>1179</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.21</td>
<td>RR Enable</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>1896</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.22</td>
<td>I/O Terminal Control</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>409</td>
<td>Enables final Run Command</td>
</tr>
<tr>
<td>P2.4.2.23</td>
<td>Keypad Control</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>410</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.24</td>
<td>Fieldbus Control</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>411</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.25</td>
<td>Enable MCB Close</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.2</td>
<td>1619</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.26</td>
<td>Reset P/Hz MPot</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1608</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.27</td>
<td>DC Ground Fault</td>
<td>0</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>441</td>
<td></td>
</tr>
</tbody>
</table>
### 4.4.3 Analogue Input 1

**Table 12. Analogue Input 1, G2.2.2**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.3.1</td>
<td>AI1 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>377</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.2</td>
<td>AI1 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.00</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.3</td>
<td>AI1 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>321</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.4</td>
<td>AI1 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>322</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.5</td>
<td>AI1 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>387</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.6</td>
<td>AI1 reference scaling, minimum</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>303</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.7</td>
<td>AI1 reference scaling, maximum</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>304</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.8</td>
<td>AI1 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1507</td>
<td></td>
</tr>
</tbody>
</table>

### 4.4.4 Analogue Input 2

**Table 13. Analogue Input 2, G2.2.3**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.4.1</td>
<td>AI2 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>388</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.2</td>
<td>AI2 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.00</td>
<td>329</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.3</td>
<td>AI2 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>326</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.4</td>
<td>AI2 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>327</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.5</td>
<td>AI2 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>398</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.6</td>
<td>AI2 reference scaling, minimum</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>393</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.7</td>
<td>AI2 reference scaling, maximum</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>394</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.8</td>
<td>AI2 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1511</td>
<td></td>
</tr>
</tbody>
</table>
### 4.4.5 Analogue Input 3

**Table 14. Analogue Input 2, G2.2.3**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.5.1</td>
<td>AI3 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>141</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.2</td>
<td>AI3 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.3</td>
<td>AI3 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.4</td>
<td>AI3 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>145</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.5</td>
<td>AI3 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>151</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.6</td>
<td>AI3 reference scaling, minimum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1037</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.7</td>
<td>AI3 reference scaling, maximum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1038</td>
<td></td>
</tr>
<tr>
<td>P2.4.5.8</td>
<td>AI3 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1509</td>
<td></td>
</tr>
</tbody>
</table>

### 4.4.6 Analogue Input 4

**Table 15. Analogue Input 2, G2.2.3**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.6.1</td>
<td>AI4 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.2</td>
<td>AI4 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.3</td>
<td>AI4 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.4</td>
<td>AI4 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>156</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.5</td>
<td>AI4 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>162</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.6</td>
<td>AI4 reference scaling, minimum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1039</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.7</td>
<td>AI4 reference scaling, maximum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1040</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.8</td>
<td>AI4 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1510</td>
<td></td>
</tr>
</tbody>
</table>
4.5 Output signals

4.5.1 Digital output signals

Table 16. Digital output signals, G2.3.1

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.1.1</td>
<td>MCB1 Close Control</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1218</td>
<td></td>
<td>AFE contactor, fixed to relay output B.2</td>
</tr>
<tr>
<td>P2.5.1.2</td>
<td>MCB1 Open Control</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.1.3</td>
<td>Ready</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>432</td>
<td></td>
<td>The AC drive is ready to operate.</td>
</tr>
<tr>
<td>P2.5.1.4</td>
<td>Run</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>433</td>
<td></td>
<td>The AC drive operates (the motor is running).</td>
</tr>
<tr>
<td>P2.5.1.5</td>
<td>Common Fault</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>434</td>
<td></td>
<td>A fault trip has occurred.</td>
</tr>
<tr>
<td>P2.5.1.6</td>
<td>Fault, Inverted</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>435</td>
<td></td>
<td>No fault trip has occurred.</td>
</tr>
<tr>
<td>P2.5.1.7</td>
<td>At reference</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.1.8</td>
<td>Overtemperature Warn.</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>439</td>
<td></td>
<td>The heatsink temperature exceeds +70 °C</td>
</tr>
<tr>
<td>P2.5.1.9</td>
<td>Warning</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>436</td>
<td></td>
<td>General warning signal.</td>
</tr>
<tr>
<td>P2.5.1.10</td>
<td>CB2 Close Control</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1709</td>
<td></td>
<td>Second AFE contactor control</td>
</tr>
<tr>
<td>P2.5.1.11</td>
<td>NET Contactor</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1605</td>
<td></td>
<td>NET contactor ( DC )</td>
</tr>
<tr>
<td>P2.5.1.12</td>
<td>D7 Synchronized</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1753</td>
<td></td>
<td>Drive is synchronised to D7 card</td>
</tr>
<tr>
<td>P2.5.1.13</td>
<td>Charge Control</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1568</td>
<td></td>
<td>Charge control from start command</td>
</tr>
<tr>
<td>P2.5.1.14</td>
<td>Common Alarm</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1684</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.1.15</td>
<td>Ready For Start</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1686</td>
<td></td>
<td>No conditions that could disable starting active</td>
</tr>
<tr>
<td>P2.5.1.16</td>
<td>Quick Stop Active</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>1687</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.1.17</td>
<td>Fieldbus digital input 1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>455</td>
<td></td>
<td>FB CWB11</td>
</tr>
<tr>
<td>P2.5.1.18</td>
<td>FB Dig 1 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td>0.1</td>
<td>891</td>
<td></td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.19</td>
<td>Fieldbus digital input 2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>456</td>
<td></td>
<td>FB CWB12</td>
</tr>
<tr>
<td>P2.5.1.20</td>
<td>FB Dig 2 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td>0.1</td>
<td>892</td>
<td></td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.21</td>
<td>Fieldbus digital input 3</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>457</td>
<td></td>
<td>FB CWB13</td>
</tr>
<tr>
<td>P2.5.1.22</td>
<td>FB Dig 3 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td>0.1</td>
<td>893</td>
<td></td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.23</td>
<td>Fieldbus digital input 4</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>169</td>
<td></td>
<td>FB CWB14</td>
</tr>
<tr>
<td>P2.5.1.24</td>
<td>FB Dig 4 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td>0.1</td>
<td>894</td>
<td></td>
<td>Select parameter to control</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.5.2 Delayed DO 1

**Table 17. Delayed DO1, G2.3.2**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.2.1</td>
<td>Dig.Out 1 Signal</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>486</td>
<td></td>
<td>Connect the delayed DO1 signal to the digital output of your choice with this parameter.</td>
</tr>
</tbody>
</table>
| P2.5.2.2 | DO1 Content          | 0   | 15    | 0    | 312     |     | 0 = Not used  
1 = Ready  
2 = Run  
3 = Fault  
4 = Fault inverted  
5 = FC overheat warning  
6 = Ext. fault or warning  
7 = Ref. fault or warning  
8 = Warning  
9 = Reverse  
10 = SynchronisedToD7  
11 = Start Command given  
12 = FB DIN2  
13 = FB DIN3  
14 = ID.Bit DO  
15 = Warning SR |
| P2.5.2.3 | DO1 ON Delay         | 0.00| 320.00| s    | 0.00    | 487 | 0.00 = On delay not in use |
| P2.5.2.4 | DO1 OFF Delay        | 0.00| 320.00| s    | 0.00    | 488 | 0.00 = On delay not in use |
| P2.5.2.5 | ID.Bit Free DO       | 0.00| 2000.00| ID.Bit | 0.00   | 1216 | |

### 4.5.3 Delayed DO 2

**Table 18. Delayed DO2, G2.3.3**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.3.1</td>
<td>Dig.Out 2 Signal</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td>486</td>
<td></td>
<td>Connect the delayed DO2 signal to the digital output of your choice with this parameter.</td>
</tr>
<tr>
<td>P2.5.3.2</td>
<td>DO2 Content</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>490</td>
<td></td>
<td>See ID312 P2.5.2.2</td>
</tr>
<tr>
<td>P2.5.3.3</td>
<td>DO2 ON Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>487</td>
<td>0.00 = On delay not in use</td>
</tr>
<tr>
<td>P2.5.3.4</td>
<td>DO2 OFF Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>488</td>
<td>0.00 = On delay not in use</td>
</tr>
<tr>
<td>P2.5.2.5</td>
<td>ID.Bit Free DO</td>
<td>0.00</td>
<td>2000.00</td>
<td>ID.Bit</td>
<td>0.00</td>
<td>1217</td>
<td></td>
</tr>
</tbody>
</table>
## 4.5.4 Analogue Output 1

### Table 19. Analogue Output Signals, G2.3.4

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.4.1</td>
<td>Iout 1 signal</td>
<td>AnOUT:0.1</td>
<td>AnOUT:E.10</td>
<td>AnOUT:A.1</td>
<td>464</td>
<td>0</td>
<td>Connect the AO1 signal to the analogue output of your choice with this parameter.</td>
</tr>
</tbody>
</table>
| P2.5.4.2 | Iout Content    | 0   | 11  |          | 1/ O/P Freq | 307 | 0 = Not used  
1 = DC Voltage  
2 = Drive Current  
3 = Output Voltage  
4 = Active Current  
5 = Power  
6 = Reactive Current  
7 = Power Bidirectional  
8 = Al1  
9 = Al2  
10 = FB Analogue Output  
11 = Line Voltage  
12 = FreqOut, bidirectional  
13 = Value Control Out |
| P2.5.4.3 | Iout Filter Time | 0  | 10  | s        | 1       | 308 | 0 = No filtering                                                              |
| P2.5.4.4 | Iout Invert     | 0   | 1   |          | 0 / No Inversion | 309 | 0 = Not inverted  
1 = Inverted |
| P2.5.4.5 | Iout Minimum    | 0   | 1   |          | 0 / 0 mA | 310 | 0 = 0 mA  
1 = 4 mA |
| P2.5.4.6 | Iout Scale      | 10  | 1000 | %        | 100     | 311 | Percentage multiplier. Defines output when content is in maximum value         |
| P2.5.4.7 | Iout Offset     | -100| 100 | %        | 0       | 375 | Add -1000 to 1000% to the analogue output.                                  |

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### Analogue Output 2

**Table 20. Analogue output signals, G2.3.4**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.5.1</td>
<td>Iout 2 signal</td>
<td>AnOUT:0.1</td>
<td>AnOUT:E.10</td>
<td>AnOUT:A.1</td>
<td>464</td>
<td>0</td>
<td>Connect the AO1 signal to the analogue output of your choice with this parameter.</td>
</tr>
<tr>
<td>P2.5.5.2</td>
<td>Iout Content</td>
<td>0</td>
<td>11</td>
<td>1/O/P Freq</td>
<td>307</td>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>DC Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>Drive Current</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>3</td>
<td>Output Voltage</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>4</td>
<td>Active Current</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>Power</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>Reactive Current</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>7</td>
<td>Power Bidirectional</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>AI1</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>9</td>
<td>AI2</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>10</td>
<td>FB Analogue Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
<td>Line Voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>FreqOut, bidirectional</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13</td>
<td>Value Control Out</td>
</tr>
<tr>
<td>P2.5.5.3</td>
<td>Iout Filter Time</td>
<td>0</td>
<td>10</td>
<td>s</td>
<td>308</td>
<td>0</td>
<td>No filtering</td>
</tr>
<tr>
<td>P2.5.5.4</td>
<td>Iout Invert</td>
<td>0</td>
<td>1</td>
<td>0/No Inversion</td>
<td>309</td>
<td>0</td>
<td>Not inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>Inverted</td>
</tr>
<tr>
<td>P2.5.5.5</td>
<td>Iout Minimum</td>
<td>0</td>
<td>1</td>
<td>0/0 mA</td>
<td>310</td>
<td>0</td>
<td>0 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>4 mA</td>
</tr>
<tr>
<td>P2.5.5.6</td>
<td>Iout Scale</td>
<td>10</td>
<td>1000</td>
<td>%</td>
<td>311</td>
<td>100</td>
<td>Percentage multiplier. Defines output when content is in maximum value</td>
</tr>
<tr>
<td>P2.5.5.7</td>
<td>Iout Offset</td>
<td>-100</td>
<td>100</td>
<td>%</td>
<td>375</td>
<td>0</td>
<td>Add -1000 to 1000% to the analogue output.</td>
</tr>
</tbody>
</table>
### 4.5.6 Analogue output 3

**Table 21. Analogue output signals, G2.3.4**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.6.1</td>
<td>Iout 3 signal</td>
<td>AnOUT:0.1</td>
<td>AnOUT:E.10</td>
<td>AnOUT:A.1</td>
<td>464</td>
<td>Connect the AO1 signal to the analogue output of your choice with this parameter.</td>
<td></td>
</tr>
<tr>
<td>P2.5.6.2</td>
<td>Iout Content</td>
<td>0</td>
<td>11</td>
<td>s</td>
<td>1</td>
<td>307</td>
<td></td>
</tr>
<tr>
<td>P2.5.6.3</td>
<td>Iout Filter Time</td>
<td>0</td>
<td>10</td>
<td>s</td>
<td>1</td>
<td>308</td>
<td>0 = No filtering</td>
</tr>
<tr>
<td>P2.5.6.4</td>
<td>Iout Invert</td>
<td>0</td>
<td>1</td>
<td>/ No Inversion</td>
<td>309</td>
<td></td>
<td>0 = Not inverted 1 = Inverted</td>
</tr>
<tr>
<td>P2.5.6.5</td>
<td>Iout Minimum</td>
<td>0</td>
<td>1</td>
<td>0 / 0 mA</td>
<td>310</td>
<td></td>
<td>0 = 0 mA 1 = 4 mA</td>
</tr>
<tr>
<td>P2.5.6.6</td>
<td>Iout Scale</td>
<td>10</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>311</td>
<td>Percentage multiplier. Defines output when content is in maximum value</td>
</tr>
<tr>
<td>P2.5.6.7</td>
<td>Iout Offset</td>
<td>-100</td>
<td>100</td>
<td>%</td>
<td>0</td>
<td>375</td>
<td>Add -100 to 100% to the analogue output.</td>
</tr>
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</table>

### 4.5.7 Options

**Table 22.**

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<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>P2.5.7.1</td>
<td>Output Inversion</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1806</td>
<td></td>
</tr>
<tr>
<td>P2.5.7.2</td>
<td>Freq Scale Min AO</td>
<td>0.00</td>
<td>320.00 Hz</td>
<td>0.00</td>
<td>1809</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.3</td>
<td>Freq Scale Max AO</td>
<td>0.00</td>
<td>320.00 Hz</td>
<td>50.00</td>
<td>1808</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.4</td>
<td>DC Supervision Limit</td>
<td>0</td>
<td>1500 V</td>
<td></td>
<td>1454</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.5</td>
<td>MCB Close Mode</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1607</td>
<td>0 = DC Voltage 1 = DC or Start command 2 = Start Command.</td>
</tr>
<tr>
<td>P2.5.7.6</td>
<td>MCB At Stop Command</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1685</td>
<td>0 = Keep CB Closed 1 = Open CB</td>
</tr>
<tr>
<td>P2.5.7.7</td>
<td>MCB Close Delay</td>
<td>0.00</td>
<td>3.00</td>
<td></td>
<td>0.00</td>
<td>1513</td>
<td>Delay to CB RO</td>
</tr>
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</table>
## 4.6 Limit Settings

### 4.6.1 Current Limit

Table 23.

<table>
<thead>
<tr>
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<th>Max</th>
<th>Unit</th>
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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.1.1</td>
<td>Current Limit</td>
<td>0</td>
<td>Varies</td>
<td>A</td>
<td>Varies</td>
<td>107</td>
<td>Total current limit</td>
</tr>
<tr>
<td>P2.6.1.2</td>
<td>Short Circuit Level</td>
<td>0</td>
<td>800.1</td>
<td>%</td>
<td>800.0</td>
<td>1620</td>
<td>Disabled above 499.0%</td>
</tr>
<tr>
<td>P2.6.1.3</td>
<td>Short Circuit Time</td>
<td>0</td>
<td>5000</td>
<td>ms</td>
<td>0</td>
<td>1515</td>
<td></td>
</tr>
<tr>
<td>P2.6.1.4</td>
<td>High Freq. Current Limit</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1517</td>
<td>0 = Enabled (FR) 1 = Disabled (INU)</td>
</tr>
<tr>
<td>P2.6.1.5</td>
<td>BiPhase fault voltage level</td>
<td>0.00</td>
<td>150.00</td>
<td>%</td>
<td>0.00</td>
<td>1518</td>
<td></td>
</tr>
<tr>
<td>P2.6.1.6</td>
<td>Output Active Current Limit</td>
<td>0</td>
<td>300.0</td>
<td>%</td>
<td>150.0</td>
<td>1290</td>
<td>Generating Active Current limit in AFE mode to grid.</td>
</tr>
<tr>
<td>P2.6.1.7</td>
<td>Input Active Current Limit</td>
<td>0</td>
<td>300.0</td>
<td>%</td>
<td>150.0</td>
<td>1289</td>
<td>Motoring active current limit in AFE mode to DC-link.</td>
</tr>
<tr>
<td>P2.6.1.8</td>
<td>OverCurrentTripLim</td>
<td>0</td>
<td>1000.0</td>
<td>%</td>
<td>0.0</td>
<td>1094</td>
<td>Software Over Current Trip</td>
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### 4.6.2 Power Limit

Table 24.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.2.1</td>
<td>Output Power Limit</td>
<td>0</td>
<td>300.0</td>
<td>%</td>
<td>150</td>
<td>1288</td>
<td>Generating Power limit in AFE mode to grid.</td>
</tr>
<tr>
<td>P2.6.2.2</td>
<td>Input Power Limit</td>
<td>0</td>
<td>300.0</td>
<td>%</td>
<td>150</td>
<td>1287</td>
<td>Motoring Power limit in AFE mode to DC.</td>
</tr>
<tr>
<td>P2.6.2.3</td>
<td>Limit increase Rate</td>
<td>0</td>
<td>10000</td>
<td>%/s</td>
<td>100</td>
<td>1502</td>
<td></td>
</tr>
<tr>
<td>P2.6.2.4</td>
<td>High Frequency Power Limit</td>
<td>0.00</td>
<td>100.00</td>
<td>Hz</td>
<td>0.00</td>
<td>1703</td>
<td>0.00 = Not Used.</td>
</tr>
<tr>
<td>P2.6.2.5</td>
<td>Stop Power Ramp Rate</td>
<td>-1.00</td>
<td>100.00</td>
<td>%/s</td>
<td>-0.01</td>
<td>1812</td>
<td></td>
</tr>
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</table>

### 4.6.3 Frequency Limit

Table 25.

<table>
<thead>
<tr>
<th>Code</th>
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<th>Max</th>
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<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.3.1</td>
<td>Line Low Trip Limit</td>
<td>0.00</td>
<td>120.00</td>
<td>Hz</td>
<td>40.00</td>
<td>1717</td>
<td>F10 immediately if above</td>
</tr>
<tr>
<td>P2.6.3.2</td>
<td>Line High Trip Limit</td>
<td>0.00</td>
<td>120.00</td>
<td>Hz</td>
<td>70.00</td>
<td>1716</td>
<td>F10 immediately if below</td>
</tr>
</tbody>
</table>

### 4.6.4 Micro Grid

Table 26.

<table>
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<th>Code</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.4.1</td>
<td>Current limit Min</td>
<td>-300.0</td>
<td>0.0</td>
<td>%</td>
<td>-150</td>
<td>1621</td>
<td>Island and uGrid mode</td>
</tr>
<tr>
<td>P2.6.4.2</td>
<td>Current limit Max</td>
<td>0.0</td>
<td>300.0</td>
<td>%</td>
<td>150</td>
<td>1622</td>
<td>Island and uGrid mode</td>
</tr>
<tr>
<td>P2.6.4.3</td>
<td>Max Limit Increase rate</td>
<td>0</td>
<td>10000</td>
<td>%/s</td>
<td>100</td>
<td>1502</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.4</td>
<td>Current limit Kp</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>100</td>
<td>1623</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.5</td>
<td>Current Limit ti</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>32</td>
<td>1625</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.6</td>
<td>Current Limit Max Minimum</td>
<td>0.0</td>
<td>10.0</td>
<td>%</td>
<td>1.0</td>
<td>1890</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.7</td>
<td>Current Limit To Zero Mode</td>
<td>0</td>
<td>10</td>
<td>%</td>
<td>0</td>
<td>1539</td>
<td>0 = No Action 1 = At Stop State</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
4.6.5 DC Voltage

Table 27.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.2.6.5.1</td>
<td>Under Voltage Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>65.00</td>
<td>1524</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.2</td>
<td>Over voltage limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>120.00</td>
<td>1523</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.3</td>
<td>Brake Chopper</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.4</td>
<td>BrakeChopperLev</td>
<td>Varies</td>
<td>Varies</td>
<td>Vdc</td>
<td>Varies</td>
<td>1267</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.3.1</td>
<td>LK Low DC</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1813</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.3.2</td>
<td>MCB Ready Level</td>
<td>0</td>
<td>1300</td>
<td>Vdc</td>
<td>0</td>
<td>1841</td>
<td></td>
</tr>
<tr>
<td>P.2.6.5.3.3</td>
<td>HighMCBCloseLim</td>
<td>0</td>
<td>1300</td>
<td>Vdc</td>
<td>0</td>
<td>1251</td>
<td></td>
</tr>
</tbody>
</table>

4.7 Drive control

Table 28. Drive control, G2.6

<table>
<thead>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.2.7.1</td>
<td>Switching Freq</td>
<td>3.6</td>
<td>6</td>
<td>kHz</td>
<td>3.6</td>
<td>601</td>
<td></td>
</tr>
<tr>
<td>P.2.7.2</td>
<td>AFE Options 1</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>544</td>
<td>1463</td>
<td></td>
</tr>
<tr>
<td>P.2.7.3</td>
<td>AFE Options 2</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1464</td>
<td></td>
</tr>
<tr>
<td>P.2.7.4</td>
<td>AFE Options 3</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1466</td>
<td></td>
</tr>
<tr>
<td>P.2.7.5</td>
<td>AFE Options 4</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1467</td>
<td></td>
</tr>
<tr>
<td>P.2.7.6</td>
<td>Start Delay</td>
<td>0.10</td>
<td>3200</td>
<td>s</td>
<td>1.00</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>P.2.7.7</td>
<td>Modulator Type</td>
<td>0</td>
<td>4</td>
<td></td>
<td>1</td>
<td>1516</td>
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</tr>
<tr>
<td>P.2.7.8</td>
<td>Control Options</td>
<td>0</td>
<td>65535</td>
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<td>0</td>
<td>1707</td>
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<td>P.2.7.9</td>
<td>Control Options 2</td>
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<td>0</td>
<td>1798</td>
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<td>P.2.7.10</td>
<td>Operation Time</td>
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<td>2^32</td>
<td>s</td>
<td>0</td>
<td>1855</td>
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</table>

4.7.1 AFE control

Table 29. AFE Control, G2.7.9

<table>
<thead>
<tr>
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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.2.7.11.1</td>
<td>Dynamic Support Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1797</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.2</td>
<td>Synch Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>2000</td>
<td>1457</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.3</td>
<td>Synch Ti</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>50</td>
<td>1458</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.4</td>
<td>Active Current Kp</td>
<td>0</td>
<td>4000</td>
<td></td>
<td>400</td>
<td>1455</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.5</td>
<td>Active Current Ti</td>
<td>0.0</td>
<td>100.0</td>
<td></td>
<td>1.5</td>
<td>1456</td>
<td></td>
</tr>
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<td>P.2.7.11.6</td>
<td>Synch. Kp Start</td>
<td>0</td>
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<td>4000</td>
<td>1300</td>
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<td>P.2.7.11.7</td>
<td>Voltage Ctrl Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>200</td>
<td>1451</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.8</td>
<td>Voltage Ctrl Ti</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>50</td>
<td>1452</td>
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</tr>
</tbody>
</table>

4.7.2 Identification

Table 30. Identification

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.2.7.11.1</td>
<td>IU Offset</td>
<td>-10000</td>
<td>10000</td>
<td></td>
<td>10000</td>
<td>668</td>
<td></td>
</tr>
<tr>
<td>P.2.7.11.2</td>
<td>IV Offset</td>
<td>-10000</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>669</td>
<td></td>
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<td>P.2.7.11.3</td>
<td>IW Offset</td>
<td>-10000</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>670</td>
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</tr>
<tr>
<td>Code</td>
<td>Parameter</td>
<td>Min</td>
<td>Max</td>
<td>Unit</td>
<td>Default</td>
<td>ID</td>
<td>Description</td>
</tr>
<tr>
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<td>-----</td>
<td>------</td>
<td>---------</td>
<td>-----</td>
<td>---------------------</td>
</tr>
<tr>
<td>P 2.7.11.1</td>
<td>DC Ripple Compensation Kp</td>
<td>0</td>
<td>100</td>
<td></td>
<td>0</td>
<td>1900</td>
<td></td>
</tr>
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<td>P 2.7.11.2</td>
<td>DC Ripple Compensation Phase</td>
<td>-360</td>
<td>360</td>
<td></td>
<td>0</td>
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<td></td>
</tr>
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<td>P 2.7.11.3</td>
<td>DC Ripple Compensation frequency</td>
<td>0</td>
<td>0</td>
<td></td>
<td>300</td>
<td>1902</td>
<td></td>
</tr>
<tr>
<td>P 2.7.11.4</td>
<td>HCompDropp</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>100</td>
<td>1938</td>
<td></td>
</tr>
<tr>
<td>P 2.7.11.5</td>
<td>HCompDroopHi</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>100</td>
<td>1939</td>
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</tbody>
</table>
### 4.8 Protections

#### 4.8.1 General

**Table 32. Protections, G2.9**

<table>
<thead>
<tr>
<th>Code</th>
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<th>Min</th>
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<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.9.1.1</td>
<td>Thermistor Fault Response</td>
<td>0</td>
<td>3</td>
<td>2/Fault</td>
<td>732</td>
<td></td>
<td>0 = No response 1 = Warning 2 = Fault, stop acc. stop mode 3 = Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.9.1.2</td>
<td>Overtemperature Response</td>
<td>2</td>
<td>5</td>
<td>2/Fault</td>
<td>1757</td>
<td></td>
<td>As Par. P2.9.1.4</td>
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<tr>
<td>P2.9.1.3</td>
<td>Overvoltage Response</td>
<td>2</td>
<td>5</td>
<td>2/Fault</td>
<td>1755</td>
<td></td>
<td>As Par. P2.9.1.4</td>
</tr>
<tr>
<td>P2.9.1.4</td>
<td>Cooling Flt. Delay</td>
<td>0</td>
<td>7</td>
<td>s</td>
<td>2</td>
<td>751</td>
<td></td>
</tr>
<tr>
<td>P2.9.1.5</td>
<td>LCL Overtemperature</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>1505</td>
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<td></td>
</tr>
<tr>
<td>P2.9.1.6</td>
<td>Max Charge Time</td>
<td>0.00</td>
<td>30.00</td>
<td>s</td>
<td>5.00</td>
<td>1522</td>
<td>Charging time limit when drive charging options are used</td>
</tr>
<tr>
<td>P2.9.1.7</td>
<td>MCB At Fault</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1699</td>
<td></td>
<td>0 = No Action 1 = Open MCB</td>
</tr>
<tr>
<td>P2.9.1.8</td>
<td>Quick Stop Response</td>
<td>1</td>
<td>2</td>
<td>1/Warning</td>
<td>1758</td>
<td></td>
<td>1 = Warning 2 = Fault</td>
</tr>
<tr>
<td>P2.9.1.9</td>
<td>Reactive Error Trip Response</td>
<td>-300</td>
<td>300</td>
<td>%</td>
<td>7.5</td>
<td>1759</td>
<td></td>
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<tr>
<td>P2.9.1.10</td>
<td>MCB Fault Delay</td>
<td>0.00</td>
<td>10.00</td>
<td>s</td>
<td>3.50</td>
<td>1521</td>
<td></td>
</tr>
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<td>P2.9.1.11</td>
<td>Line Phase Supervision</td>
<td>0</td>
<td>2</td>
<td>0/No Action</td>
<td>702</td>
<td></td>
<td>0 = No Action 1 = Warning 2 = Fault</td>
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<tr>
<td>P2.9.1.12</td>
<td>4 mA Fault Response</td>
<td>0</td>
<td>2</td>
<td>0/No Action</td>
<td>700</td>
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</tr>
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<td>P2.9.1.13</td>
<td>Reactive Current Limit Response</td>
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<td>1/Warning</td>
<td>1981</td>
<td></td>
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<td>P2.9.1.14</td>
<td>ACTempFaultLevel</td>
<td>0</td>
<td>100</td>
<td>°C</td>
<td>0</td>
<td>1998</td>
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#### 4.8.2 PT-100

**Table 33.**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.9.2.1</td>
<td>No. of used inputs on board 1</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>739</td>
<td></td>
<td></td>
<td>0 = Not used (ID Write) 1 = Sensor 1 in use 2 = Sensor 1 &amp; 2 in use 3 = Sensor 1 &amp; 2 &amp; 3 in use 4 = Sensor 2 &amp; 3 in use 5 = Sensor 3 in use</td>
</tr>
<tr>
<td>P2.9.2.2</td>
<td>Response to temperature fault</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>740</td>
<td></td>
<td></td>
<td>0 = No response 1 = Warning 2 = Fault, stop acc. to 2.3.2 3 = Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.9.2.3</td>
<td>Board 1 warning limit</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>120.0</td>
<td>741</td>
<td></td>
<td>0 = Not used (ID Write) 1 = Sensor 1 in use 2 = Sensor 1 &amp; 2 in use</td>
</tr>
<tr>
<td>P2.9.2.4</td>
<td>Board 1 fault limit</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>130.0</td>
<td>742</td>
<td></td>
<td>0 = Not used (ID Write) 1 = Sensor 1 in use 2 = Sensor 1 &amp; 2 in use</td>
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<tr>
<td>P2.9.2.5</td>
<td>No. of uses inputs on board 2</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>743</td>
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<td>0 = Not used (ID Write) 1 = Sensor 1 in use 2 = Sensor 1 &amp; 2 in use</td>
</tr>
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### 4.8.3 Earth fault

*Table 34.*

<table>
<thead>
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<th>Description</th>
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<tr>
<td>P2.9.3.1</td>
<td>Earth Fault Response</td>
<td>2</td>
<td>5</td>
<td>%</td>
<td>2 / Fault</td>
<td>1756</td>
<td></td>
</tr>
<tr>
<td>P2.9.3.2</td>
<td>Earth Fault Level</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>50</td>
<td>1333</td>
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### 4.8.4 Fieldbus fault

*Table 35.*

<table>
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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.9.4.1</td>
<td>FB Fault response Slot D</td>
<td>0</td>
<td>6</td>
<td>%</td>
<td>2</td>
<td>733</td>
<td></td>
</tr>
<tr>
<td>P2.9.4.2</td>
<td>FB Fault response Slot E</td>
<td>0</td>
<td>6</td>
<td>%</td>
<td>2</td>
<td>761</td>
<td></td>
</tr>
<tr>
<td>P2.9.4.3</td>
<td>FB WD Time</td>
<td>0.00</td>
<td>30.00</td>
<td>s</td>
<td>0.00</td>
<td>1354</td>
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### 4.8.5 External fault

*Table 36.*

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<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.9.5.1</td>
<td>External Fault 1</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>2 / Fault</td>
<td>701</td>
<td></td>
</tr>
<tr>
<td>P2.9.5.2</td>
<td>External Fault 2</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>1 / Warning</td>
<td>1504</td>
<td></td>
</tr>
<tr>
<td>P2.9.5.3</td>
<td>External Fault Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>1506</td>
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### 4.8.6 Grid Voltage D7

*Table 37.*

<table>
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<th>Unit</th>
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<th>ID</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>P2.9.6.1</td>
<td>Voltage D7 Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1626</td>
<td></td>
</tr>
<tr>
<td>P2.9.6.2</td>
<td>Voltage Low Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>1893</td>
<td></td>
</tr>
<tr>
<td>P2.9.6.3</td>
<td>Voltage Low Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>80.00</td>
<td>1899</td>
<td></td>
</tr>
<tr>
<td>P2.9.6.4</td>
<td>Voltage High Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>110.00</td>
<td>1895</td>
<td></td>
</tr>
<tr>
<td>P2.9.6.5</td>
<td>Voltage High Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>115.00</td>
<td>1799</td>
<td></td>
</tr>
<tr>
<td>P2.9.6.6</td>
<td>Voltage Trip Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.50</td>
<td>1898</td>
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### 4.8.7 Grid Frequency

*Table 38.*

<table>
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<th>Code</th>
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<th>ID</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>P2.9.7.1</td>
<td>Freq. Supply Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1627</td>
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</tr>
<tr>
<td>P2.9.7.2</td>
<td>Freq. D7 Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1628</td>
<td></td>
</tr>
<tr>
<td>P2.9.7.3</td>
<td>Freq. Low Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>95.00</td>
<td>1780</td>
<td>Low limit for e.g. Mot Pot function</td>
</tr>
<tr>
<td>P2.9.7.4</td>
<td>Freq. Low Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>1781</td>
<td></td>
</tr>
<tr>
<td>P2.9.7.5</td>
<td>Freq. High Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>106.00</td>
<td>1783</td>
<td>High limit for e.g. Mot Pot function.</td>
</tr>
<tr>
<td>P2.9.7.6</td>
<td>Freq. High Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>110.00</td>
<td>1784</td>
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</tr>
<tr>
<td>P2.9.7.7</td>
<td>Freq. Trip Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.50</td>
<td>1785</td>
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### 4.8.8 Supply Voltage

*Table 39.*

<table>
<thead>
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<th>Code</th>
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<th>Unit</th>
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<th>ID</th>
<th>Description</th>
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<tbody>
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<td>P2.6.8.1</td>
<td>Voltage Supply Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1629</td>
<td></td>
</tr>
<tr>
<td>P2.6.8.2</td>
<td>Voltage Low Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>75.00</td>
<td>1891</td>
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</tr>
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<td>Voltage Low Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>1880</td>
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</tr>
<tr>
<td>P2.6.8.4</td>
<td>Voltage High Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>120.00</td>
<td>1881</td>
<td></td>
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<tr>
<td>P2.6.8.5</td>
<td>Voltage High Trip Limit</td>
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<td>320.00</td>
<td>%</td>
<td>130.00</td>
<td>1992</td>
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</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
## 4.8.9 Over Load

Table 40.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
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<th>Unit</th>
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<th>ID</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>P2.9.9.1</td>
<td>Over Load Response</td>
<td>0</td>
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<td>1838</td>
<td>0=No response</td>
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<td>1=Warning</td>
</tr>
<tr>
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<td></td>
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<td>2=Fault</td>
</tr>
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<td>P2.9.9.2</td>
<td>Over Load Signal</td>
<td>0</td>
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<td>1837</td>
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<td>1=Current %</td>
</tr>
<tr>
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<td></td>
<td>2=Active Current</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>3=Reactive Current</td>
</tr>
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<td>P2.9.9.3</td>
<td>Over Load Maximum Input</td>
<td>0.0</td>
<td>300.0</td>
<td>%</td>
<td>150.0</td>
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<td>P2.9.9.4</td>
<td>Over Load maximum Step</td>
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<td>1840</td>
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## 4.8.10 OPT-D7 PROTECTIONS

Table 1. D7 protection settings, G2.9.10

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<th>Parameter</th>
<th>Min</th>
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<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
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</thead>
<tbody>
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<td>P2.9.10.1</td>
<td>THD response</td>
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<td>1672</td>
<td>0=No Action</td>
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<td></td>
<td></td>
<td>1=Warning</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>2=Fault</td>
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<td>P2.9.10.2</td>
<td>THD warning limit</td>
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<td>5000</td>
<td>%</td>
<td>600</td>
<td>1673</td>
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<td>P2.9.10.3</td>
<td>THD fault limit</td>
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<td>5000</td>
<td>%</td>
<td>1000</td>
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</tr>
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<td>P2.9.10.4</td>
<td>HF RMS response</td>
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<td>2</td>
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<td>1675</td>
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<td>1=Warning</td>
</tr>
<tr>
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<td></td>
<td></td>
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</tr>
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<td>P2.9.10.5</td>
<td>HF RMS warning limit</td>
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<td>4000</td>
<td>V</td>
<td>200</td>
<td>1676</td>
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<td>P2.9.10.6</td>
<td>HF RMS fault limit</td>
<td>0</td>
<td>4000</td>
<td>V</td>
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## 4.8.11 Extra

Table 2.

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<th>ID</th>
<th>Description</th>
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<tbody>
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<td>P2.9.11</td>
<td>Fault Simulation</td>
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<td>65535</td>
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<td>0</td>
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</tr>
<tr>
<td>P2.9.12</td>
<td>Reset Datalogger</td>
<td>0</td>
<td>1</td>
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<td>0</td>
<td>1857</td>
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</table>
### 4.9 Fieldbus

Table 3. Fieldbus, G2.10

<table>
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<th>ID</th>
<th>Description</th>
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<tbody>
<tr>
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<td>FB Actual Value Sel</td>
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<td>P2.10.2</td>
<td>FB Data Out1 Sel</td>
<td>0</td>
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<td>1104</td>
<td>852</td>
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</tr>
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<td>P2.10.3</td>
<td>FB Data Out2 Sel</td>
<td>0</td>
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<td>853</td>
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<tr>
<td>P2.10.4</td>
<td>FB Data Out3 Sel</td>
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<td>10000</td>
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<td>1172</td>
<td>854</td>
<td></td>
</tr>
<tr>
<td>P2.10.5</td>
<td>FB Data Out4 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1173</td>
<td>855</td>
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</tr>
<tr>
<td>P2.10.6</td>
<td>FB Data Out5 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>56</td>
<td>856</td>
<td></td>
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<tr>
<td>P2.10.7</td>
<td>FB Data Out6 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1174</td>
<td>857</td>
<td></td>
</tr>
<tr>
<td>P2.10.8</td>
<td>FB Data Out7 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1125</td>
<td>858</td>
<td></td>
</tr>
<tr>
<td>P2.10.9</td>
<td>FB Data Out8 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1157</td>
<td>859</td>
<td></td>
</tr>
<tr>
<td>P2.10.10</td>
<td>FB Data Out9 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>558</td>
<td>Data Out 9-16 visible only with correct HW and SW.</td>
</tr>
<tr>
<td>P2.10.11</td>
<td>FB Data Out10 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>559</td>
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<tr>
<td>P2.10.12</td>
<td>FB Data Out11 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>560</td>
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<td>P2.10.13</td>
<td>FB Data Out12 Sel</td>
<td>0</td>
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<td>0</td>
<td>561</td>
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<td>P2.10.14</td>
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<td>10000</td>
<td></td>
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<td>P2.10.16</td>
<td>FB Data Out15 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>564</td>
<td></td>
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<tr>
<td>P2.10.17</td>
<td>FB Data Out16 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>565</td>
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<td>P2.10.18</td>
<td>FB Data In 1 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>876</td>
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<tr>
<td>P2.10.19</td>
<td>FB Data In 2 Sel</td>
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<td>10000</td>
<td></td>
<td>0</td>
<td>877</td>
<td></td>
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<td>P2.10.20</td>
<td>FB Data In 3 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>878</td>
<td></td>
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<td>P2.10.21</td>
<td>FB Data In 4 Sel</td>
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<td>10000</td>
<td></td>
<td>0</td>
<td>879</td>
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<td>P2.10.22</td>
<td>FB Data In 5 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>880</td>
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<td>P2.10.23</td>
<td>FB Data In 6 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>881</td>
<td></td>
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<tr>
<td>P2.10.24</td>
<td>FB Data In 7 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>882</td>
<td></td>
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<tr>
<td>P2.10.25</td>
<td>FB Data In 8 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>883</td>
<td></td>
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<td>P2.10.26</td>
<td>FB Data In 9 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>550</td>
<td>Data In 9-16 visible only with correct HW and SW.</td>
</tr>
<tr>
<td>P2.10.27</td>
<td>FB Data In 10 Sel</td>
<td>0</td>
<td>10000</td>
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</tr>
<tr>
<td>P2.10.28</td>
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<td>10000</td>
<td></td>
<td>0</td>
<td>552</td>
<td></td>
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<tr>
<td>P2.10.29</td>
<td>FB Data In 12 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>553</td>
<td></td>
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<tr>
<td>P2.10.30</td>
<td>FB Data In 13 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>554</td>
<td></td>
</tr>
<tr>
<td>P2.10.31</td>
<td>FB Data In 14 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>555</td>
<td></td>
</tr>
<tr>
<td>P2.10.32</td>
<td>FB Data In 15 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>556</td>
<td></td>
</tr>
<tr>
<td>P2.10.33</td>
<td>FB Data In 16 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>557</td>
<td></td>
</tr>
<tr>
<td>P2.10.34</td>
<td>GSW Data</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>68</td>
<td>897</td>
<td></td>
</tr>
<tr>
<td>P2.10.35</td>
<td>State Machine</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>896</td>
<td>0 = Basic, 1 = Standard, 2 = Vacon AFE 1</td>
</tr>
<tr>
<td>P2.10.36</td>
<td>FB Ref Min</td>
<td>105.00</td>
<td>320.00</td>
<td>%</td>
<td>105.00</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>P2.10.37</td>
<td>FB Ref Max</td>
<td>105.00</td>
<td>320.00</td>
<td>%</td>
<td>130.00</td>
<td>851</td>
<td></td>
</tr>
<tr>
<td>P2.10.38</td>
<td>Control Slot Selector</td>
<td>0</td>
<td>Varies</td>
<td></td>
<td>0</td>
<td>1440</td>
<td></td>
</tr>
<tr>
<td>P2.10.39</td>
<td>SW B11 ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1907</td>
<td></td>
</tr>
<tr>
<td>P2.10.40</td>
<td>SW B12 ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1908</td>
<td></td>
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<tr>
<td>P2.10.41</td>
<td>SW B13 ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1909</td>
<td></td>
</tr>
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</table>

Note: Options 8-9 visible only with correct HW and SW.
<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
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<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.10.42</td>
<td>SW B14 ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1910</td>
<td></td>
</tr>
<tr>
<td>P2.10.43</td>
<td>uCW B12</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1934</td>
<td></td>
</tr>
<tr>
<td>P2.10.44</td>
<td>uCW B13</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1935</td>
<td></td>
</tr>
<tr>
<td>P2.10.45</td>
<td>uCW B14</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1936</td>
<td></td>
</tr>
<tr>
<td>P2.10.46</td>
<td>uCW B15</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1937</td>
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</table>
### 4.10 Micro Grid

**Table 4.**

<table>
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<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default ID</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.11.1</td>
<td>Control Mode</td>
<td>0</td>
<td>6</td>
<td>0 / AFE</td>
<td>1531</td>
<td>0</td>
<td>1 = Island 2 = Micro Grid 3 = Island-AFE 4 = Island-Micro Grid 5 = Island-Micro Grid (Reserved) 6 = FreeSelect</td>
</tr>
<tr>
<td>P2.11.2</td>
<td>Frequency Droop</td>
<td>0</td>
<td>32</td>
<td>Hz</td>
<td>1</td>
<td>1534</td>
<td>Reactive current drooping in percentage of P2.1.</td>
</tr>
<tr>
<td>P2.11.3</td>
<td>Voltage Droop</td>
<td>0</td>
<td>320</td>
<td>%</td>
<td>10</td>
<td>1535</td>
<td></td>
</tr>
<tr>
<td>P2.11.4</td>
<td>Start Power Mode</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1503</td>
<td>0 = Zero power D7 1 = Zero Power F/O 2 = Drooping 3 = Isochron.Gen</td>
</tr>
<tr>
<td>P2.11.5</td>
<td>Voltage Rise Time</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>100</td>
<td>1541</td>
<td></td>
</tr>
<tr>
<td>P2.11.6</td>
<td>Generator Mechanical Time Constant</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>0</td>
<td>1722</td>
<td>0 = Not used 1 &gt;= Active Use 1000 ms as a starting point.</td>
</tr>
<tr>
<td>P2.11.7</td>
<td>Generator Speed Control Kp</td>
<td>0,0</td>
<td>3200,0</td>
<td>%/Hz</td>
<td>40,0</td>
<td>1723</td>
<td></td>
</tr>
<tr>
<td>P2.11.8</td>
<td>Generator Speed Control Ti</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>32000</td>
<td>1724</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.11.9.1</td>
<td>AFE Mode 1</td>
<td>0</td>
<td>6</td>
<td>0 / AFE</td>
<td></td>
<td>1616</td>
<td></td>
</tr>
<tr>
<td>P2.11.9.2</td>
<td>AFE Mode 2</td>
<td>0</td>
<td>6</td>
<td>1 / Island</td>
<td></td>
<td>1617</td>
<td></td>
</tr>
<tr>
<td>P2.11.9.3</td>
<td>AFE Mode 3</td>
<td>0</td>
<td>6</td>
<td>2 / Micro Grid</td>
<td></td>
<td>1713</td>
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### 4.11 Synchronisation to external grid

**Table 5.**

<table>
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<th>Code</th>
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<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.1</td>
<td>Synch. Offset</td>
<td>-3172</td>
<td>3171</td>
<td></td>
<td>0</td>
<td>1601</td>
<td>Used to compensate for transformer angle offset. (3172 equals 180 degrees offset).</td>
</tr>
<tr>
<td>P2.12.2</td>
<td>Synch Reference</td>
<td>-3170</td>
<td>3170</td>
<td></td>
<td>0</td>
<td>1611</td>
<td>Gives synchronisation point for synch error.</td>
</tr>
<tr>
<td>P2.12.3</td>
<td>Synch Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>500</td>
<td>1612</td>
<td></td>
</tr>
<tr>
<td>P2.12.4</td>
<td>Synch Ti</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1613</td>
<td></td>
</tr>
<tr>
<td>P2.12.5</td>
<td>Synch. Hysteresis</td>
<td>-3170</td>
<td>3170</td>
<td></td>
<td>50</td>
<td>1614</td>
<td></td>
</tr>
<tr>
<td>P2.12.6</td>
<td>Contactor Delay</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>0</td>
<td>1624</td>
<td>In case no feedback from shore contactor, this can be used to simulate feedback signal.</td>
</tr>
<tr>
<td>P2.12.7</td>
<td>Synch Stop Mode</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0 / Stay Run</td>
<td>1618</td>
<td>When stop is selected, drive will go to stop mode when feedback from shore contactor.</td>
</tr>
</tbody>
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### 4.12 Reserved

**Table 6.**

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<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
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<th>Unit</th>
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<th>Description</th>
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<td>P2.13.3</td>
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<td>P2.13.4</td>
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</table>
## 4.13 ID Control Functions

### 4.13.1 Value control

**Table 7. Power reference input signal selection, G2.2.8**

<table>
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<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>P2.14.1.1</td>
<td>Control Input Signal ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td>1580</td>
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<tr>
<td>P2.14.1.2</td>
<td>Control Input Off Limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1581</td>
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<td></td>
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<td>P2.14.1.3</td>
<td>Control Input On Limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1582</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.14.1.4</td>
<td>Control Output Off Value</td>
<td>-32000</td>
<td>32000</td>
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<td>0</td>
<td>1583</td>
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<td></td>
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<td>P2.14.1.5</td>
<td>Control Output On Value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1584</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.14.1.6</td>
<td>Control Output Signal ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td>1585</td>
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<td>P2.14.1.7</td>
<td>Control Mode</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>1586</td>
<td></td>
<td>0 = 5R ABS</td>
</tr>
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<td></td>
<td></td>
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<td>1 = Scale ABS</td>
</tr>
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<td>2 = Scale INV ABS</td>
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<td>3 = 5R</td>
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<td></td>
<td>4 = Scale INV</td>
</tr>
<tr>
<td>P2.14.1.8</td>
<td>Control Output Filtering time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td>1721</td>
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</tr>
</tbody>
</table>

### 4.13.2 DIN ID control 1

**Table 8. DIN ID control parameters, G2.2.8**

<table>
<thead>
<tr>
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<th>Parameter</th>
<th>Min</th>
<th>Max</th>
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<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1570</td>
<td></td>
<td>Slot Board input No. If 0.1 ID61 can be controlled from FB</td>
</tr>
<tr>
<td>P2.14.2.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td>1571</td>
<td></td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.2.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1572</td>
<td></td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.2.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1573</td>
<td></td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>

### 4.13.3 DIN ID control 2

**Table 9. DIN ID control parameters, G2.2.8**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.3.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1590</td>
<td></td>
<td>Slot Board input No. If 0.1 ID61 can be controlled from FB</td>
</tr>
<tr>
<td>P2.14.3.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td>1575</td>
<td></td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.3.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1592</td>
<td></td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.3.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1593</td>
<td></td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>
4.13.4 DIN ID control 3

Table 10. DIN ID control parameters, G2.2.8

<table>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.4.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1578</td>
<td>Slot Board input No. If 0.1 ID61 can be controlled from FB</td>
</tr>
<tr>
<td>P2.14.4.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1579</td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.4.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1594</td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.4.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1596</td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>

4.13.5 DIN ID control 4

Table 11. DIN ID control parameters, G2.2.8

<table>
<thead>
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<th>Code</th>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.5.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1930</td>
<td>Slot Board input No. If 0.1 ID61 can be controlled from FB</td>
</tr>
<tr>
<td>P2.14.5.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1931</td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.5.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1932</td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.5.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1933</td>
<td>Value when DI is high</td>
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</table>

4.13.6 ID controlled digital output 1

Table 12.

<table>
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<th>Code</th>
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<th>Max</th>
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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.6.1</td>
<td>ID.Bit Free DO</td>
<td>0.00</td>
<td>2000.15</td>
<td>ID.Bit</td>
<td>0.00</td>
<td></td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>P2.14.6.2</td>
<td>Free DO Sel</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1326</td>
<td></td>
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</table>

4.13.7 ID controlled digital output 2

Table 13.

<table>
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<th>Code</th>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.6.1</td>
<td>ID.Bit Free DO</td>
<td>0.00</td>
<td>2000.15</td>
<td>ID.Bit</td>
<td>0.00</td>
<td></td>
<td>1386</td>
<td></td>
</tr>
<tr>
<td>P2.14.6.2</td>
<td>Free DO Sel</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1325</td>
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</tbody>
</table>

4.14 Auto reset

Table 14.

<table>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.15.1</td>
<td>Wait Time</td>
<td>0.00</td>
<td>60.00</td>
<td>s</td>
<td>5.00</td>
<td>717</td>
<td></td>
</tr>
<tr>
<td>P2.15.2</td>
<td>Trial Time</td>
<td>0.00</td>
<td>120.00</td>
<td>s</td>
<td>30.00</td>
<td>718</td>
<td></td>
</tr>
<tr>
<td>P2.15.3</td>
<td>Over voltage tries</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>721</td>
<td></td>
</tr>
<tr>
<td>P2.15.4</td>
<td>Over current tries</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>722</td>
<td></td>
</tr>
<tr>
<td>P2.15.6</td>
<td>External fault tries</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>725</td>
<td></td>
</tr>
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</table>
## 4.15 Grid voltage PI

Table 15: Grid voltage PI function

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.16.1</td>
<td>PID Activation</td>
<td>0.1</td>
<td>E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td></td>
<td>1807</td>
<td>Digital input to activate PI controller</td>
</tr>
<tr>
<td>P2.16.2</td>
<td>PI controller gain</td>
<td>0.0</td>
<td>1000.0</td>
<td>%</td>
<td>200.0</td>
<td>118</td>
<td></td>
<td>PI controller gain</td>
</tr>
<tr>
<td>P2.16.3</td>
<td>PI controller I-time</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.05</td>
<td>119</td>
<td></td>
<td>PI controller I-time</td>
</tr>
<tr>
<td>P2.16.4</td>
<td>PI Max Adjust</td>
<td>-32000</td>
<td>32000</td>
<td>%</td>
<td>5.00</td>
<td>360</td>
<td></td>
<td>PI High limit</td>
</tr>
<tr>
<td>P2.16.5.1</td>
<td>PI Frequency Low Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>95.00</td>
<td>1630</td>
<td></td>
<td>PI High limit</td>
</tr>
<tr>
<td>P2.16.5.2</td>
<td>PI Frequency High Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>102.00</td>
<td>1631</td>
<td></td>
<td>PI High limit</td>
</tr>
<tr>
<td>P2.16.5.3</td>
<td>PI Voltage Low Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>1632</td>
<td></td>
<td>PI High limit</td>
</tr>
<tr>
<td>P2.16.5.4</td>
<td>PI Voltage High Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>110.00</td>
<td>1633</td>
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<td>PI High limit</td>
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</table>

## 4.16 Grid Code Parameters

<table>
<thead>
<tr>
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<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.1</td>
<td>GGC License</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>3201</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.2</td>
<td>Set Grid Code</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>3401</td>
<td></td>
<td>1 = Factory Defaults</td>
</tr>
<tr>
<td>P2.17.3</td>
<td>EnableGridCode</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>3254</td>
<td></td>
<td>0 = Disabled; 1 = Enabled; No Trip. 2 = Enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 = uGrid Simulation</td>
</tr>
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</table>

### 4.16.1 Anti-islanding

<table>
<thead>
<tr>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.4.1</td>
<td>Anti-islanding</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0/Disabled</td>
<td>3250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.4.2</td>
<td>High Volt AI</td>
<td>0</td>
<td>320</td>
<td>%</td>
<td>0</td>
<td>3404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.4.3</td>
<td>Low Volt AI</td>
<td>0</td>
<td>320</td>
<td>%</td>
<td>0</td>
<td>3405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.4.4</td>
<td>High Freq AI</td>
<td>0</td>
<td>320</td>
<td>%</td>
<td>105</td>
<td>3406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.4.5</td>
<td>Low Freq AI</td>
<td>0</td>
<td>320</td>
<td>%</td>
<td>95</td>
<td>3407</td>
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<td></td>
</tr>
<tr>
<td>P2.17.4.6</td>
<td>AI Trip Decay</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>50</td>
<td>3408</td>
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<td></td>
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</table>

### 4.16.2 FRT

<table>
<thead>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.5.1</td>
<td>FRT Function</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0/No</td>
<td>3251</td>
<td></td>
<td>0 = Disabled; Both 1 = Enabled; Limits 2 = Enabled; Curve 3 = Enabled; Neither 4 = Enabled; Both</td>
</tr>
<tr>
<td>P2.17.5.2</td>
<td>ReactivInjection</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0/Tri:N, Bi:N</td>
<td>3252</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.5.3</td>
<td>Symmetrical Reactive</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0/No</td>
<td>3323</td>
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</table>

### 4.16.3 Reconnection

<table>
<thead>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.6.1</td>
<td>ReConnectTime</td>
<td>1,1</td>
<td>1000</td>
<td>s</td>
<td>2</td>
<td>3253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.6.2</td>
<td>ReConnTimeStop</td>
<td>1,1</td>
<td>1000</td>
<td>s</td>
<td>2</td>
<td>3255</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.6.3</td>
<td>ReConRampUpRate</td>
<td>-1</td>
<td>320</td>
<td>%/s</td>
<td>20</td>
<td>3297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.6.4</td>
<td>RampReleaseDelay</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>600</td>
<td>3421</td>
<td></td>
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</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.16.4 Line Voltage

<table>
<thead>
<tr>
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<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.7.1</td>
<td>Voltage Monitor</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>3364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.2</td>
<td>LV High 1</td>
<td>0</td>
<td>200</td>
<td>%</td>
<td>115</td>
<td>3256</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.3</td>
<td>LV High 1 Delay</td>
<td>0</td>
<td>60000</td>
<td>ms</td>
<td>0</td>
<td>3257</td>
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<td></td>
</tr>
<tr>
<td>P2.17.7.4</td>
<td>LV High 1 PLim</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300</td>
<td>3412</td>
<td></td>
<td></td>
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<tr>
<td>P2.17.7.5</td>
<td>LV High 2</td>
<td>0</td>
<td>200</td>
<td>%</td>
<td>0</td>
<td>3258</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.6</td>
<td>LV High 2 Delay</td>
<td>0</td>
<td>120000</td>
<td>ms</td>
<td>0</td>
<td>3259</td>
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<tr>
<td>P2.17.7.7</td>
<td>LV High 2 PLim</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300</td>
<td>3413</td>
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<td></td>
</tr>
<tr>
<td>P2.17.7.8</td>
<td>LV High 3</td>
<td>0</td>
<td>200</td>
<td>%</td>
<td>0</td>
<td>3361</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.9</td>
<td>LV High 3 Delay</td>
<td>0</td>
<td>120000</td>
<td>ms</td>
<td>0</td>
<td>3362</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.10</td>
<td>LV High 3 PLim</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300.0</td>
<td>3363</td>
<td></td>
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</tr>
<tr>
<td>P2.17.7.11</td>
<td>LV Low 1</td>
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<td>200</td>
<td>%</td>
<td>0</td>
<td>3260</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.12</td>
<td>LV Low 1 Delay</td>
<td>0</td>
<td>120000</td>
<td>ms</td>
<td>0</td>
<td>3261</td>
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<td>P2.17.7.13</td>
<td>LV Low 1 PLim</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300</td>
<td>3414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.17.7.14</td>
<td>LV Low 2</td>
<td>0</td>
<td>200</td>
<td>%</td>
<td>80</td>
<td>3262</td>
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<td></td>
</tr>
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<td>P2.17.7.15</td>
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<td>120000</td>
<td>ms</td>
<td>0</td>
<td>3263</td>
<td></td>
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</tr>
<tr>
<td>P2.17.7.16</td>
<td>LV Low 2 PLim</td>
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#### 4.16.8.1 Linear UV

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#### 4.16.8.3 Power Lock UV

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<tr>
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<td>OVReacRefLowCor</td>
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<td>%</td>
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<td>P2.17.11.6.8</td>
<td>OV LockOutVoltag</td>
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Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.16.8.5  Q(U) Power

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### 4.16.8.6  Q(U) Curve

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<td>300</td>
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<td>%</td>
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<td>%</td>
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### 4.16.9  Power Limit/Reference

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<td>Power RampUp Rate</td>
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<td>320,00</td>
<td>%/s</td>
<td>50,00</td>
<td>3324</td>
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<td>Negative value means no limitation in power increase.</td>
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### 4.16.9.1  High Frequency

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<td>1</td>
<td>%</td>
<td>0</td>
<td>3307</td>
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<td>0 =High Limit 1 =Minimum</td>
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<tr>
<td>P2.17.12.2.2</td>
<td>HighFreqLowCorr</td>
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<td>200</td>
<td>%</td>
<td>0,00</td>
<td>3295</td>
<td></td>
<td></td>
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<tr>
<td>P2.17.12.2.3</td>
<td>HighFreqPLimSlop</td>
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<td>300</td>
<td>%/Hz</td>
<td>50,0</td>
<td>3239</td>
<td></td>
<td>End corner mode activated by setting this to zero -&gt; - P2.17.12.1.7 - P2.17.12.1.8</td>
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<td>P2.17.12.2.4</td>
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<td>%</td>
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<td>100000</td>
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<td>50</td>
<td>3299</td>
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<tr>
<td>P2.17.12.2.7</td>
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<td>100000</td>
<td>ms</td>
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<td>P2.17.12.2.8</td>
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<td>ms</td>
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<td>%</td>
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### 4.16.9.2 High Voltage

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<th>Description</th>
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<td></td>
<td></td>
<td>1 = Minimum</td>
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<td>P2.17.12.3.2</td>
<td>Log In Voltage</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>0</td>
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### 4.16.9.3 Low Voltage Charge Limit

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### 4.16.9.4 Low Frequency Charge Limit

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### 4.16.9.5 Low Frequency Power Increase

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### 4.16.10 Cos PhiII Control

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<td>1 = Volt Log In Log Out</td>
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### 4.16.10.1 Voltage Log In Log Out

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### 4.16.10.2 Active Current

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<th>ID</th>
<th>Description</th>
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<td>Min Cos Ref Min Power</td>
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<td>%</td>
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### 4.16.11 External Input

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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.14.1</td>
<td>Ext GC Trip NO</td>
<td>0</td>
<td>E.10</td>
<td>DI</td>
<td>0.1</td>
<td></td>
<td>3310</td>
<td></td>
</tr>
<tr>
<td>P2.17.14.2</td>
<td>Ext GC Trip NC</td>
<td>0</td>
<td>E.10</td>
<td>DI</td>
<td>0.2</td>
<td></td>
<td>3308</td>
<td></td>
</tr>
<tr>
<td>P2.17.14.3</td>
<td>SeparateFLimMon</td>
<td>0</td>
<td>E.10</td>
<td>DI</td>
<td>0.1</td>
<td></td>
<td>3311</td>
<td></td>
</tr>
<tr>
<td>P2.17.14.4</td>
<td>SepFreqHighLim</td>
<td>0</td>
<td>150</td>
<td>%</td>
<td>0</td>
<td></td>
<td>3312</td>
<td></td>
</tr>
<tr>
<td>P2.17.14.4</td>
<td>SepFreqLowLim</td>
<td>0</td>
<td>150</td>
<td>%</td>
<td>0</td>
<td></td>
<td>3313</td>
<td></td>
</tr>
</tbody>
</table>

### 4.16.12 Options

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.15.1</td>
<td>GC Options 1</td>
<td>0</td>
<td>65535</td>
<td>m</td>
<td>0</td>
<td></td>
<td>3328</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.2</td>
<td>Voltage Filt. TC</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>20</td>
<td></td>
<td>3332</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.3</td>
<td>Frequency Filt. TC</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>35</td>
<td></td>
<td>3333</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.4</td>
<td>FRT Options</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td></td>
<td>3400</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.5</td>
<td>Vac Stop Offset</td>
<td>-10,000</td>
<td>10,000</td>
<td>%</td>
<td>0,00</td>
<td></td>
<td>3337</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.6</td>
<td>Vac Run Offset</td>
<td>-10,000</td>
<td>10,000</td>
<td>%</td>
<td>0,00</td>
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<td>3338</td>
<td></td>
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<tr>
<td>P2.17.15.7</td>
<td>Power Follower Hysteresis</td>
<td>0,0</td>
<td>100,000</td>
<td>%</td>
<td>3,0</td>
<td></td>
<td>1529</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.8</td>
<td>Line Voltage High Filter TC</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>500</td>
<td></td>
<td>3373</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.9</td>
<td>LineFreqLow TC</td>
<td>0</td>
<td>100</td>
<td>ms</td>
<td>16</td>
<td></td>
<td>3375</td>
<td></td>
</tr>
<tr>
<td>P2.17.15.10</td>
<td>FRT Trig Level</td>
<td>0,000</td>
<td>320,000</td>
<td>%</td>
<td>0,00</td>
<td></td>
<td>3382</td>
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<td>P2.17.15.11</td>
<td>Current x TC</td>
<td>0</td>
<td>10000</td>
<td>ms</td>
<td>16</td>
<td></td>
<td>3409</td>
<td></td>
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<tr>
<td>P2.17.15.12</td>
<td>LV Feedback Kp</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>0,00</td>
<td></td>
<td>3420</td>
<td></td>
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<tr>
<td>P2.17.15.13</td>
<td>Current Priority Sel</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td></td>
<td>3422</td>
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</tr>
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4.17 Keypad control (Control panel: menu M3)

Table 16. Keypad control parameters M3

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Default</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3.1</td>
<td>Control Place</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1403</td>
<td>0 = PC Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = I/O terminal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 = Keypad (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 = Fieldbus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 = SystemBus</td>
</tr>
<tr>
<td>P3.2</td>
<td>Licence Key</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td>1995</td>
<td></td>
</tr>
</tbody>
</table>

4.18 System menu (Control panel: menu M6)

For the parameters and functions related to the general use of the AC drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the Vacon NX User Manual.

4.19 Expander boards (Control panel: menu M7)

The M7 menu shows the expander and option boards attached to the control board, and the board-related information. For more information, see the Vacon NX User Manual and the Vacon I/O option board manual.
5. Description of parameters

5.1 Basic parameters

2.1.1 Grid Nominal Voltage $V$  \textit{ID110}

This parameter sets the incoming line voltage for the regenerative drive. Set this parameter to the nominal line voltage at the installation site. Used also as a reference point for grid voltage protection functions. Use G2.2.8 Voltage Correction for static voltage correction.

When transformer parameters are given, this parameter will be voltage reference of grid when operating in Island and uGrid modes. When transformer rating is different than 1:1 System Rated DC parameter must be given so that AFE operation will work correctly and MCB is closed at correct voltage level.

2.1.2 Grid Nominal Frequency $Hz$  \textit{ID1532}

Micro Grid and Island mode frequency set point. In Micro Grid mode used as a reference point for the Base Current reference and drooping. In AFE mode used as a reference point for frequency protection functions. Use G2.11 FreqDroopOffset for static frequency adjustment.

![Diagram showing frequency change related to load](attachment:figure_9.png)

*Figure 9.*
2.1.3 System Rated Current  A  ID113
The rated current capacity of the supply or the transformer May need to be set if AFE is oversized compared to LCL or feeding transformer capacity or feeding supply. It’s not recommended to increase this reference current value from I_{ref} current.

The active current and the reactive current are scaled to this parameter as is the current cutter level.

For testing purposes (FAT) feeding transformer should not be less than 20% of the unit nominal current or following breakers or fuses.

2.1.4 System Rated Cos Phi  ID120
Enter the system rated Cos Phi.

2.1.5 System Rated kVA  ID213
Enter the system rated kVA.

2.1.6 System Rated kW  kW  ID116
Set the the rated active power of the system.

2.1.7 Nominal DC  ID1805
This value is used as a reference point for DC Voltage reference instead of Grid Nominal Voltage.

Recommended to set to highest DC Source voltage of the system.

Based on:
Grid voltage: Grid Nominal Voltage * 1.35
Generator Voltage: Motor/Generator nominal voltage * 1.35
DC-DC Converter: Maximum battery DC voltage.

2.1.8 Parallel AFE  ID1501
Set this to 1 if more than one unit is connected to same DC bus.

0 = Single AFE
1 = Parallel AFE

When you select parallel AFE, DC drooping is set to 3.00% and modulation is synchronised to reduce circulating current if the drives are in a common DC bus.
5.1.1 Transformer parameters

These parameters are used to scale voltage so that the parameter P2.1.1 Grid Nominal Voltage can be given a value as actual grid voltage. The drive will calculate the actual drive terminal voltage based on these values.

NOTE: When ration is different than 1:1 also P2.1.7 System Nominal DC parameter must be given so that MCB is closed at correct voltage level and AFE mode DC Voltage reference will give correct DC-Link Voltage.

2.1.9 Transformer GC Side Voltage ID1850

Set the transformer nominal voltage on Grid Converter side (U4).

2.1.10 Transformer Grid Side Voltage ID1851

Set the transformer nominal voltage on Grid side (U5).

2.1.11 Transformer Phase Shift ID1852

Set the transformer phase shift. Difference in angle, between U3 and U5. When OPT-D7 measurement is connected to U5 (i.e. to ship grid). This information is used if OPT-D7 assisted AFE start synchronization is activated. Usually Dyn11 transformer has 30.0 degree phase shift.

NOTE: Synchronization to external grid will use different set of parameters for phase shifts.

![Diagram of transformer parameters](image)

Figure 10.

P2.1.12 Identification ID631

Identification function will calibrate current measurement.

0 = No Action
1 = Current measurement offset

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.2 Reference handling

2.2.1 DC Voltage Reference  ID1462
This parameter sets the DC Voltage reference in % of the Nominal DC voltage.
If P2.1.5 System Nominal DC is zero then
Nominal DC voltage = 1.35 * Grid Nom. Voltage (P2.1.1).
Final DC Voltage Ref (V1.1.2) = Nominal DC Voltage * DC Voltage Reference
The DC Voltage will be maintained at this level when the regenerative unit is running.
There is internal limitation to reference: For 500V units the maximum limit is 797 Vdc and for 690V units the maximum limit 1099 Vdc.
The maximum limit can be monitored from V1.1.15 DC Ref Max Lim.

NOTE! If DC voltage exceeds the values below in STOP state, the drive will lose READY state:
- 797 Vdc for 500V unit, trip limit 911 Vdc
- 1099 Vdc for 690V unit, immediate trip limit 1200 Vdc, U2t protection above 1100 Vdc.
- 1136 Vdc for LC 690V voltage class 8 (Order code example: NXA15008_ _ _ _ _W)

NOTE! When transformer ratio is different than 1:1 also P2.1.7 System Nominal DC parameter must be given so that MCB is closed at correct voltage level and AFE mode DC Voltage reference is giving correct DC-Link Voltage.

By default the internal DC voltage reference is kept the same as the actual DC voltage when the drive is in STOP state, or the operation mode is Island or Micro Grid. This is to make the change to the AFE mode smoother when the change is done on the fly.

2.2.2 Reactive Current Reference  ID1459
This parameter sets the reference for the reactive current in % of the nominal current.
This can be used for power factor correction of AFE system or reactive power compensation. Positive value gives inductive compensation whereas negative value gives capacitive compensation.
In uGrid mode 100.0 % reactive reference will decrease voltage by set voltage drooping value.

NOTE: Reactive Current reference does not affect voltage in island mode operation.
5.2.1 DC Reference Tuning

2.2.3.1 DC Drooping ID620

When AFEs are used in parallel in independent mode, drooping can be used for current balancing. The DCV voltage reference drooping is set as % of the active current reference.

For example, if drooping is 3.00% and active current is 50%, the DC voltage reference is reduced by 1.5%. With drooping, paralleled units can be balanced by adjusting the DCVoltReference to slightly different values.

![Figure 11](image)

2.2.3.2 DC Voltage Ramp Rate ID1199

This parameter defines the ramp rate for the DC voltage reference change. The rate is defined as %/s.

By default the internal DC voltage reference is kept the same as the actual DC voltage when the drive is in STOP state, or the operation mode is Island or Micro Grid. This is to make the change to the AFE mode smoother when the change is done on the fly.

![Figure 12](image)
2.2.3.3 **DC Voltage Reference Filter ID1760**

By default the internal DC voltage reference is kept the same as the actual DC voltage when the drive is in STOP state, or the operation mode is Island or Micro Grid. This is to make the change to the AFE mode smoother when the change is done on the fly. This will prevent over current and current spikes when the control mode is changed.

![Graph of unfiltered and filtered DC voltage references](figure13.png)

**Figure 13.**

2.2.3.4 **DC Reference Offset**

Offset for DC Reference, used to balance parallel unit active current while using same DC Reference P2.2.1. in all units.

5.2.2 **Power /frequency reference**

2.2.4.1 **Frequency Drooping Offset**

This parameter is used to adjust the base frequency for drooping purposes. For example, if drooping is set to 2 Hz this parameters can be set to 1 Hz so that when the load is 50%, the frequency will be at the nominal point. The offset can also be set by the supply frequency parameters. However, in that case the grid frequency protection function will also use this increased value as a reference point and makes the protection function activate at the wrong frequency.

When you use this parameter for drooping purposes, the supply frequency can be left to the nominal value.

Final frequency reference is also limited by G2.9.7 frequency warning limits.

2.2.4.2 **Frequency Down (DigIn) ID417**

Select a digital input to decrease the base frequency with a set ramp rate.

See also ID1700 FB Micro Grid CW1 Bit 4 Power Down
2.2.4.3  **Frequency Up (DigIn)  ID418**

Select a digital input to increase the base frequency with a set ramp rate. Frequency change is also limited by G2.3 Ramp Time and Ramp Range.

See also ID1700 FB Micro Grid CW1 Bit 5 Power Up

2.2.4.6  **Base Current Reference  ID1533**

The Base Current Reference determines offset for frequency reference within Frequency Drooping. For example, if frequency drooping is set to 2.000 Hz and grid frequency is constant 50 Hz with very small or nonexistent changes (isochronous or strong grid), and if 100% of Base Current Reference is given, the drive will feed 100% power to the grid. The situation is the same with the frequency reference set to 52 Hz and with 2.000 Hz drooping.

Base current reference can be used together with selection 3 of P2.11.5 StartPowerMode: Isochron.Gen. This selection will keep the drive frequency reference same as the grid frequency, and the power that is fed or taken from the drive is solely defined by the Base Current Reference parameter.

![Figure 14.](image-url)
2.2.4.7 *Base Reference Ramp Rate*  
*ID1536*

This parameter defines the increase rate of the base current reference when the reference is changed, or the drive is started. This is used in uGrid mode. AFE used Power PI Controller.

![Diagram of current reference ramp rate](image)

*Figure 15.*

2.2.4.8 *Base Reference to Zero*  
*ID1537*

This parameter defines in which situations Base Current Reference is set to the value of P2.2.6.8 BaseRefAtStop.

- **0** = No action.
- **1** = Reference set to P2.2.6.4 when at STOP state.
- **2** = Reference set to P2.2.6.4 when AFE mode is active.
- **3** = Reference set to P2.2.6.4 when AFE mode is active or drive in STOP state.

2.2.4.9 *Base Reference at Stop State*  
*ID1538*

Base reference on situation selected by P2.2.6.7 Base Reference to Zero. Reference is ramped after start command to P2.2.6.5. This parameter defines power level that is injected to grid right after synchronisation.

**NOTE!** The actual power will be determined by the set supply frequency, drooping and the start power mode.

2.2.4.10 *Frequency; MotPot Reset*  
*ID 367*

Select reset function for motor potentiometer function,

- **0** = No action.
- **1** = MotPot adjustment is reset at stop state.
- **2** = MotPot adjustment is reset when AFE mode is active.
- **3** = MotPot adjustment is reset when AFE mode or in stop state.
2.2.4.11 Reference Mode ID1914

Select if Power PI Reference is direct Iq current reference or if the reference is voltage compensated between 80%...135% of Un.

0 = Pure Iq Reference
1 = Voltage Compensated (Power Ref)
5.2.3 **PID Power Controller**

This function is meant to control drive power when operating in AFE mode. P2.2.4.6 Base Current Reference is used as reference input and V1.1.5 Active Current is used as actual value. PID Controller is forced to zero when DI: PID Power Activation is low or drive is in stop state or drive is not operating in AFE mode. PID Controller will adjust power flow by giving offset to given DC Voltage Reference. It’s recommended to use some drooping to make controller smoother.

2.2.4.12.1 **PID Power Activation  ID1905**

Select digital input to activate PID Power control function. This signal can be controlled from fieldbus with FB Control Word by assailing e.g. P2.5.1.20 to ID1905.

2.2.4.12.2 **PID Kp  ID1911**

Gain for PID controller.

2.2.4.12.3 **PID Ti  ID1906**

Integration time for PID controller.

2.2.4.12.4 **PID DC Low  ID1903**

This parameter defined how low PID controller can adjust DC Voltage Reference from P2.2.1 DC Voltage Ref.

2.2.4.12.5 **PID DC High  ID1904**

This parameter defined how high PID controller can adjust DC Voltage Reference from P2.2.1 DC Voltage Ref.
2.2.4.12.6 Reference Down Rate  \( \%/s \)  ID1810
Power reference ramp rate when increasing the reference. Setting negative value will bypass reference ramping.

2.2.4.12.7 Reference Up Rate  \( \%/s \)  ID1811
Power reference ramp rate when decreasing the reference. Setting negative value will bypass reference ramping.

2.2.4.12.8 PI Limit Hysteresis to Reference  ID1842  “PI LimHystToRef”
When PI controller is operational this parameter defines how far a way final power limits are kept from used reference value.

2.2.4.12.9 PI Reference Hysteresis to Limit  ID1844 “PI RefHystToLim”
When PI controller is operational this parameter defines how much less is the PI reference compared to used final power limits.

2.2.4.12.10 Zero Error Limit  ID1843
When PI Error is below this value regulation is stopped with delay (5\( \times \) Ti).

2.2.4.12.11 PI Start Delay  ID1845
This parameter defines delay after the Run state when PI-controller is started.

5.2.4 Reference adjust functions

2.2.5.1 Reactive Adjust Rate  ID1557
Defines the rate that is used to change the reactive current reference when Up and Down inputs are used.

2.2.5.2 Reactive Ref Up (DigIn)  ID1553
Select a digital input to increase the reactive reference with a set ramp rate.

2.2.5.3 Reactive Ref Down (DigIn)  ID1554
Select a digital input to increase the reactive reference with a set ramp rate.

2.2.5.4 Maximum Reactive Adjust  ID1559
Maximum reference change that Reactive MotPot function can make to main reference.
5.2.5 **AC Voltage Reference**

**P2.2.6.1 Voltage at field weakening point**  ID603

Above the field weakening point, the output voltage remains at the set value. Below the field weakening point, the output voltage depends on the setting of the U/f curve parameters.

**P2.2.6.2 Field weakening point**  ID602

The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage. Set this to level where generator’s AVR starts to decrease voltage as a function of generator speed.

**P2.2.6.3 Voltage Correction**  ID1790

This parameter is used to compensate the zero load voltage drop in grid side when running in Micro Grid or island mode. The supply voltage parameter can also be used for this purpose, but Grid Voltage D7 protection uses this increased value for reference too. When using this parameter for compensation, the supply voltage can be left to nominal value.

**NOTE!** Some cases when inductor size and losses are compensated, the zero load voltage may need to decrease.
P2.2.6.4 **Capacitor Size [\%]** *(ID1460)*

**AFE:** This parameter defines the reactive current going to the LCL filter capacitor. It compensates the LCL effect to the reactive current by adjusting the reactive current reference internally. The inductor size is also added to compensation. If set correctly, the power factor on the grid side will be 1.

**Island and Micro Grid:** Not used.

P2.2.6.5 **Inductor Size [\%]** *(ID1461)*

**AFE:**
This parameter defines voltage losses in percentage of the nominal voltage at 100% active current. This value is internally added to the reactive current reference thus giving power factor 1 on the grid side, if set correctly together with Capacitor Size. The transformer and feeding cables can be compensated by increasing this value.

**Island and Micro Grid:**
This parameter defines the voltage increase in percentage of the nominal voltage at 100% reactive current.

- Supply Voltage: 400 Vac
- Inductor Size: 15.0 %
- Inductor losses: 15.0 %
- Reactive Current: 30.0 %
- Active Current: 50.0 %

\[ 400 \text{ Vac} \times 30.0 \% \times 15.0 \% = 18 \text{ Vac} \]

Voltage drooping will decrease the final voltage if it is used.

P2.2.6.6 **Inductor Losses [\%]** *(ID1465)*

**AFE:** Not used.

**Island and Micro Grid:** This parameter defined voltage increase in percentage from Inductor size at nominal voltage at 100% active current.

- Supply Voltage: 400 Vac
- Inductor Size: 15.0 %
- Inductor losses: 15.0 %
- Reactive Current: 30.0 %
- Active Current: 50.0 %

\[ 400 \text{ Vac} \times 50.0 \% \times 15.0 \% = 4.5 \text{ Vac} \]

Voltage drooping will decrease the final voltage if it is used.

Together with inductor size and inductor losses voltage will be increased

\[ 18 \text{ Vac} + 4.5 \text{ Vac} = 22.5 \text{ Vac} \] from Supply Voltage parameter - > 422.5 Vac.
2.2.6.7 **Voltage Down (DigIn) ID1551**
Select a digital input to decrease the supply voltage with a set ramp rate.

2.2.6.8 **Voltage Up (DigIn) ID1550**
Select a digital input to increase the supply voltage with a set ramp rate.

2.2.6.9 **Voltage Adjust Rate ID1555**
Defines the rate that is used to change the base voltage when Up and Down inputs are used.

2.2.6.10 **Voltage Maximum Adjust ID1639**
The maximum adjustment to the voltage when controlling reactive power.

2.2.4.11 **Voltage; MotPot Reset ID 1640**
Select reset function for motor potentiometer function,
0 = No action.
1 = MotPot adjustment is reset at stop state.

2.2.6.12 **Start Voltage Mode ID1641**
This parameter select how internal voltage reference is used in Micro Grid mode.
Change that this function can do to Field Weakening Point voltage is limited by ID1880 and ID1881, Supply Voltage warning limits.

0 = **Start Zero Reactive Power OPT-D7**
The option board D7 is used to monitor the grid voltage and uses this as a starting point for reactive power drooping control.

1 = **Drooping**
The drive does not control the power to zero but goes directly to the drooping control with set parameters.

2 = **Keep Reactive Reference**
The drive will follow the line voltage exactly while reactive reference is zero, so the voltage change will not change the reactive power of the Micro Grid application. In this mode, reactive power is controlled by the reactive current reference assuming drive is not single power source for the grid.

2.2.6.13 **Reset Zero Q Delay ID1642**
This parameter defines delay when Zero Reactive Power is reset, returning internal voltage compensation back to zero. Setting this value to zero will keep function active.

2.2.6.14 **Capacitor Size 2nd ID3330**
Capacitor size can be adjusted based on voltage level. Set here the capacitor size at voltage level defined by ID2331
P2.2.6.15  **Capacitor Size 2nd Voltage ID3331**
Set here the voltage level where Capacitor Size 2nd is used ID2330
5.3 Ramp control

P2.3.1 Ramp Time ID103
This parameter defines the time required for the frequency to increase and decrease between zero frequency and P2.3.2 Ramp Range.

P2.3.2 Ramp Range ID232
This parameter defines the frequency range where the ramp time is related. Starting from zero frequency.
5.4 INPUT SIGNALS

5.4.1 Basic settings

P2.4.1.1 Start/Stop Logic Selection  ID300 Start/Stop Logic

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.

![Diagram of Start pulse/Stop pulse](image)

**Figure 16. 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"
2.4.1.2  Input Inversion  ID1091

Bit selection to invert input signal logic.

B00  = INV Open Contactor
B01  = INV Ext. Fault 1
B02  = INV Ext. Fault 2
B03  = INV MCB Close Enable
B04  = INV DC Ground Fault
5.4.2 **Digital input signals**

**2.4.2.1 Start Signal 1  ID403**
Signal selection 1 for the start/stop logic. This parameter is used to select the input for Run Request signal.

**2.4.2.2 Start Signal 2  ID404**
Signal selection 1 for the start/stop logic. This parameter is used to select the input for Stop Request signal.

**2.4.2.3 Open MCB  ID1600**
This parameter is used to select the input for the Open Contactor signal. The signal is used to force the main circuit breaker open (MCB or MCB2) and to stop the modulating.

When this input is used to stop AFE and open a main circuit breaker, the DC link must be discharged and recharged to close the main circuit breaker again and to continue modulation.

If the Force Main circuit breaker Open signal is not used the option 0.1 = FALSE must be selected.

When the control is on the keypad, pressing the Stop button more than a 2 second opens the MCB.

**2.4.2.4 MCB Feed Back  ID1453**
This parameter defines which digital input is used to the monitor circuit breaker status. The drive monitors the status and does not start if the state of the contactor does not correspond to the required status, that is, is open when it should be closed.

While feedback signal is missing drive will not go to ready state.

If the status of the main circuit breaker is not monitored, there will be a 3 s forced delay in the internally generated feedback signal.

**2.4.2.5 Fault Reset  ID414**
Contact closed: all faults are reset. Rising edge.

**2.4.2.6 Ext Fault 1  ID405**
Contact closed: the fault is displayed and the motor stopped. Fault 51. Can be inverted by the input inversion control.

**2.4.2.7 Ext Fault 2  ID406**
Contact open: the fault is displayed and the motor stopped. Fault 51. Can be inverted by the input inversion control.

**2.4.2.8 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.
5.4.2.1 Synchronization to external grid

Synchronization logic is activated when digital output P2.5.1.11 NET CB Cont. is >0.10. In this function OPT-D7 needs to be connected to external grid side and cannot be used for voltage compensation. When there are parallel unit’s synchronization needs to be done by upper system, e.g. by controlling Frequency Up and Down commands to all units (and other power sources in the same grid).

![Diagram of synchronization to external grid](image)

Figure 17.

2.4.2.9 NET Synchronisation ID 1602

This input is used to the synchronisation of the external network when the drive is already generating network but in a different phase. It can be used only when OPT-D7 board is installed and measurements are on the external network side.

When the input is activated, the drive uses line frequency as a frequency reference and adjusts the voltage angle to correspond with the line voltage angle with given hysteresis.

When there are parallel unit’s synchronization needs to be done by upper system, e.g. by controlling Frequency Up and Down commands to all units (and other power sources in the same grid).

2.4.2.10 NET Close Enabled ID 1705

An interlock for the NET contactor (shore). Used as information from Shore side is NET close is allowed.

If the interlock is not used in the system, the option 0.2=TRUE must be selected.

2.4.2.11 NET Close Request ID 1604

A command to close NET (shore) contactor. The closing will take place only when the drive is synchronised to the grid (shore).

This function is needed when the drive is already making a grid and needs to be synchronised to another grid that cannot be synchronised to the grid that the drive is making.
2.4.2.12 **NET Contactor Feedback**  
**ID 1660**
This parameter determines if the drive monitors the status of the NET contactor (shore) of the unit. The drive will switch from Island mode to Micro Grid mode if the control mode 4 / Island – Micro Grid is used.
If the status of the NET contactor is not monitored in the system, the option 0.1 = FALSE must be selected.

2.4.2.13 **Forced AFE Mode**  
**ID 1540**
Forces the drive control mode to 0 = AFE mode.

2.4.2.14 **Cooling Monitor**  
**ID 750**
OK input from the cooling unit.
If the status is not monitored in the system, the option 0.2 = TRUE must be selected.

2.4.2.15 **Use MCB 2 Control**  
**ID 1708**
This parameter is useful if 2 different supply networks are used. With this input, it is possible to select which one is used.
When the input is HIGH, MCB 1 is opened immediately.

2.4.2.16 **MCB 2 Feedback**  
**ID 1710**
This parameter determines if the drive monitors the status of the main circuit breaker (MCB 2) of the unit. If the monitoring function is used, the unit monitors the status and will not start if the state of the contactor does not correspond to the required status, that is, is open when it should be closed.
If the status of the main circuit breaker 2 is not monitored in the system, the option 0.1 = FALSE must be selected.

2.4.2.17 **AFE Mode 2**  
**ID 1711**
Forces mode to P2.11.8 (MODE2). Only active when P2.1.1 is in 6/Free select.

2.4.2.18 **AFE Mode 3**  
**ID 1712**
When both 2.4.2.17 and 2.4.2.17 are true then P2.11.9 (Mode3) is selected. When 2.4.2.17 LOW and 2.4.2.17 HIGH, the AFE mode 1 selected. Only active when P2.11.1 is in 6/Free select.

2.4.2.19 **Quick Stop**  
**ID 1213**
The drive stops the modulation immediately and opens the main circuit breaker.

2.4.2.20 **LCL Temperature**  
**ID 1179**
The digital input from the LCL temperature monitoring.
2.4.2.21 **RR Enable**

Enables the final run request command. Used for testing purposes when precharge control is started directly from the start command and when you do not want the system to go the RUN state.

5.4.2.2 **Forced control place**

The digital inputs can be used to bypass parameter P3.1 Control Place, for example, in an emergency situation when PLC is not able to send command to the drive.

**Figure 18. Control place selection priority order**

**P2.4.2.22 Control from I/O terminal**  ID409 “I/O Term Control”

Contact closed: force the control place to I/O terminal.

**P2.4.2.23 Control from Keypad**  ID410 “Keypad Control”

Contact closed: force the control place to keypad.

**P2.4.2.24 Control from Fieldbus**  ID411 “Keypad Control”

Contact closed: force the control place to fieldbus.

***NOTE!*** When the control place is forced to change, the values of Start/Stop, Direction and Reference that are valid in the control place in question are used. The value of parameter ID125 (Keypad Control Place) does not change. When the input opens, the control place is selected according to keypad control parameter P3.1 Control Place.

**P2.4.2.25 Enable CB Close ID1619 “Enable CB Close”**

This input enables CB closing when the DC voltage is at a required level. It can be used on a battery system where drive DC is charged but it is not necessary for CB to close at this point. When the input goes high and DC is at required level, CB will close immediately.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.4.2.26  Reset P/Hz MotPot Adjust  ID 1608  "Reset P/Hz MPot"
This input will reset adjustment made with Motor Potentiometer function to Power/Hz reference.

P2.4.2.27  DC Ground Fault  ID 441
Digital input to give DC Ground fault indication to the drive.
5.4.3 Analogue inputs 1-4

2.4.3.1 AI1 signal selection  ID377 “AI1 Signal Sel”
2.4.4.1 AI2 signal selection  ID388 “AI2 Signal Sel”
2.4.5.1 AI3 signal selection  ID141 “AI3 Signal Sel”
2.4.6.1 AI4 signal selection  ID152 “AI4 Signal Sel”

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

When the analogue input selection parameter is set to 0.1, you can control the analogue input monitoring variable from fieldbus by assigning a process data input ID number to the monitoring signal. This allows the scaling function on the drive side to PLC input signals.

2.4.3.2 Analogue input 1 signal filtering time ID324 “AI1 Filter Time”
2.4.4.2 Analogue input 2 signal filtering time ID329 “AI2 Filter Time”
2.4.5.2 Analogue input 3 signal filtering time ID142 “AI3 Filter Time”
2.4.6.2 Analogue input 4 signal filtering time ID153 “AI4 Filter Time”

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

2.4.3.3 AI1 custom setting minimum  ID321 “AI1 Custom Min”
2.4.3.4 AI1 custom setting maximum  ID322 “AI1 Custom Max”
2.4.4.3 AI2 custom setting minimum  ID326 “AI2 Custom Min”
2.4.4.4 AI2 custom setting maximum  ID327 “AI2 Custom Max”
2.4.5.3 AI3 custom setting minimum  ID144 “AI3 Custom Min”
2.4.5.4 AI3 custom setting maximum  ID145 “AI3 Custom Max”
2.4.6.3 AI4 custom setting minimum  ID155 “AI4 Custom Min”
2.4.6.4 AI4 custom setting maximum  ID156 “AI4 Custom Max”

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

Figure 19.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.4.3.5 AI1 signal inversion  ID387 “AI1 Signal Inv”
2.4.4.5 AI2 signal inversion  ID398 “AI2 Signal Inv”
2.4.5.5 AI3 signal inversion  ID151 “AI3 Signal Inv”
2.4.6.5 AI4 signal inversion  ID162 “AI3 Signal Inv”

The signal inversion function is useful for example in a situation where PLC sends power limit to the drive by using analogue inputs. If PLC is unable to communicate to the drive, the power limit is normally zero. When an inverted signal logic is used, a zero value from PLC means maximum power limit. This allows you to run the drive, for example, from the keypad without changing the power limit parameters.

0 = No inversion
1 = Signal inverted
5.4.3.1 Analogue input to any parameter

This function allows you to control any parameter by using an analogue input. Use a parameter to select the range of the control area and the ID number for the parameter that is controlled.

2.4.3.6 Analogue input 1, minimum value ID303 “A1 Scale Min”
2.4.3.7 Analogue input 1, maximum value ID304 “A1 Scale Max”
2.4.4.6 Analogue input 2, minimum value ID393 “A2 Scale Min”
2.4.4.7 Analogue input 2, maximum value ID394 “A2 Scale Max”
2.4.5.6 Analogue input 3, minimum value ID1037 “A3 Scale Min”
2.4.5.7 Analogue input 3, maximum value ID1038 “A3 Scale Max”
2.4.6.6 Analogue input 4, minimum value ID1039 “A4 Scale Min”
2.4.6.7 Analogue input 4, maximum value ID1040 “A4 Scale Max”

These parameters define the range for the controlled parameter. All the values are considered to be integers, so when you are controlling FWP as in the example, you also need to set numbers for the decimals. For example, FWP 100.00 must be set as 10000.

2.4.3.8 A1 Controlled ID ID1507 “A1 Control. ID”
2.4.4.8 A2 Controlled ID ID1511 “A2 Control. ID”
2.4.5.8 A3 Controlled ID ID1509 “A3 Control. ID”
2.4.6.8 A4 Controlled ID ID1510 “A4 Control. ID”

These parameters define which parameter is controlled.

Example:

You want to control Motor Field Weakening Point Voltage by an 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 field weakening point.

The analogue input 3 signal 0 V to 10 V (0 mA to 20 mA) will control the field weakening point voltage between 70.00% and 130.00%. When setting a value, decimals are handled as integers.
5.5 Output signals

5.5.1 Digital output signals

2.5.1.1 Main Circuit Breaker 1 Close Control ID1218 “MCB1 Close Cont”
AFE contactor, fixed to the relay output B.2.
When P2.5.1.2 is not activated, this output will stay high as long as MCB must be closed.
When the signal goes low, MCB must be open.
When P2.5.1.2 is activated, this gives only a closing command with a 2 s pulse.

2.5.1.2 Main Circuit Breaker 1 Open Control ID1219 “MCB1 Open Cont”
When this output is selected above 0.9, the drive will use pulse control for the MCB breaker. P2.5.1.1 is used to close the breaker with a 2 s pulse.
The opening command is given by P2.5.1.2 with a 2 s pulse.

2.5.1.3 Ready ID432
The AC drive is ready to operate.

2.5.1.4 Run ID433
The AC drive operates (the drive is modulating).

2.5.1.5 Common Fault ID434
A fault trip has occurred.

2.5.1.6 Fault, Inverted
No fault trip has occurred.

2.5.1.7 At Reference
The output frequency has reached the set reference. In AFE mode, when DC voltage level is on setpoint.

2.5.1.8 Overtemperature Warning
The heatsink temperature exceeds unit temperature warning limit.

2.5.1.9 Warning
A general warning signal. The warning will go low when the reset command is given.

2.5.1.10 Circuit Breaker 2 Close Control ID1709 “CB2 Close Cont”
A second AFE contactor control. The drive can connect to two different networks. This will control the main circuit breaker of the second network.

2.5.1.11 NET Contactor Control
The NET contactor control. Contactor control for Grid where the drive will be synchronised. This grid is usually the shore supply. When P2.4.2.12 NET Contactor feedback is received, the drive will change the operation mode to AFE mode.

2.5.1.12 D7 Synchronized
The drive is synchronised to the D7 card. Information is sent, for example, to PLC that the drive is synchronised to an external network (where D7 is connected). This output cannot be used to control the NET contactor. There is a separate output signal for that purpose.
2.5.1.13 Charge control
When this is activated, the drive will start charging of DC from the start command and go directly to RUN state. The charging starts from the start command.

2.5.1.14 Common alarm
Drive has a warning active. This indication needs to be reset separately even if the situation is over.

2.5.1.15 Ready For Start
The drive has no interlock for starting the charging and going to RUN state.

2.5.1.16 Quick Stop Active
The drive has received a quick stop command.

5.5.1 Fieldbus digital inputs connection

P2.5.1.17 Fieldbus input data 1 ID455 “FB Dig Input 1”
P2.5.1.19 Fieldbus input data 2 ID456 “FB Dig Input 2”
P2.5.1.21 Fieldbus input data 3 ID457 “FB Dig Input 3”
P2.5.1.23 Fieldbus input data 4 ID169 “FB Dig Input 4”

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.

P2.5.1.18 Fieldbus digital input 1 parameter ID891 “FB Dig 1 Par ID”
P2.5.1.20 Fieldbus digital input 2 parameter ID892 “FB Dig 2 Par ID”
P2.5.1.22 Fieldbus digital input 3 parameter ID893 “FB Dig 3 Par ID”
P2.5.1.24 Fieldbus digital input 4 parameter ID894 “FB Dig 4 Par ID”

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: DC Brake Command (ID416). You also have a fieldbus board in the drive.

Set parameter ID891 (Fieldbus Digital Input 1) to 416. Now you are able to control DC braking 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, P2.6.5.3 Brake Chopper (ID504) can be switched on and off using this function (Brake Chopper: 0 = Not Used, 1 = On, Run).
5.5.2 Delayed digital output 1 & 2

2.5.2.1 Dig.Out 1 Signal

2.5.3.1 Dig.Out 2 Signal

Connect the delayed DO1 signal to the digital output of your choice with this parameter.

2.5.2.2 DO1 Content

2.5.3.2 DO2 Content

0 = Not used
1 = Ready
2 = Run
3 = Fault
4 = Fault inverted
5 = FC overheat warning
6 = Ext. fault or warning
7 = Ref. fault or warning
8 = Warning
9 = Reverse
10 = SynchronisedToD7
11 = Start Command given
12 = FB DIN2
13 = FB DIN3
14 = ID.Bit DO, See P2.4.x.5
15 = Warning SR

2.5.2.3 DO1 ON Delay

2.5.3.3 DO2 ON Delay

2.5.2.4 DO1 OFF Delay

2.5.3.4 DO2 OFF Delay

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

![Figure 23. Digital outputs 1 and 2, on- and off-delays](image)
2.5.2.5 ID.Bit Free DO

Select the signal for controlling the DO. The parameter must be set in the 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 the bit number 02 of the warning word (ID no. 1174), that is, Motor underload is high.

5.5.3 Analogue output 1 & 2 & 3

2.5.4.1 Iout 1 signal

2.5.5.1 Iout 2 signal

2.5.6.1 Iout 3 signal

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

2.5.4.2 Iout 1 Content

2.5.5.2 Iout 2 Content

2.5.6.2 Iout 3 Content

0 = Not used
1 = DC Voltage
   Scaling: 500 Vac Unit 0-1000 Vac, 690 Vac Unit 0-1317 Vdc
2 = Drive Current
   Scaled to Nominal Current
3 = Output Voltage
   Scaled to Nominal Voltage
4 = Active Current
   Scaled to 100 %.
5 = Power
   Scaled to 100 %
6 = Reactive Current
   Scaled to 100 %
7 = Power Bidirectional
   Scaled to -200 % to 200 %
8 = AI1
9 = AI2
10 = FB Analogue Output
11 = Line Voltage
   Scaled to Nominal Voltage.
12 = FreqOut, bidirectional
13 = Control Value output

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.5.4.3 *Iout 1 Filter Time*

2.5.5.3 *Iout 2 Filter Time*

2.5.6.3 *Iout 3 Filter Time*

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.

![Diagram](image1.png)

*Figure 24.*

2.5.4.4 *Iout 1 Invert*

2.5.5.4 *Iout 2 Invert*

2.5.6.4 *Iout 3 Invert*

Inverts the analogue output signal:

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

![Diagram](image2.png)

*Figure 25.*
2.5.4.5  \( I_{out \, 1 \, \text{Minimum}} \)
2.5.5.5  \( I_{out \, 2 \, \text{Minimum}} \)
2.5.6.5  \( I_{out \, 3 \, \text{Minimum}} \)

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

![Graph showing \( I_{out \, 1 \, \text{Minimum}} \) and \( I_{out \, 2 \, \text{Minimum}} \)](image)

**Figure 26.**

2.5.4.6  \( I_{out \, 1 \, \text{Scale}} \)
2.5.5.6  \( I_{out \, 3 \, \text{Scale}} \)
2.5.6.6  \( I_{out \, 4 \, \text{Scale}} \)

A scaling factor for an analogue output.

![Graph showing \( I_{out \, 1 \, \text{Scale}} \) and \( I_{out \, 3 \, \text{Scale}} \)](image)

**Figure 27.**
2.5.4.7  \textit{iout 1 Offset}

2.5.5.7  \textit{iout 2 Offset}

2.5.6.7  \textit{iout 3 Offset}

Add –100.0 to 100.0\% to the analogue output.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{analogue_output}
\caption{Figure 28.}
\end{figure}

5.5.4  \textbf{Options}

\textbf{P2.5.7.1  \textit{Output Inversion} \hspace{1cm} ID1806}

With this parameter it is possible to select which output signals are inverted.

- B00 = +1 = Invert Common Alarm
- B01 = +2 = Invert Common Warning
- B02 = +4 = Invert delayed output 1
- B03 = +8 = Invert delayed output 2

\textbf{P2.5.7.2  \textit{Freq Scale Min AO} \hspace{1cm} ID1807}

This parameter is used to scale the analogue output function 12 / \textit{FreqOut}, bidirectional. This parameter defines the frequency where the analogue output is at the minimum. For example, when it is set to 45.00 Hz, the analogue output is 0 V, 0 mA, or 4 mA depending on signal selections.

\textbf{P2.5.7.3  \textit{Freq Scale Max AO} \hspace{1cm} ID1808}

This parameter is used to scale the analogue output function 12 / \textit{FreqOut}, bidirectional. This parameter defines the frequency where the analogue output is at the maximum. For example, when it is set to 55.00 Hz, the analogue output is 10 V or 20 mA depending on signal selections.
P2.5.7.4 DC Supervision Limit  ID1454
This parameter defines when FB Status Word B10 is high (ID68). The Bit is high when DC voltage is above the value set by this parameter.

P2.5.7.5 CB Close Mode
This parameter defines how the closing of circuit breaker is handled.

0 = DC Voltage
Normal AFE operation type circuit breaker control. The circuit breaker is closed when DC voltage is at a required level.

1 = DC Voltage or Start Command
The circuit breaker is closed when DC voltage is at the required level, or from a start command if DC is at a required level. This can be used when the breaker is opened, for example, by a stop command but DC remains high. It is useful when used in a battery system.

2 = Start Command
The circuit breaker is closed from a start command if DC is at a required level.

P2.5.7.6 MCB At Stop Command
The parameter defines the action for MCB when a stop command has been given.

0 = Keep closed
1 = Open CB when drive has stopped

P2.5.7.7 MCB close delay
The parameter defines the delay when RO2 is closed after the drive has determined that MCB can be closed.
5.6 LIMIT SETTINGS

5.6.1 Current limits

2.6.1.1 Current Limit  \( \text{ID 107} \)

The parameter sets the current limit for the Grid Converter unit. Set the value to correspond to the maximum peak overload for the unit or if needed, to required short circuit current (\( I_{\text{SCC}} \)).

The maximum value for air cooled unit is \( I_s \) and liquid cooled unit \( I_{th} \). For air cooled units \( I_s \) is available when short circuit functionality is activated. See available current values from "GTC Product compatibility notes" column b.

The drive can operate against the current limit if P2.6.1.3 Short Circuit time has been set to zero, and P2.6.1.4 High Frequency Current limit has been enabled. Otherwise the drive will trip to a short circuit fault immediately, or after a set time delay.

NOTE! The internal protections of the drive can trip the drive before the time limit or the current level is reached.

NOTE! Set the current limit high enough so that limit is not reached in normal operation.

2.6.1.2 Short Circuit Detection Level  \( \text{ID 1620} \)

This parameter defines the current level when the drive will start to feed reactive current to the short circuit, i.e. this is short circuit current detection level (\( I_{\text{SCD}} \)).

This is instantaneous value, related to P2.1.3 System Rated Current. \((P2.1.3 \times \sqrt{2})\)

This value should be above the set current limit of the drive but below the (F1) over current trip limit (3,2-4 \( \times I_n \), depending on unit).

The recommendation is to set Short Circuit Level about 25 \% higher than the value of the current limit. This will eliminate short circuit operation while already operating against current limit due current spikes that goes to short circuit detection level.

Example LC AFE unit 730 A 500 Vac:

System Rated Current (\( I_{\text{SRC}} \)): 487 A (\( I_n \))
Current Limit (\( I_{\text{SCC}} \)): 730 A (\( I_{th} \))
Short Circuit Detection Level (\( I_{\text{SCD}} \)): \( \frac{730 \times \sqrt{2}}{487} \times 1.25 = 256 \% \)

In this case Short Circuit Level 212\% would be equal to Current Limit in rms. The recommended value for the Short Circuit Level in the case above is 265 \%. The function will be disabled if a value above 499\% is given. If it is possible, adjust System Rated current to have values below 499\%.

NOTE! The function requires a uGrid Licence (P3.2 uGrid Licence)

NOTE! During the short circuit grid voltage will be low; it may require that UPS is used for auxiliary voltage that MCB is kept closed during short circuit.
Example Air Cooled AFE unit 460 A 500 Vac:
System Rated Current ($I_{SRC}$): 385 A ($I_h$)
Current Limit ($I_{SCC}$): 693 A ($I_s$)
Short Circuit Detection Level ($I_{SCD}$): $\frac{693}{385} \times \sqrt{2} \times 1.25 = 319\%$

![Short Circuit Detection Diagram]

**Figure 1.**

### 2.6.1.3 Short Circuit Time

**ID 1515**

The maximum time that the drive can operate against the current limit.

### 2.6.1.4 High Frequency Current Limit

In normal motoring drives $I_s$ is for starting current below 30 Hz. In Grid Converter case $I_s$ must be enabled separately for short circuit current if current levels above $I_h$ 50% over load currents are needed for air cooled units. Liquid cooled units $I_h$ is always the maximum limit.

The high frequency current limit can be disabled when the licence key has been given and the drive is connected to DC (INU unit) by setting parameter to 0 / Disable. If connected to AC grid (FC unit), this parameter must be kept at 0 / Enable.

0 = Enabled

High Frequency Current limit is enabled, drive will not make $I_s$ current above 30 Hz

1 = Disabled

High Frequency Current limit is disabled, drive can make $I_s$ current above 30 Hz.

**NOTE!** The function requires a uGrid Licence (P3.2 uGrid Licence)
2.6.1.5 **Short Circuit Fault Voltage Level**  

The BiPhase fault is detected by monitoring the supply voltage. Set this value lower than the supply voltage would be in normal operation. For three phase fault voltage needs to be below this level additionally that drive is running against current limit.

![Short Circuit detection Two phase Fault: F91 Short Circuit](image)

*Figure 2.*

**P2.6.1.6 Output Active Current Limit [%] ID1290 “OutputActCurLim”**

This parameter sets the active current limit for the generator side operation of the regenerative unit. 100.0% is equal to nominal current. Generator Side operations is when power flows from DC side to AC side. Setting too low value may lead to over voltage fault even on situation when power is not mend to regenerate to grid side.

**P2.6.1.7 Input Active Current Limit [%] ID1289 “InputActCurLim”**

This parameter sets the active current limit for the motor side operation of the regenerative unit. 100.0% is equal to nominal current. Motoring Side operations is when power flows from AC side to DC side.

**P2.6.1.8 Software Over Current fault level ID1094**

Software level Over Current Protection. This is instantaneous value, related to P2.1.3 System Rated Current. \((P2.1.3 \times \sqrt{2})\). Drive stops to F1 Over Current Sub Code S4.
5.6.2 Power limits

2.6.2.1 Output Power Limit ID1288
This parameter sets the power limit for the generator side operation of the regenerative unit. 100.0% is equal to nominal current at nominal voltage. Generator Side operations is when power flows from DC side to AC side. Setting too low value may lead to over voltage fault even on situation when power is not mend to regenerate to grid side.

2.6.2.2 Input Power Limit ID1287
This parameter sets the power limit for the motor side operation of the regenerative unit. 100.0% is equal to nominal current at nominal voltage. Motoring Side operations is when power flows from AC side to DC side.

2.6.2.3 Power Limit Increase Rate ID1502 “Limit.Inc.Rate”
This parameter defines the limit increase rate. The limit will start to decrease immediately.

P2.6.2.4 High Frequency Power Limit Function ID1703
This parameter provides a high frequency power limit function for AFE. When the frequency exceeds this value, power is limited with 1 Hz slope. The value 0 = Not in use.

P2.6.2.5 Stop Power Ramp Rate ID1812
Defines ramp rate for power when stopping. Ramping disabled when negative value selected.
5.6.3 Frequency limits

NOTE: This functionality is not Grid Code functionality even if functionality may be similar.

2.6.3.1 Line Low Frequency Trip Limit
If the drive output frequency goes below this level, the drive will trip to a line synch fault. Use this limit as a final and immediate protection function for the grid or generator. In the protection group there are protection functions that will use OPT-D7 information. The common tripping limit of the land based grid code standard is 47.5 Hz within 200 ms.

2.6.3.2 Line High Frequency Trip Limit
If the drive output frequency goes above this level, the drive will trip to a line synch fault. Use this limit as a final and immediate protection function for the grid or generator. In the protection group there are protection functions that will use OPT-D7 information. The common tripping limit of the land based grid code standard is 50.2-51.5 Hz within 200 ms.

Figure 3.
5.6.4 Micro Grid limits

2.6.4.1 Current Limit Minimum
An active current limit from AC to DC direction. This limit affects the Island and uGrid operation modes but not the AFE operation mode.

2.6.4.2 Current Limit Maximum
An active current limit from DC to AC direction. This limit affects the Island and uGrid operation modes but not the AFE operation mode.

2.6.4.3 Maximum Limit Increase Rate
This parameter defines the increase rate for the current limit from DC to AC direction.

2.6.4.4 Current Limit Kp
The gain for the current limit operation.

Figure 4.

Figure 5.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.6.4.5  **Current Limit Ti**  
The integration time for the current limit operation.

2.6.4.6  **Current Limit Max Minimum**  
This parameter defines the minimum limit for the maximum current limit.  
Use this function to limit minimum when PLC control value to zero. The value zero will cause instability in the control. Depending on the system, the value is usually between 1% and 5%.

2.6.4.7  **Current limit to Zero Mode**  
Defines how the maximum current limit is handled in the STOP state.  
In a starting situation, the current can increase above the reference when the grid frequency is below the base frequency. This function will decrease the starting current in starting situations.  
0 = Current limit is kept at parameter level in STOP state.  
1 = Current limit is set to minimum level in STOP state.

5.6.5  **DC voltage regulators**

**P2.6.5.1 Under Voltage Limit**  ID1524  
This parameter provides the under voltage regulator limit for Island and Micro Grid operation. A percentage value related to the nominal AC voltage of the drive.

\[ DC \text{ Under Voltage Limit} = Unit \text{ Nom AC Voltage} \times 1.35 \times \text{Under Voltage Limit} \]

500 Vac unit: \[ 439 \text{ Vdc} = 500 \text{ Vac} \times 1.35 \times 65.00 \% \]

690 Vac unit: \[ 605 \text{ Vdc} = 690 \text{ Vac} \times 1.35 \times 65.00 \% \]

**P2.6.5.2 Over Voltage limit**  ID1523  
This parameter provides the over voltage regulator limit for Island and Micro Grid operation. A percentage value related to the nominal AC voltage of the drive.

\[ DC \text{ Under Voltage Limit} = Unit \text{ Nom AC Voltage} \times 1.35 \times \text{Over Voltage Limit} \]

500 Vac unit: \[ 810 \text{ Vdc} = 500 \text{ Vac} \times 1.35 \times 120.00 \% \]

690 Vac unit: \[ 1117 \text{ Vdc} = 690 \text{ Vac} \times 1.35 \times 120.00 \% \]
P2.6.5.3 Brake chopper  ID504  "Brake Chopper"

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

0  =  "Not Used" - No brake chopper used
    Brake chopper not active or present in the DC link. **NOTE:** The overvoltage controller level is set to a little lower, see parameter P2.6.5.2.

1  =  "On, Run" - Brake chopper in use and tested when running.
    The drive’s own brake chopper is activated and operational when the drive is in Run state. The drive also sends test pulses for feedback from the brake resistor.

2  =  "On, Run+Stop" - Used and tested in READY state and when running
    Brake chopper is also active when the drive is not in Run state. This option can be used, for example, when other drives are generating but energy levels are low enough to be handled with only one drive.

3  =  "On, No test" - Used when running (no testing)
    Brake chopper is active in Run state but no test pulse to resistor is generated.

**Note:** In the system menu, there is a parameter "InternBrakeRes". This parameter is used for brake resistor overheating calculations. If an external brake resistor is connected to the drive the parameter should be set to ‘Not connected’ to disable temperature calculation for the brake resistor.

P2.6.5.4 Brake Chopper Level  ID1267  "BrakeChopperLeve"

Brake chopper control activation level in volt. This parameter is active when “OverVolt.Ref.Sel” is 2 / "BrakeChLevel”

For 400V Supply:  \(400 \times 1.35 \times 1.18 = 638\) V
For 500V Supply:  \(500 \times 1.35 \times 1.18 = 808\) V
For 690V Supply:  \(690 \times 1.35 \times 1.18 = 1100\) V

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.7 Drive control

2.7.1 Switching Frequency

The switching frequency of the IGBT Bridge in kHz. Changing the default value can have an impact on the LCL filter operation.

2.7.2 AFE Options 1

This packed bit word is made for enabling/disabling different control options for the regeneration control.

- **B0** = Disable DCV reduction with a reactive reference generation with high line voltage.
- **B1** = Disable LCL reactive power compensation.
- **B5** = Disable all harmonic elimination compensation.
  
  This is active by default. When activated, this function will reduce little $5^{th}$ and $7^{th}$ harmonics. This will not reduce harmonics of the grid, only the harmonics of the drive.

- **B8** = Enable double pulse synchronisation.
  
  This option will generate two synchronisation pulses instead of one. It can help the synchronisation on a weak grid.

- **B9** = Enable soft synchronisation (>= FI9).
  
  This function enables zero crossing detection on drives that are FI9 or bigger. When this is active and there is a connection to the grid when the drive is in the STOP state, Supply Frequency is updated by the detected frequency.

- **B12** = Enable floating DC reference. DC-link voltage will follow the line voltage.
  
  When the drive is in the RUN state, it can detect the Supply Voltage. If the supply voltage changes, also the internal DC Reference is changed so that DC voltage is:

  \[
  DC\, Voltage = Estimated\, Supply\, Voltage \times 1,35 \times DC\, Reference
  \]

- **B13** = Enable use of D7 board for start synchronisation.
  
  When an OPT-D7 board is installed, this bit will activate the synchronisation by using a voltage angle and frequency information from the D7 board. The phase order must be same in both the OPT-D7 and input phases. It is also necessary to keep the frequency on the positive side. The frequency of the D7 board can be the same as a Supply Frequency but the phase order can be still wrong.

2.7.3 AFE Options 2

This packed bit word is made for enabling/disabling different control options for the regeneration control.

2.7.4 AFE Options 3

This packed bit word is made for enabling/disabling different control options for the regeneration control.
2.7.5 **AFE Options 4**
This packed bit word is made for enabling/disabling different control options for the regeneration control.

2.7.6 **Start Delay**
This parameter defines a starting delay when a run command is given. When programming different delays to parallel units, the units will start in sequence. This is necessary in parallel units to make sure that the synchronisation does not happen simultaneously in all the drives. A simultaneous start can lead to a failed synchronisation. The recommended value between the drives is 500 ms.

![Start Delay Diagram](image)

**Figure 6.**

2.7.7 **Modulator Type (ID1516)**
With this parameter you can change the modulator type. With an ASIC (HW) modulator, the current distortion is lower, but losses are higher compared to a software modulator. It is recommended to use Software modulator 1 as a default option.

0 = **Hardware modulator**: an ASIC modulator, with a classical third harmonic injection. The spectrum is slightly better compared to Software 1 modulator.

1 = **Software modulator 1**: A symmetric vector modulator with symmetrical zero vectors. The current distortion is smaller than with Software modulator 2 if boosting is used.

2 = **Software modulator 2**: A symmetric BusClamb, in which one switch always conducts 60 degrees either to a negative or a positive DC-rail. Switching losses are reduced without different heating of upper and lower switches. The spectrum is narrow. Not recommended for parallel units.

3 = **Software modulator 3**: An unsymmetric BusClamb, in which one switch always conducts 120 degrees to a negative DC-rail to reduce switching losses. The upper and lower switches are unevenly loaded and the spectrum is wide. Not recommended for parallel units.
4 = **Software modulator 4**: A pure sine wave, sinusoidal modulator without harmonic injection. It is dedicated to be used, for example, in back-to-back test benches to avoid a circulating third harmonic current. The required DC voltage is 15% higher compared to other modulator types.

### 2.7.8 Control Options 1  ID1707

- **B01 = +2** = Bypass minimum DC Voltage reference limit.
- **B03 = +8** = Disable D7 frequency monitoring for diagnostic. Used for testing purposes.
- **B04 = +16** = Disable D7 voltage monitoring for diagnostic. Used for testing purposes.
- **B05 = +32** = Keep frequency drooping while synchronising to external grid.
- **B06 = +64** = Enable external grid contactor closing in STOP state.
- **B07 = +128** = Enable changing (temporally) MCB Control output. Used to disable MCB close for testing purposes.
- **B08 = +256** = Disable floating DC reference, Island and Micro Grid modes will follow actual DC.
- **B10 = +1024** = Bypass normal DC-Link voltage reference level for 500 Vac unit.
- **B11 = +2048** = Enable drive stop when OPT-D7 voltage is below P.2.9.6.2 VoltLowWarnLim. This function is used to keep AFE-INU system operational during short circuit on grid side given that inertia of INU side will keep DC high enough for long enough.

### 2.7.9 Control Options 2

- **B00 = +1** = Reserved.
- **B02 = +4** = OPT-D7 simulation. When OPT-D7 board is not used, it is possible to use Analogue Input 3 and 4 ID write function to give the grid the Line Frequency D7 (ID1654) and Line Voltage D7 (ID1650). This enables use of grid protection functions without OPT-D7 board. Note that both line frequency and line voltages needs to be given.
- **B04+B05 = +48** = DCV-ripple compensation
- **B06 = +64** = Enable Double Sampling.

### 2.7.10 Operation Time  ID1855

This parameter stores the operation time. When the application is reloaded, operation hours will go to zero if this parameter is not updated.

The unit of the monitoring signal is h with two decimals.

Parameter is in this format:

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
XX (Years) XX (Months) XX (Days) XX (Hours) XX Minutes
1211292359 -> 12 years, 11 months, 29 days, 23 hours and 59 minutes.

5.7.1 AFE Control

P2.7.11.1 Dynamic Support Kp  ID1797

P2.7.11.2 Synch Kp  ID1457
This parameter sets the gain of the synchronisation controller used to synchronise the switching to the supply.

P2.7.11.3 Synch Ti  ID1458
This parameter sets the time constant of the controller used to synchronise the switching to the supply (15 equals 7ms).

P2.7.11.4 Active Current Kp  ID1455
This parameter sets the gain of the controller for the active current of the regenerative unit.

P2.7.11.5 Active Current Ti  ID1456
This parameter sets the time constant of the controller for the active current of the regenerative unit (15 equals 1.5ms).

P2.7.10.6 Synch. Kp Start  ID1300

P2.7.11.7 Voltage Control Kp  ID1451
This parameter sets the gain for the DC link PI voltage controller.

P2.7.11.8 Voltage Control Ti  ID1452
This parameter sets the time constant in ms of the DC link PI controller.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.7.2 IDENTIFICATION

P2.7.12.1 IU Offset ID668
Identified U phase current measurement offset, identified during identification run.

P2.7.12.2 IV Offset ID669
Identified U phase current measurement offset, identified during identification run.

P2.7.12.3 IW Offset ID670
Identified W phase current measurement offset, identified during identification run.

5.7.3 DC-LINK COMPENSATION

P2.7.13.1 DC Ripple Compensation Kp ID1897
Gain for DC-Link ripple compensation.

P2.7.13.2 DC Ripple Compensation Phase ID1898
Phase for DC-Ripple compensation.

P2.7.13.3 DC Ripple Compensation Frequency ID1899
Frequency for DC-Link ripple compensation.
5.8 Protections

5.8.1 General settings

2.9.1.1 Thermistor Fault Response

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

Setting the parameter to 0 will deactivate the protection.

2.9.1.2 OverTemp Response

2 = Fault
3 = Fault, Open MCB
4 = Fault, Open NET CB
5 = Fault, Open Main & NET CB

2.9.1.3 Overvoltage Response

2 = Fault
3 = Fault, Open MAIN CB
4 = Fault, Open NET CB
5 = Fault, Open Main & NET CB

2.9.1.4 CoolingFlt.Delay

Protection for 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 this is only a warning. In RUN state, the drive will issue a fault with a coast stop. This parameter defines the delay after which the drive goes to FAULT state when Cooling OK signal is missing.

2.9.1.5 LCL Temperature input monitor

This parameter defines a response to the input filter overtemperature fault. The fault is monitored through a digital input.

2.9.1.6 Max Charge Time

When the drive charging options are used, this parameter defines the maximum time limit for charging.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.9.1.7  **MCB at Fault**  
Defines action for the main circuit breaker when the drive has a fault. 
F1 Over Current, F31 Hardware IGBT and F41 Software IGBT will open MCB immediately regardless of the setting of this parameter.
0 = Keep closed
1 = Open at any fault situation

**P2.9.1.8  Quick Stop Response  ID1758**  
This function will stop the drive at any case. This parameter is used to select which action is shown on keypad.
1 = Warning
2 = Fault

**P2.9.1.9  Reactive Error Trip Limit  ID1759**  
Limit for the reactive current for the line fault detection, when the reactive current is less than the value of parameter Line Synch fault.

**P2.9.1.10  MCB Fault Delay  ID1521**  
The delay for the main circuit breaker open fault. The delay between the control relay close command of the main circuit breaker and the acknowledge signal of the main circuit breaker. If the acknowledge signal is not received within this time, a fault F64 will be generated.

**P2.9.1.11  Line Phase Supervision  ID702**  
Defines the response when the drive notices that one of the line phases is missing.
0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function
3 = Fault, stop mode after fault always by coasting

**P2.9.1.12  Response to the 4mA reference fault  ID700**  
The 4 mA protection monitors the analogue input signal level from Analogue Input 1 and Analogue Input 2. The monitoring function is active when the signal Custom Minimum is bigger than 16.00% and the mode is defined as a living zero. A fault or warning is generated when the signal goes below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds.
0 = No response
1 = Warning
2 = Fault

**P2.9.1.13  Reactive Current Limit Response  ID1981**  
This function can be used to generate a fault or a warning when the reactive current exceeds 110% value.
0 = No response
1 = Warning
2 = Fault

P2.9.1.14  ACTempFaultLevel   ID1998
5.8.2 PT-100

The temperature protection function is used to measure temperatures and issue warnings and/or faults when the set limits are exceeded. The marine application supports two OPT-BH and OPT-B8 board simultaneously. One can be used for the motor winding and one for the motor bearings.

P2.12.2.1 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.

P2.12.2.2 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

P2.12.2.3 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).

P2.12.2.5 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).

P2.12.2.5 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

**P2.12.2.6 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

**P2.12.2.7 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).

**P2.12.2.8 Board 2 fault limit**  
ID746 “Board2 Fault Lim”
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).

**5.8.2.1 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.

**P2.12.2.9.1 Channel 1B Warn**  
ID764
**P2.12.2.9.2 Channel 1B Fault**  
ID765
First board second (1B) channel warning and fault limits.

**P2.12.2.9.3 Channel 1C Warn**  
ID768
**P2.12.2.9.4 Channel 1C Fault**  
ID769
First board third (1C) channel warning and fault limits.
P2.12.2.9.5 Channel 2B Warn  ID770
P2.12.2.9.6 Channel 2B Fault  ID771

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

P2.12.2.9.7 Channel 2C Warn  ID772
P2.12.2.9.8 Channel 2C Fault  ID773

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

5.8.3 Earth fault

2.9.3.1 EarthFlt Response
2=Fault
3=Fault, Open MCB
4=Fault, Open NET CB
5 =Fault, Open Main & NET CB

2.9.3.2 EarthFaultLevel
This parameter defines the maximum level of earth current in % of the unit current.

5.8.4 Fieldbus

2.9.4.1 Fieldbus Fault Slot D Response  ID733
2.9.4.2 Fieldbus Fault Slot E Response  ID761
Set the response for a fieldbus fault if the active control place is fieldbus. For more information, see the relevant Fieldbus Board Manual.
0 =No response
1 =Warning
2 =Fault, stop mode after fault according to Stop Function

2.9.4.3 FB WD Time
Delay time to a fieldbus fault when the pulse from PLC is missing. Setting the time to zero will disable the monitoring function.

5.8.5 External fault

2.9.5.1 Response to External Fault 1  ID701 “External Fault 1”
2.9.5.2 Response to External Fault 2  ID1504 “External Fault 1”
Defines response when a digital input signal is used to give signal about an external condition to which the drive needs to react. The external warning/fault indication can be connected to a digital output.
2.9.5.3 External fault delay
Defines the delay for an external fault, and affects both external fault inputs.

5.8.6 Grid voltage D7
This function monitors the grid voltage by using measurement from the OPT-D7 board.

**NOTE:** This functionality is not Grid Code functionality even if functionality may be similar.

**P2.9.6.1 Voltage D7 Response ID1626**
0 = No response
1 = Warning
2 = Fault

Note: Low Voltage trip from D7 board is disabled if drive has detected Short Circuit

*Figure 7.*
P2.9.6.2 Voltage Low Warning Limit

Low limit for a warning indication. A percentage value from a set supply voltage parameter.

P2.9.6.3 Voltage Low Trip Limit

Low limit for a fault indication. A percentage value from a set supply voltage parameter.
The common tripping limit of the land based grid code standard is 80 % of Un within 200 ms.

P2.9.6.4 Voltage High Warning Limit

High limit for a warning indication. A percentage value from a set supply voltage parameter.

P2.9.6.5 Voltage High Trip Limit

High limit for a fault indication. A percentage value from a set supply voltage parameter.
The common tripping limit of the land based grid code standard is 115 % of Un within 200 ms.

P2.9.6.6 Voltage Trip Delay

Delay to a fault when the voltage has exceeded the fault levels.
5.8.7 Grid Frequency

A monitoring function for the drive output frequency and the measured frequency from OPT-D7. Will also trip this when operating in pure AFE mode.

**NOTE:** This functionality is not Grid Code functionality even if functionality may be similar.

```
OPT-D7 Grid Freq. D7
Fault: F93 D7 Frequency
```

![Figure 8.](image)

**P2.9.7.1 Freq. Supply Response ID1627**
0 = No response
1 = Warning
2 = Fault

**P2.9.7.2 Freq. D7 Response ID1628**
0 = No response
1 = Warning
2 = Fault

**P2.9.7.3 Freq. Low Warning Limit ID1780**
Low limit for a warning indication. A percentage value from a set supply frequency parameter. This also limits the adjusted frequency references.

**P2.9.7.4 Freq. Low Trip Limit ID1781**
Low limit for a fault indication. A percentage value from a set supply frequency parameter. Use G2.6.3 Frequency limits for final and immediate protection.

The common tripping limit of the land based grid code standard is 47.5 Hz within 200 ms.

**P2.9.7.5 Freq. High Warning Limit ID1783**
High limit for a warning indication. A percentage value from a set supply frequency parameter. This also limits the adjusted frequency references.
P2.9.7.6  **Freq. High Trip Limit**  \( \text{ID1784} \)
High limit for a fault indication. A percentage value from a set supply frequency parameter. Use G2.6.3 Frequency limits for final and immediate protection.

The common tripping limit of the land based grid code standard is 50.2-51.5 Hz within 200 ms.

P2.9.7.7  **Freq. Trip Delay**  \( \text{ID1785} \)
Delay to a fault when the frequency has exceeded the fault levels.

5.8.8  **Supply Voltage**
There is a tripping function for the drive output voltage. It is possible that the drive output voltage is higher (or lower) than the grid voltage, depending on the voltage compensation for LCL and transformer.

P2.9.8.1  **Voltage, Supply response**  \( \text{ID1629} \)

0 = No response  
1 = Warning  
2 = Fault

P2.9.8.2  **Voltage Low Trip Limit**  \( \text{ID1891} \)
When the supply voltage drops below this limit, the drive will trip to an F70 Supply voltage fault. If the drive is already at the current limit, this low voltage trip limit is not active.

**NOTE!** OPT-D7 is not used for detection.

Use this function for the final protection function for the grid or the generator. Delay to trip is 150 ms. The protection group has functions that use OPT-D7 for voltage level protection.

P2.9.8.3  **Voltage Low Warning Limit**  \( \text{ID1880} \)
When the supply voltage drops below this limit, the drive will give a warning. If the drive is already at the current limit, this low voltage trip limit is not active.

**NOTE!** OPT-D7 is not used for detection.

P2.9.8.4  **Voltage Low Warning Limit**  \( \text{ID1881} \)
When the supply voltage increases above this limit, the drive will give a warning.

**NOTE!** OPT-D7 is not used for detection.

P2.9.8.5  **Voltage High Trip Limit**  \( \text{D1992} \)
When the supply voltage increases above this limit, the drive will trip to an F70 Supply voltage fault.

**NOTE!** OPT-D7 is not used for detection.

Use this function for the final protection function for the grid or the generator. Delay to trip is 150 ms. The protection group has functions that use OPT-D7 for voltage level protection.
Limit Setting: Voltage  
Fault: F70 Line Voltage  

Note: This monitor voltage at drive terminal. When compensating LCL terminal voltage, Output voltage may be considerable higher on full load situations than given Supply Voltage.

Note: Low Voltage trip from output voltage is disabled if drive has detected Short Circuit.

Figure 9.
5.8.9 **Over Load Protection**

With this function it is possible to select if Current %, Active Current or Reactive Current is used for over load protection. Over Load is based on internal counter that is increased when input value is above 105 % level and decreased when below 105 % level. The increase and decrease occurs every 100 ms.

Tripping is made when over load counter value is over 10 000.

With parameters you can define the increase (Over load maximum step) at maximum defined input level (Over Load Maximum Input). These points define the slope for the function. For example, if the input value is in the middle of 105 % and Over Load Maximum Input values, the counter is increased by a half of the Over Load Maximum step.

![Figure 10](image)

2.9.9.1 **Response to over load** ID1838 "OverLoadResponse"

0 = No response  
1 = Warning  
2 = Fault

2.9.9.2 **Over Load Signal** ID1837 "OverLoadSignal"

0 = Not Used  
1 = Total Current [%] (FW: MotorCurrentPU_100ms)  
2 = Active Current  
3 = Reactive Current

2.9.9.3 **Over Load Maximum Input** ID1839 "OverLoadMaxIN"

Input value level where the over load counter is increased with maximum step defined by P2.9.9.4
2.9.9.4 Over Load Maximum Step ID 1840 “OverLoadMaxStep”
Step in the over load counter when the input value is at maximum input level defined by P2.9.9.3.

5.8.10 D7 PROTECTIONS

2.9.10.1 THD Response ID 1672
Use this parameter to select the response for the total harmonic distortion protection of the OPT-D7 option board.
0 = No response
1 = Warning
2 = Fault

2.9.10.2 THD Warning Limit ID 1673
When the total harmonic distortion measured in the voltage measured by the OPT-D7 board exceeds this limit, the drive can issue a warning.

2.9.10.3 THD Fault Limit ID 1674
When the total harmonic distortion measured in the voltage measured by the OPT-D7 board exceeds this limit, the drive can issue a fault.

2.9.10.4 HF RMS Response ID 1675
Use this parameter to select the response for the high frequency root-mean-square protection of the OPT-D7 option board.
0 = No response
1 = Warning
2 = Fault

2.9.10.5 HF RMS Warning Limit ID 1676
When the high frequency root-mean-square voltage measured by the OPT-D7 board exceeds this limit, the drive can issue a warning.

2.9.10.6 HF RMS Fault Limit ID 1677
When the high frequency root-mean-square voltage measured by the OPT-D7 board exceeds this limit, the drive can issue a fault.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.8.11 Extra

2.9.11 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.

\[
\begin{align*}
B00 &= +1 = \text{Simulates an over current fault (F1)} \\
B01 &= +2 = \text{Simulates an over voltage fault (F2)} \\
B02 &= +4 = \text{Simulates an under voltage fault (F9)} \\
B03 &= +8 = \text{Simulates an output phase supervision fault (F11)} \\
B04 &= +16 = \text{Simulates an earth fault (F3)} \\
B05 &= +32 = \text{Simulates a system fault (F8)} \\
B06 &= +64 = \text{Free} \\
B07 &= +128 = \text{Simulates an over temperature warning (W14)} \\
B08 &= +256 = \text{Simulates an over temperature fault (F14)}
\end{align*}
\]

This fault simulation covers a wide range of different faults in drive. See the fault description for details.

B06 = +64 = Free
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

2.9.11 Reset Datalogger  ID1857

Resets datalogger setting back to factory defaults.
5.9 Fieldbus

2.10.1 FB Actual Value Sel ID 1853
Enter the ID of the parameter you wish to use as the Fieldbus Actual control variable.

2.10.2 to
2.10.9 FB Data Out 1-8 Sel ID 852-859
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 as the value of these parameters.

2.10.10 to
2.10.17 FB Data Out 9-16 Sel ID 558-565
These parameters are the same as parameters P2.10.2-9, but they are only available if a fieldbus board with hardware and software support for 16 process data variables is inserted in option board slot D or E.

2.10.18 to
2.10.25 FB Data In 1-8 Sel ID 876-883
Using these parameters, you can control any parameter value from the fieldbus. Enter the ID number of the item you wish to control as the value of these parameters.

2.10.26 to
2.10.33 FB Data In 9-16 Sel ID 550-557
These parameters are the same as parameters P2.10.18-25, but they are only available if a fieldbus board with hardware and software support for 16 process data variables is inserted in option board slot D or E.

2.10.34 GSW Data ID 897
With this parameter it is possible to select which data is sent in FBGeneralStatusWord.
2.10.35  **State Machine**  
*ID 896*

The application provides a possibility to select what kind of state machine is used.

- **0: Basic**
  This mode makes fieldbus control behave as is explained in the fieldbus board manual.

- **1: Standard**
  A simple control word that is used in modes where the control word from fieldbus is used as such. For some fieldbus boards this requires a bypass operation.

- **2: Vacon AFE 1**
  This mode uses a ProfiDrive type state machine in the application level. You can use this mode on fieldbus boards that do not have a state machine or have a possibility to bypass the state machine function in the option board.

2.10.36  **FB Ref Min**  
*ID 850*

2.10.37  **FB Ref Max**  
*ID 851*

The minimum and maximum limits for fieldbus DC Voltage Reference.

2.10.38  **Control Slot selector**  
*ID 1440*

This parameter defines which slot is used as the main control place when fieldbus boards have been inserted into the drive. When values 8-9 are selected the drive can use the Extended fieldbus mode if a fieldbus board with support for that mode is inserted in slot D or E. For more information refer to the fieldbus board manual.

- **0 = No Sel.** Control signals are monitored from every fieldbus board.
- **4 = Slot D** Control signals are monitored from Slot D (8 process data variables).
- **5 = Slot E** Control signals are monitored from Slot E (8 process data variables).
- **8 = Slot D with Extended fieldbus mode** (16 process data variables).
- **9 = Slot E with Extended fieldbus mode** (16 process data variables).

2.10.39  **SW ID.Bit selection B11**  
*ID 1907*

2.10.40  **SW ID.Bit selection B12**  
*ID 1908*

2.10.41  **SW ID.Bit selection B13**  
*ID 1909*

2.10.42  **SW ID.Bit selection B14**  
*ID 1910*

Select the bit that used in FB Status Word Bit 11, 12, 13 and 14.
2.10.43  uGrid CW B12 parameter  ID 891 "uCW B12"
2.10.44  uGrid CW B13 parameter  ID 892 "uCW B13"
2.10.45  uGrid CW B14 parameter  ID 893 "uCW B14"
2.10.46  uGrid CW B15 parameter  ID 894 "uCW B15"

With these parameters you can define the parameter to be controlled by using Micro Grid Control Word bits 12-15.
5.10 Micro Grid

2.11.1 Control Mode

Select the AFE operation mode.

0 = AFE
Standard AFE functionality, no license key required. Keeps fixed DC-Link Voltage.

1 = Island
Island operation mode, cannot operate parallel with other power sources. Makes fixed voltage and frequency, i.e. no voltage or frequency drooping. Also low DC-Link Voltage limitation function is disabled. Reacts only to set DC Under Voltage limit.

2 = Micro Grid
uGrid operation mode, can operate parallel with other power sources. Parallel operation is achieved by voltage and frequency drooping. Start to reduce output frequency when not sufficient DC-Link Voltage, this will prevent reactive current generation in case of low power in DC-Link side.

3 = Island-AFE
The drive changes the control mode automatically when feedback from the external net contactor has been received.

4 = Island-Micro Grid
The drive changes the control mode automatically when feedback from the external net contactor has been received.

5 = (Reserved)

6 = Free Select
The operation mode is selected by digital inputs and AFE mode 1-3 selections.

NOTE! A licence is necessary for other than the standard AFE mode.
### 2.11.2 Frequency Droop

Drooping related to the active current in Hz. Set to the same value as all other power sources drooping. Used in uGrid operation mode.

![Diagram of Frequency Droop](image)

**Figure 11.**

### 2.11.3 Voltage Droop

This parameter defines the voltage droop at 100% reactive current. The reactive current drooping in percentage of P2.1.1. Used in uGrid operation mode.

![Diagram of Voltage Droop](image)

**Figure 12.**
2.11.4 Start Power Mode
Defines how power is controlled to zero in Micro Grid mode.

0 = Zero Power OPT-D7
The option board D7 is used to monitor the grid frequency and uses this as a starting point for power drooping control.

1 = Zero Power from Supply Frequency
This selection is only possible with unit FI9 and bigger.
The drive monitors the supply frequency by itself and uses this as a starting point for power drooping control.

2 = Drooping
The drive does not control the power to zero but goes directly to the drooping control with set parameters.

3 = Isochron Generator
The drive will follow the line frequency exactly, so the frequency change will not change the power of the Micro Grid application. In this mode, power is controlled by the base current reference.

2.11.5 Voltage Rise Time ID1541
This parameter defines the time until the voltage is at nominal when the drive is started in Island mode or when in Micro Grid mode without an existing grid. Voltage Rise Time is used to minimize inrush current e.g. when Grid Converter needs to magnetize transformer on start.

5.10.1.1 Generator Simulation
These parameters are used to make drive operate more like diesel generator set.

P2.11.6 Generator Mechanical Time Constant ID1722
Simulated diesel generator mechanical time constant.
Values above zero will enable diesel generator simulation function. Use 1000 ms as a starting point if actual mechanical time constant is not known.

P2.11.7 Generator Speed Control Kp ID1723
Simulated diesel generator speed control gain.

P2.11.8 Generator Speed Control Ti ID1724
Simulated diesel generator speed control Ti.
5.10.1.2 AFE operation mode selection

When using digital input P2.4.2.17 AFE Mode 2 and P2.4.2.18 AFE Mode 3 with the parameters below, it is possible to select the operation independently for both the digital inputs.

\[ \text{SEL G IN 0 IN 1} \]

\[ \text{DI AFE Mode 2 P AFE Mode 1} \]

\[ \text{DI AFE Mode 3 P AFE Mode 3} \]

\[ \text{V Used AFE Mode} \]

Figure 13.

2.11.10.1 AFE Mode 1

Only active when P2.11.1 is 6/Free select.

0=AFE
1=Island
2=Micro Grid

2.11.10.2 AFE Mode 2

Only active when P2.11.1 is 6/Free select.

0=AFE
1=Island
2=Micro Grid

2.11.10.3 AFE Mode 3

Only active when P2.11.1 is 6/Free select.

0=AFE
1=Island
2=Micro Grid
5.11 Synch to external grid

This function is used to synchronise to an external grid. Measurements with OPT-D7 are necessary for the use of this function. When there are parallel unit’s synchronization needs to be done by upper system, e.g. by controlling Frequency Up and Down commands to all units (and other power sources in the same grid).

2.12.1 Synch. Offset

Used to compensate angle offset between the drive output terminals and OPT-D7 measurement point. E.g. with Dyn11, the transformer angle offset is usually 30.0 degree. This equals as 512 for this parameter. (3072 equals 180 degrees offset). If possible, run in AFE mode and see monitoring variable “D7 Synch. Error” to see what is needed for the offset.

\[
\frac{x \text{ degree} \times 3071}{180 \text{ degree}} = \text{Synch. Offset}
\]

2.12.2 Synch Reference

Use of P:Synch. Offset do not affect the error value that is shown in monitoring variable “D7 Synch. Error”. Therefore you must give the reference for synchronization; usually this reference is roughly the same as P:”Synch. Offset” value, depending on the system. (3072 equals 180 degrees offset).

2.12.3 Synch Kp

Island mode line sync gain. Init = 500.

2.12.4 Synch Ti

Reserved (not in use)

2.12.5 Synch.Hysteresis

Window for closing the net circuit breaker. (3172 equals 180 degrees).

2.12.6 Contactor Delay

In case no feedback is received from the shore contactor, this can be used to simulate a feedback signal. That means that the control mode is changed after this time delay, after the command to close NET contactor has been given.

2.12.7 Synch Stop Mode

Select operation after the drive has synchronised and received feedback from the shore contactor.

0 = Stay Run
1 = Stop
5.12 Reserved
5.13 ID functions
Here you will find the functions that use the parameter ID number to control and monitor the signal.

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

P2.14.1.1 Control Input Signal ID ID1580 "ContrInSignal ID"
With this parameter you can select which signal is used to control the selected parameter.

P2.14.1.2 Control Off Limit ID1581 "Contr Off Limit"
This parameter defines the limit when the selected parameter value is forced to Off value.

P2.14.1.3 Control On Limit ID1582 "Contr On Limit"
This parameter defines the limit when the selected parameter value is forced to On value.

P2.14.1.4 Control Off Value ID1583 "Contr Off Value"
This parameter defines the value that is used when the used input signal is below Off limit.

P2.14.1.5 Control On Value ID1584 "Contr On Value"
This parameter defines the value that is used when the used input signal is above On limit.

P2.14.1.6 Control Output Signal ID ID1585 "ContrOutSignalID"
This parameter defines which parameter is forced to On and Off values when selected input signal exceeds the set limits.

P2.14.1.7 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 ABS

Input values are scaled linearly between On and Off values.

5 = Scale Inverted

Inverted value is scaled linearly between On and Off values.

P2.14.1.8 Control Signal Filtering TC  ID1586  “Control Filt TC”

This parameter is used to filter the scaling function output. This can be used, for example, when unfiltered torque is used to control a parameter that needs stabilisation.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.13.2 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.

![Diagram of DIN ID control](image)

**Figure 17.**

**P2.14.2.1** ID Control Digital Input ID1570  “ID Control DIN”

**P2.14.3.1** ID Control Digital Input ID1590  “ID Control DIN”

**P2.14.4.1** ID Control Digital Input ID1578  “ID Control DIN”

Select a digital input to be used for controlling the parameter selected by ID1571.

**P2.14.2.2** DIN Controlled ID ID1571  “Controlled ID”

**P2.14.3.2** DIN Controlled ID ID1575  “Controlled ID”

**P2.14.4.2** DIN Controlled ID ID15719  “Controlled ID”

Select a parameter ID controlled by ID1570.

**P2.14.2.3** Value for Low digital input (FALSE) ID1572  “FALSE Value”

**P2.14.3.3** Value for Low digital input (FALSE) ID1592  “FALSE Value”

**P2.14.4.3** Value for Low digital input (FALSE) ID15794  “FALSE Value”

Set the controlled parameter value when the digital input (ID1570) is LOW for the parameter selected by ID1571. The function does not recognise decimals. For example, give the value 10.00 Hz as 1000.

**P2.14.2.4** Value for High digital input (TRUE) ID1573  “TRUE Value”

**P2.14.3.4** Value for High digital input (TRUE) ID1593  “TRUE Value”

**P2.14.4.4** Value for High digital input (TRUE) ID1596  “TRUE Value”

Set the controlled parameter value when the digital input (ID1570) is HIGH for the parameter selected by ID1571. The function does not recognise decimals. For example, give the value 10.00 Hz as 1000.
5.13.3 ID Controlled Digital Output

This function is used to control any Digital output by any status that can be presented as bit. The input signal is selected with the ID number and bit number.

Example: Most of the faults and warnings are normally presented in the common digital output. With the ID-controlled DO function, it is possible to select a specific fault to be connected to the digital output.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor stalled</td>
<td>W15</td>
</tr>
<tr>
<td>Motor over temperature</td>
<td>W16</td>
</tr>
<tr>
<td>Motor underload</td>
<td>W17</td>
</tr>
<tr>
<td>Input phase loss</td>
<td>W10</td>
</tr>
<tr>
<td>Output phase loss</td>
<td>W11</td>
</tr>
<tr>
<td>Safe disable</td>
<td>W30 (Not implemented)</td>
</tr>
<tr>
<td>FieldBus communication fault in slot D</td>
<td>W53 (Not implemented)</td>
</tr>
<tr>
<td>FieldBus communication fault in slot E</td>
<td>W67 (Not implemented)</td>
</tr>
<tr>
<td>Drive over temperature</td>
<td>W14</td>
</tr>
<tr>
<td>Analogue input &lt;4mA</td>
<td>W50</td>
</tr>
<tr>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>Emergency stop</td>
<td>W63 (Not implemented)</td>
</tr>
<tr>
<td>Run disabled</td>
<td>W62 (Not implemented)</td>
</tr>
<tr>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>Mechanical Brake</td>
<td>W58</td>
</tr>
<tr>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

P2.14.6.1 ID.Bit Free Digital output control 1 ID1216 “ID.Bit Free D01”
P2.14.7.1 ID.Bit Free Digital output control 2 ID1386 “ID.Bit Free D02”

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.

P2.14.6.2 Free Digital Output selector ID1574 “Free D01 Sel.”
P2.14.7.2 Free Digital Output selector ID1325 “Free D02 Sel.”

Select the output terminal to be controlled with the parameter ID.bit Free Digital output control.
5.14 **Auto Reset**

**P2.15.1 Wait Time**  
ID 717  
Use this parameter to set a delay between the fault clearing and automatic fault reset.

**P2.15.2 Trial Time**  
ID 718  
Use this parameter to specify the duration for supervising measurements and signals for fault clearing.

**P2.15.3 Overvoltage Tries**  
ID 721  
Use this parameter to define the amount of auto reset tries for an overvoltage fault.

**P2.15.4 Overcurrent Tries**  
ID 722  
Use this parameter to define the amount of auto reset tries for an overcurrent fault.

**P2.15.5 External Fault Tries**  
ID 725  
Use this parameter to define the amount of auto reset tries for an external fault.
5.15 Grid Voltage PI controller

The PI controller is meant to help keep the line voltage constant when the load changes in Island mode. The OPT-D7 option board is necessary. The PI controller controls the field weakening voltage point to keep a constant voltage on the line.

In uGrid mode controller is I type controller and considers set Voltage Drooping.

When OPT-D7 board is not used, it is possible to use Analogue Input 3 and 4 ID write function to give the grid the Line Frequency D7 (ID1654) and Line Voltage D7 (ID1650). This enables use of grid PI voltage controller without the OPT-D7 board. Note that both line frequency and line voltages needs to be given. When Line Voltage is given without OPT-D7 board this mode can be used only in Island mode.

P2.16.1 PI Activation ID1807
Select the digital input that will activate the PI controller. Set selection to 0.2 and the PI controller is activated without an external wiring.

P2.16.2 PI Controller Gain ID118
This parameter defines the gain of the PID controller. If the value of the parameter is set to 100%, a change of 10% in the error value causes the controller output to change by 10%. If the parameter value is set to 0, the PID controller operates as an I controller.

P2.16.3 PI Controller I-time ID119
The parameter ID119 defines the integration time of the PID controller. If this parameter is set to 1.00 second, a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00s, the PID controller will operate as a P controller.

P2.16.4 PI Max Adjust ID360
This parameter defines maximum adjustment that PI controller can made to voltage.

5.15.1 Grid Voltage PI OPT-D7 limits

These parameters define the limits within which the OPT-D7 measurements must remain in order for the PI controller to remain active. This is a protection function in case of a measurement loss. When a measurement loss is detected, the drive will not stop, but instead it continues to operate by using open loop voltage compensation (Inductor Size and Losses).

P2.16.5.1 PI Frequency Low Limit ID1630
P2.16.5.2 PI Frequency High Limit ID1631
P2.16.5.3 PI Voltage Low Limit ID1632
P2.16.5.4 PI Voltage High Limit ID1633

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16 Grid Code parameters

P 2.17.1 GGC License ID 3201
Enter here license code to activate General Grid Code functionality.

P 2.17.2 Set Grid Code ID 3401
Load Grid Code setting
1 = Factory Defaults.

P 2.17.3 EnableGridCode ID 3254
Parameter to enable Grid Codes if correct license is given.
0 = Disabled
    Grid Code functions are disabled.
1 = Enabled; No Trip. (Functional testing mode)
    Grid Code functions are active but do not cause drive to trip.
2 = Enabled (Select this mode when Grid Codes are needed)
    Grid Code functions are active, and drive will stop modulating if trip conditions are met.
3 = Simulation (Functional testing mode)
    Grid Code enabled in Island and uGrid mode. Note. This is only for testing e.g. tripping limits. e.g. reactive current or reactive power do not follow Grid Code settings. This mode do not use OPT-D7 but Supply Frequency and Supply Voltage for Grid Code functions.
5.16.1 **Anti-Islanding**

Anti-Islanding function makes small disturbances to grid, this is not noticeable during normal operation but when there is an islanding situation frequency and voltage will not be stable. Here you can select tripping limit for Anti-islanding function that are separated than normal frequency and voltage tripping limits. It's recommended to select values outside the normal tripping limits. Infernally software is monitoring if e.g. FRT is active and during this time anti-islanding is disabled.

**P 2.17.4.1 Anti-Islanding ID3250**

Enables or disables anti-islanding function.

0 = Disabled

In islanding situation frequency may stay inside acceptable operation.

1 = Active

In islanding situation frequency will change rapidly and frequency limit will trip the drive. Anti-Islanding function is activated 500 ms after drive goes to Run state.

**P2.17.4.2 High Volt Al % ID3404**

High Voltage tripping limit for Anti-Islanding function.

**P2.17.4.3 Low Volt Al % ID3405**

Low Voltage tripping limit for Anti-Islanding function.

**P2.17.4.4 High Freq Al % ID3406**

High Frequency tripping limit for Anti-Islanding function.

**P2.17.4.5 Low Freq Al % ID3407**

Low Frequency tripping limit for Anti-Islanding function.

**P2.17.4.6 AI Trip Delay ID3408**

Delay for Anti-Islanding function recommended to keep at least 50 ms that software has time to detect e.g. FRT situation.
5.16.2 FRT

P2.17.5.1 FRT Function

Enables FRT functionality.

0 = Disabled; Both
Fault Ride Through is disabled but voltage level and FRT Timer are active at the same time.

1 = Enabled; Limits
Fault Ride Through is enabled, voltage levels make the trip but not FRT Timer.

2 = Enabled; Curve
Fault Ride Through is enabled, FRT Timer makes the trip but not voltage levels.

3 = Enabled; Neither
Fault Ride Through is enabled, but neither FRT Timer or voltage levels are not making trip.

4 = Enabled; Both
Fault Ride Through is enabled, and voltage level and FRT Timer are active at the same time.

P2.17.5.2 ReactivInjection

Select the grid fault types when reactive current is injected.

0 = Tri:N, Bi:N
Reactive current is not injected.

1 = Tri:Y, Bi:Y
Reactive current is injected

2 = Tri:Y, Bi:N
Reactive current is injected to three phase faults but not to bi-phase faults.

P2.17.5.3 Symmetrical Reactive

Select if unsymmetrical fault will be feed by symmetrical current.

0 = No

1 = Yes
5.16.3 Reconnection

P 2.17.6.1 ReConnectTime s ID 3253
Reconnection time when fault happens on run state.

P 2.17.6.2 ReConnTimeStop s ID 3255
Reconnection time when fault happens in stop state. Disables drive starting when start command is given if Stop State reconnection time has not passed.

P 2.17.6.3 ReConRampUpRate %/s ID 3297
Power ramp up rate on reconnection.

P 2.17.6.4 RampReleaseDelay ms ID 3421
Delay in reconnection situation when output power limit is started to ramp up after drives start modulating.
5.16.4 Line Voltage

Line voltage trip levels and times to tripping. Times defines delay when drive sees that voltage has exceed set limit. Monitored signal may have hardware and/or software filtering function that will need to be considered when estimating total tripping time. Each tripping limit is independent of each other. Reference voltage is P2.1.1 Grid Nom. Voltage

Grid Voltage Warning: F95
High A2 & A3
Low A4 & A5

Grid Voltage Warning: F95
High A16
Low A17
P 2.17.7.1  Voltage Monitor  %  ID  3364
Line Voltage monitoring type
0 = Average voltage from phase voltages
1 = Minimum and Maximum from phase voltages.
2 = Separate Average and BiPhase voltage monitor.
3 = Separate Average and BiPhase Fast Voltage Monitor.

P 2.17.7.2  LV High 1  %  ID  3256
Line Voltage High Limit 1, % of Grid Nominal Voltage.
Trip after delay defined by ID 3257.

P 2.17.7.3  LV High 1 Delay  ms  ID  3257
Line Voltage High 1 Delay to trip when voltage above ID 3256.

P 2.17.7.4  LV High 1 PLim  %  ID  3412

P 2.17.7.5  LV High 2  %  ID  3258
Line Voltage High Limit 2, % of Grid Nominal Voltage.
Trip after delay defined by ID 3259.

P 2.17.7.6  LV High 2 Delay  ms  ID  3259
Line Voltage High 2 Delay to trip when voltage above ID 3258.

P 2.17.7.7  LV High 2 PLim  %  ID  3413

P 2.17.7.8  LV High 3  %  ID  3361
Line Voltage High Limit 3, % of Grid Nominal Voltage.
Trip after delay defined by ID 3262.
When voltage is above this level also power is limited to ID 3362

P 2.17.7.9  LV High 3 Delay  ms  ID  3362
Line Voltage High 3 Delay to trip when voltage above ID 3261.

P 2.17.7.10  LV High 3 PLim  %  ID  3363
Line Voltage High 3 Active power limit, activated when voltage goes above ID 3261

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P 2.17.7.11  LVLow 1 % ID 3260
Line Voltage Low Limit 1, % of Grid Nominal Voltage.
Trip after delay defined by ID3261.

P 2.17.7.12  LVLow 1 Delay ms ID 3261
Line Voltage Low 1 Delay to trip when voltage below ID3260.

P2.17.7.13  LVLow 1 PLim % ID 3414

P 2.17.7.14  LVLow 2 % ID 3262
Line Voltage Low Limit 2, % of Grid Nominal Voltage.
Trip after delay defined by ID3263.

P 2.17.7.15  LVLow 2 Delay ms ID 3263
Line Voltage Low 2 Delay to trip when voltage below ID3263.

P2.17.7.16  LVLow 2 PLim % ID 3415
Line Voltage Low 2 Active power limit, activated when voltage goes below ID3262

P2.17.7.17  LVLow 3 ID3365
Line Voltage Low Limit 3, % of Grid Nominal Voltage.
Trip after delay defined by ID3366.
When voltage is below this level also power is limited to ID3365

P2.17.7.18  LVLow 3 Delay ID3366
Line Voltage Low 3 Delay to trip when voltage below ID3366.

P2.17.7.19  LVLow 3 PLim ID3367
Line Voltage Low 3 Active power limit, activated when voltage goes below ID3365.

P2.17.7.20  LVLow 4 ID3416
Line Voltage Low Limit 4, % of Grid Nominal Voltage.
Trip after delay defined by ID3417.
When voltage is below this level also power is limited to ID3418
**P2.17.7.21 LVLow 4 Delay  ID3417**
Line Voltage Low 4 Delay to trip when voltage below ID3416

**P2.17.7.22 LVLow 4 PLim  ID3418**
Line Voltage Low 4 Active power limit, activated when voltage goes below ID3416.

**P 2.17.7.2310 Min average voltage trip level % ID3353**
This parameter defines 10-minute average voltage trip limit.

**P 2.17.7.24 10 Min Average Voltage Trip Delay ID3376**
Defines delay for 10 min average voltage monitoring.

**P 2.17.7.25 Voltage Response Time ID3410**
Define here voltage response time, this time is subtracted from tripping time.

**P2.17.7.26 PLim Down Rate ID3419**
When power limit by voltage limit is activated this is the ramp rate how fast limit is ramping down.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.5 Line Frequency

Line frequency trip levels and times to tripping. Times defines delay when drive sees that frequency has exceed set limit. Monitored signal may have hardware and/or software filtering function that will need to be considered when estimating total tripping time.

Reference frequency is P2.1.2 Grid Nom Freq.

Grid Frequency Warning: F95
High A6, A7, A18
Low A8, A9, A19

P 2.17.8.1 Frequency Monitoring Mode ID3423
0 = Normal
1 = Low filtered frequency below 500 ms trip times.

P 2.17.8.2 LF High 1 % ID 3264
Line Frequency High Limit 1 % of Grid Nominal Frequency.

P 2.17.8.3 LF High 1 Delay ms ID 3265
Line Frequency High Limit 1 trip delay.

P 2.17.8.4 LF High 2 % ID 3266
Line Frequency High Limit 2 % of Grid Nominal Frequency.

P 2.17.8.5 LF High 2 Delay ms ID 3267
Line Frequency High Limit 2 trip delay.

P 2.17.8.6 LF High 3 % ID 3368
Line Frequency High Limit 3 % of Grid Nominal Frequency.
P 2.17.8.7 LF High 3 Delay ms ID 3369
Line Frequency High Limit 3 trip delay.

P 2.17.8.8 LF Low 1 % ID 3268
Line Frequency Low Limit 1 % of Grid Nominal Frequency.

P 2.17.8.9 LF Low 1 Delay ms ID 3269
Line Frequency High Limit 1 trip delay.

P 2.17.8.10 LF Low 2 % ID 3270
Line Frequency Low Limit 2 % of Grid Nominal Frequency.

P 2.17.8.11 LF Low 2 Delay ms ID 3271
Line Frequency High Limit 2 trip delay.

P 2.17.8.12 LF Low 3 % ID 3370
Line Frequency Low Limit 3 % of Grid Nominal Frequency.

P 2.17.8.13 LF Low 3 Delay ms ID 3371
Line Frequency High Limit 3 trip delay.

P 2.17.8.14 LF MaxChangeRate Hz/s ID 3322
Tripping if line frequency has changed more than set value inside one (1) second.

P 2.17.8.15 Frequency Response Time ID 3399
Define here frequency response time, this time is subtracted from tripping time.
P2.17.8.16  Time Off Cycles   ID3411

Off timer when voltage goes below the tripping limit. This is used when tripping time is below 500 ms and low filtered frequency value is used for tripping functions.

One cycle is 5 ms
5.16.6 FRT Timer

Define voltage drop curve, drive will trip if curve is exceeded. Timer start when Voltage is below Voltage X6 point.

![Diagram of voltage drop curve and trip area]

\[
P 2.17.9.1 \quad \text{Voltage X0} \quad \% \quad \text{ID} \quad 3272
\]

Lowest voltage level.

\[
P 2.17.9.2 \quad \text{Time Y0} \quad \text{ms} \quad \text{ID} \quad 3273
\]

\[
P 2.17.9.3 \quad \text{Voltage X1} \quad \% \quad \text{ID} \quad 3274
\]

\[
P 2.17.9.4 \quad \text{Time Y1} \quad \text{ms} \quad \text{ID} \quad 3275
\]

\[
P 2.17.9.5 \quad \text{Voltage X2} \quad \% \quad \text{ID} \quad 3276
\]

\[
P 2.17.9.6 \quad \text{Time Y2} \quad \text{ms} \quad \text{ID} \quad 3277
\]

\[
P 2.17.9.7 \quad \text{Voltage X3} \quad \% \quad \text{ID} \quad 3278
\]

\[
P 2.17.9.8 \quad \text{Time Y3} \quad \text{ms} \quad \text{ID} \quad 3279
\]

\[
P 2.17.9.9 \quad \text{Voltage X4} \quad \% \quad \text{ID} \quad 3280
\]

\[
P 2.17.9.10 \quad \text{Time Y4} \quad \text{ms} \quad \text{ID} \quad 3281
\]

\[
P 2.17.9.11 \quad \text{Voltage X5} \quad \% \quad \text{ID} \quad 3282
\]

\[
P 2.17.9.12 \quad \text{Time Y5} \quad \text{ms} \quad \text{ID} \quad 3283
\]

\[
P 2.17.9.13 \quad \text{Voltage X6} \quad \% \quad \text{ID} \quad 3284
\]

Highest voltage level. Below this level timer is started.

\[
P 2.17.9.14 \quad \text{Time Y6} \quad \text{ms} \quad \text{ID} \quad 3285
\]

Time to trip when voltage is below X6 point and above X5 point.

Trip time is scaled between X6 and X5 points.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.7 Line OK Limits

Separate Grid OK levels when reconnection is allowed. If these values are zero tripping limits for voltage and frequency are used also as a OK limit. If Grid Frequency and Voltage are not inside OK limit drive start is prevented even if Grid Frequency or Voltage trip limit has not been exceeded.

P 2.17.10.1 LF OK High % ID 3287
P 2.17.10.2 LF OK Low % ID 3286
P 2.17.10.3 LV OK High % ID 3289
P 2.17.10.4 LV OK Low % ID 3288
P 2.17.10.5 Line OK Delay ms ID 3290

Minimum time that line needs to be inside acceptable limits before reconnection counter is started.
5.16.8 Reactive Injection

Reactive current injection is activated by ID3252.

P 2.17.11.1 UV Reactive Mode ID 3314
Select the operation mode for reactive reference handling for under voltage.
0 = Linear
1 = Power Lock In and Lock Out.

P 2.17.11.1 OV Reactive Mode ID 3377
Select the operation mode for reactive reference handling for over voltage.
0 = Linear
1 = Power Lock In and Lock Out.
5.16.8.1 Linear reference under voltage

Injected reactive current is changing linearly between high and low voltage corners. Reactive current will have priority when voltage is below UV High Corner.

\[ V_{\text{line}} \text{[%]} \]
\[ I_{\text{react}} \text{[%]} \]

![Graph showing linear reference under voltage](image)

**P 2.17.11.3.1 UV High Corner % ID 3291**

Defines voltage level where reactive current injection is started.

Also, Reactive Current will get priority over Active Current.

**P 2.17.11.3.2 UV Low Corner % ID 3292**

Defines voltage level where full Reactive Current, specified in ID 3293, is injected to the grid.

**P 2.17.11.3.3 UV Reac. Ref % ID 3293**

Reactive current reference at low voltage corner.

**P 2.17.11.3.4 UV Bi Reac. Ref % ID 3294**

Reactive current reference at low voltage corner on bi phase fault situation.
5.16.8.2 Linear reference over voltage

Reactive current has priority when voltage is above OV Low Corner.

\[
I_{\text{react}} [\%] \\
\begin{array}{c}
100 \% \\
105 \% \\
128 \% \\
\text{OV Low Corner} \\
\text{OV Max Reactiv} \\
-100 \%
\end{array}
\]

\[
V_{\text{line}} [\%]
\]

\[\text{OV React \ Slope} \]

**P 2.17.11.4.1 OV Low Corner % ID 3300**

Voltage corner where reactive current injection is started on line over voltage situation.

Also, Reactive Current will get priority over Active Current.

**P 2.17.11.4.2 OV Max Reactiv % ID 3301**

Maximum reactive current reference on over voltage situation.

**P 2.17.11.4.3 OV React Slope %/% ID 3302**

Slope for reactive current reference, started at ID2300.

100 %/% means that reactive current is increase 100 % by 1 % voltage increase.

**P 2.17.11.4.4 OV React PLim In % ID 3303**

If drive output power is below this reactive current injection is not started on over voltage.

**P 2.17.11.4.5 OV React PLim Out % ID 3329**

When drive output power falls below this level reactive injection is stopped recess of over voltage in the grid.
5.16.8.3 Power Lock In and Out Reference under voltage.

\[ P \text{ 2.17.11.5.1 Under Voltage PowerLockIn } \% \text{ ID 3315} \]

Power level where reactive current injection is started if Line Voltage is below ID3291.

\[ P \text{ 2.17.11.5.2 Under Voltage PowerLockOut } \% \text{ ID 3316} \]

Reactive current injection is stopped if power is below this value.

\[ P \text{ 2.17.11.5.3 Under Voltage PowerLoginMode } \text{ ID 3372} \]

0 = Voltage Level Trig
1 = Linear

\[ I_{\text{react}} [\%] \]

\[ V_{\text{line}} [\%] \]

\[ I_{\text{react}} [\%] \]

\[ V_{\text{line}} [\%] \]

\[ 100 \% \]

\[ 50\% \]

\[ 90 \% \]

\[ 100 \% \]

\[ UV \text{ Low Corner} \]

\[ UV \text{ High Corner} \]

\[ UV \text{ Reac MaxRef} \]

\[ UV \text{ LockOut Voltag} \]

\[ UV \text{ Reac HalfRef} \]

\[ UV \text{ Reac Max Ref} \]

\[ UV \text{ Bi Reac Max Ref} \]

\[ P 2.17.11.5.4 \quad \text{UV High Corner} \quad \% \quad \text{ID} \quad 3291 \]

If power is above ID3315 and voltage below this value but above ID3292 reactive current set by ID3318 is injected to grid. Also, Reactive Current will get priority over Active Current.

\[ P 2.17.11.5.5 \quad \text{UV Low Corner} \quad \% \quad \text{ID} \quad 3292 \]

If power is above ID3315 and voltage below this value, reactive current set by ID3293 is injected to grid.

\[ P 2.17.11.5.6 \quad \text{UV LockOut Voltag} \quad \% \quad \text{ID} \quad 3317 \]

Voltage limit for disabling the reactive current injection in undervoltage situation.

\[ P 2.17.11.5.7 \quad \text{UV Reac Half Ref} \quad \text{ID} \quad 3318 \]

Reactive current injected to grid when power is above ID3315 and Line voltage below ID3291 but above ID3292.

\[ P 2.17.11.5.8 \quad \text{UV Reac Max Ref} \quad \% \quad \text{ID} \quad 3293 \]

Reactive current injected to grid when power is above ID3315 and voltage below ID3292. This level is kept until voltage is above ID3311.

\[ P 2.17.11.5.9 \quad \text{UV Bi Reac Max Ref} \quad \% \quad \text{ID} \quad 3294 \]

Reactive reference used when Bi-phase fault, in both voltage levels.
5.16.8.4 Power Lock In and Out Reference over voltage.

**P 2.17.11.6.1 OVPowerLockIn % ID 3378**

Power level where reactive current injection is started if Line Voltage is above ID3300.

**P 2.17.11.6.2 OVPowerLockOut % ID 3379**

Reactive current injection is stopped if power is below this value.

**P 2.17.11.5.3 OVPowerLoginMode ID 3380**

0 = Voltage Level Trig

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
1 = Linear

P 2.17.11.6.4 OV Low Corner  %   ID  3300
If power is above ID3315 and voltage above this value but below ID3320 reactive current set by ID3321 is injected to grid. Also, Reactive Current will get priority over Active Current.

P 2.17.11.6.5 OV High Corner  %   ID  3320
If power is above ID3315 and voltage above this value, reactive current set by ID3301 is injected to grid.

P 2.17.11.6.6 OV LockOut Voltag  %   ID  3319
Reactive current injection is stopped if voltage is below this value.

P 2.17.11.6.7 OV Reac Half Ref  ID  3321
Reactive current injected to grid when power is above ID3315 and Line voltage above ID3300 but below ID3320.

P 2.17.11.6.8 OV Max Reactiv  %   ID  3301
Reactive current injected to grid when power is above ID3315 and voltage above ID3320. This level is kept until voltage is below ID3319.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.8.5 Q(U) Power

Reactive power reference based on grid voltage. Independently from Linear and Power Lock in modes. Priority is selected with P2.17.15.13 Current Priority.

\[ V_{\text{line}} [\%] \]

\[ I_{\text{react}} [\%] \]

\[ +100 \% \]

\[ 128 \% \]

\[ 110 \% \]

\[ 90 \% \]

\[ 50\% \]

\[ \text{High Min Voltage} \]

\[ \text{High Max Voltage} \]

\[ \text{High Max Q Power} \]

\[ \text{Low Max Voltage} \]

\[ \text{Low Min Voltage} \]

\[ +100 \% \]

\[ \text{P2.17.11.7.1 High Max Q Power ID3341} \]

Maximum reactive power when over voltage is at Max.

\[ \text{P2.17.11.7.2 High Max Voltage ID3340} \]

Over voltage level when maximum reactive power is injected to grid.

\[ \text{P2.17.11.7.3 High Min Voltage ID3339} \]

Over voltage level when reactive power is started to inject to grid.

\[ \text{P2.17.11.7.4 Low Max Voltage ID3343} \]

Under voltage level when reactive power is started to inject to grid.

\[ \text{P2.17.11.7.5 Low Min Voltage ID3342} \]

Under voltage level when maximum reactive power is injected to grid.

\[ \text{P2.17.11.7.6 Low Max Q Power ID3344} \]

Maximum reactive power when under voltage is at min.
5.16.8.6  **Q(U) Curve**


Use negative reference for low voltage, negative reactive reference tries to increase grid voltage.

![Diagram of Q(U) Curve]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reference Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 2.17.11.8.1 Voltage 01</td>
<td>% 3385</td>
</tr>
<tr>
<td>P 2.17.11.8.2 Q Power 01</td>
<td>% 3391</td>
</tr>
<tr>
<td>P 2.17.11.8.3 Voltage 02</td>
<td>% 3386</td>
</tr>
<tr>
<td>P 2.17.11.8.4 Q Power 02</td>
<td>% 3392</td>
</tr>
<tr>
<td>P 2.17.11.8.5 Voltage 03</td>
<td>% 3387</td>
</tr>
<tr>
<td>P 2.17.11.8.6 Q Power 03</td>
<td>% 3393</td>
</tr>
<tr>
<td>P 2.17.11.8.7 Voltage 04</td>
<td>% 3388</td>
</tr>
<tr>
<td>P 2.17.11.8.8 Q Power 04</td>
<td>% 3394</td>
</tr>
<tr>
<td>P 2.17.11.8.9 Voltage 05</td>
<td>% 3389</td>
</tr>
<tr>
<td>P 2.17.11.8.10 Q Power 05</td>
<td>% 3395</td>
</tr>
<tr>
<td>P 2.17.11.8.11 Voltage 06</td>
<td>% 3390</td>
</tr>
<tr>
<td>P 2.17.11.8.12 Q Power 06</td>
<td>% 3396</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.9 Power Limit/Reference

P 2.17.12.1 Power Ramp Up Rate  ID3324
Limits power increase rate. Negative value will disable power increase rate limiter.

P 2.17.12.2 Maximum Power with Grid Codes  ID3397
Maximum power that is allowed to use when Grid Codes are active.
5.16.9.1 High Frequency Power Limit
Select power limit behavior on high line frequency.

**P2.17.12.2.1 HighFreqModes**

Parameter select how minimum power limit is handled.

**0 = High Limit**
Power limit will follow set scaled line.

**1 = Minimum**
Power limit is kept at magnum level set by scaled line.
P2.17.12.2 HighFreqLowCornr % ID 3295
High Frequency Low Corner, limiting function is activated when this parameter is above 100.00 %.
Corner where power limiting is started on high line frequency. There is a 100 ms delay before limiting is started. Limiting delay can be adjusted with HighFreqLimOnDelay.

P2.17.12.3 HighFreqPLimSlop %/Hz ID 3239
High Frequency Power Limit Slope
Slope for power limit. If set to zero, function will use P2.17.12.1.9 High Freq High Corner and P2.17.12.1.10 High Freq Power Ratio. Use this parameter when power is needed to reduce with certain slope. Use P2.17.12.1.7 High Freq High Corner and P2.17.12.1.8 High Freq Power Ratio when power limits need to be in certain value at certain frequency.

P2.17.12.4 HighFreqLockOut % ID 3308
High Frequency Lock Out
Below this limit power limitation is stopped. P2.17.12.1.6 can be used to define delay before power limit is released.

P2.17.12.5 HighFreqPLimRamp %/s ID 3298
High Frequency Power Limit Ramp.
Power limit increase ramp rate used after power is released to normal operation.

P2.17.12.6 HighFreqPReleDel ms ID 3299
Delay how long limit is kept after frequency is below HighFreqLockOut.

P2.17.12.7 HighLFFullPRelDel ms ID3374
High Line Frequency Full Power Release Delay
When this is activated power is limited for this time to level where power was when High Frequency Low corner was exceeded.

P2.17.12.8 HighFreqLimOnDelay ms ID3402
High Frequency Limit On Delay.
This parameter defines delay before limiting of power is activated when frequency exceeds HighFreqLowCornr.
High Frequency Power Limit with absolute high frequency limit
This mode is active if HighFreqP limSlop is set to zero.

**P2.17.12.9 HighFreqHigCornr % ID 3296**
Frequency corner where minimum power limit is used. If power limitation is defined with slope use P2.17.1.1.3 parameter to define slope.

**P2.17.12.10 HighFreqPowRatio % ID 3309**
Power level in relation to actual power when ID3295 was exceeded to be used at ID3296 corner.
5.16.9.2 High Voltage Power Limit

**P2.17.12.3.1 Limit Mode ID3360**

Parameter select how minimum power limit is handled.

0 = High Limit

Power limit will fallow set scaled line.

1 = Minimum

Power limit is kept at minim level set by scaled line.
P2.17.12.3.2 Log In Voltage [%] ID3325
High voltage level when power will be started to limit by the defined slope. Power limit will not increase until voltage has gone below Log Out Voltage Level.

P2.17.12.3.3 Log Out Voltage [%] ID3326
Low Voltage Level where power limit is released if line voltage has increased above Log In Voltage Level.

P2.17.12.3.4 Limit Slope [%/%] ID3327
Defines slope for the power limit when voltage goes above Log In Voltage. Function is disabled when this parameter is zero.

P2.17.12.3.5 Power Limit Release Delay ID3424
Defines delay after power limit is released when voltage has gone below Log Out Voltage.

P2.17.12.3.6 Power Limit Release Ramp Rate ID3425
Ramp rate for power limit when released from High Voltage power limit function. if normal power increase rate if slow drive will follow the slowest ramp rate.
5.16.9.3 Low Voltage Charge Limit

This function will limit charging power when grid voltage decreases.

\[ P_{\text{ChargeMaxVolt}} \]

\[ P_{\text{ChargeMinVolt}} \]

\[ V_{\text{line}} \% \]

\[ P \% \]

\[ \text{Charge} \]

100 %

> 100 %

\[ P_{2.17.12.4.1 \ P_{\text{ChargeMaxVolt}}} \quad ID3347 \]

Voltage level where limiting is started. When this limit is reached charging power limit is lowered to 100 % is higher from some other function.

\[ P_{2.17.12.4.1 \ P_{\text{ChargeMinVolt}}} \quad ID3348 \]

Voltage level where charging power limit reached minimum level.
5.16.9.4 Low Frequency Charge Limit
This function will limit charging power when grid frequency decreases.

P2.17.12.5.1 PChargeLimitMode ID3354
Parameter to select if power limit changed linearly based on frequency or stays at reached minimum level until lock out frequency has been reached.

0 = High Limit

1 = Minimum
P2.17.12.5.2  \textit{PChargeMaxFreq}  ID3349  
Frequency point where charging limit is started to decrease starting from current active power level.

P2.17.12.5.3  \textit{PChargeMinFreq}  ID3350  
Frequency point where charging limit reached minimum.

P2.17.12.5.4  \textit{PChargeLogOutFreq} ID3351  
Frequency level where charging limit is released once limiting has been active.

P2.17.12.5.5  \textit{PChargeLogOutDelay}  ID3352  
Delay to release charging power limit once lock out frequency has been reached.

P2.17.12.5.6  \textit{PCharRefPRate}  ID3355  
Separate power increase rate for this function when power is released by this function.

P2.17.12.5.7  \textit{PChargeOnDelay}  ID3403  
Delay to activate Low Freq Charge Limit
5.16.9.5 Low Frequency Power Reserve

Power increase function when frequency decreases. When activated and frequency goes low, drive will activate Power PI controller and start to increase power.

\[ P \text{ [%]} - f_{\text{line}} \text{ [%]} \]

- PowerIncMax
- PowerIncRate
- PowerIncHighFreq

\[ P2.17.12.6.1 \text{ PowerIncHighFreq} \text{ [%]} \text{ ID3334} \]
Power Increase High Frequency
Frequency when power is started to increase.

\[ P2.17.12.6.2 \text{ PowerIncSlope} \text{ [%/%]} \text{ ID3335} \]
Power Increase Slope
Slope how steeply power is increased.

\[ P2.17.12.6.3 \text{ PowerInc Max} \text{ [%]} \text{ ID3336} \]
Power Increase Max
Limit for increased power.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.10 Cos Phi Control

**P 2.17.13.1 CosPhi1Mode**

- ID 3345
- 0 = Direct Reference
- 1 = Volt LogIn LogOut
- 2 = Act. Current

**P 2.17.13.2 CosPhi1Ref**

- ID 3304
- Direct Cos Phi reference. 1000=unity, 100=min, neg=capacitive
5.16.10.1 Lock In and Out control

Cos Phi control is used at over voltage situations. Controller is activated when voltage is above Lock In Voltage and Active Current is more than 50%. \(1.0\) ref at 50 % power and \(P:(\text{Max Cos Ref})\) at 100 % power.

![Graph of Lock In and Out control](image)

**P 2.17.13.3.1 LockInVoltage % ID 3305**

Voltage level when Cos Phi control is started.

**P 2.17.13.3.2 LockOutVoltage % ID 3306**

Voltage level when Cos Phi control is stopped.

**P 2.17.13.3.3 Max Cos Ref ID3346**

Cos Phi control used when power is at 100 %.

![Graph of Max Cos Ref](image)

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.16.10.2 Cos Phi Active Current Control

Cos Phi reference is started to adjust above 50 % power and reach value set by ID3346 at 100 % Power.

\[ \text{MaxCosRef} \]

\[ \text{MinCosRef} \]

\[ \text{CosRefMidPower} \]

\[ \text{P2.17.13.4.1 MinCosRefMinPower ID3357} \]
Minimum power where Min Cos Ref is used

\[ \text{P2.17.13.4.2 MinCosRef ID3356} \]
Cos Phi Reference at Min Power point.

\[ \text{P2.17.13.4.3 CosRefMidPower ID3358} \]
Middle power point where Cos Phi Ref is 1,000

\[ \text{P2.17.13.4.4 MaxCosRefMaxPower ID3359} \]
Maximum power where Max Cos Ref is used

\[ \text{P2.17.13.4.5 MaxCosRef ID3346} \]
Cos Phi Reference at maximum power point.
5.16.11 External Input

External input to make a trip and/or to activate separate frequency limits for tripping.

P 2.17.14.1 Ext GC Trip NO DigIN ID 3310
Direct digital input to activate Grid Code trip function. Normally Open.

P 2.17.14.2 Ext GC Trip NC DigIN ID 3398

P 2.17.14.3 SeparateFLimMon DigIn ID 3311
Digital input to active more strict frequency trip limits.

P 2.17.14.4 SepFreqHighLim % ID 3313
Frequency high limit used to Grid Code trip when digital input defined by ID3311 is active.

P 2.17.14.5 SepFreqLowLim % ID 3313
Frequency low limit used to Grid Code trip when digital input defined by ID3311 is active.
5.16.12 Grid Code Options

P.2.17.15.1 Grid Code Options
B00 = +1 = Activate this bit for Grid Code: GB/T 19964-2012.
B01 = +2 =

P.2.17.15.2 Voltage Filt. TC ms 3332
Filtering time constant for voltage that is used Grid Code monitoring.

P.2.17.15.3 Frequency Filt. TC ms 3333
Filtering time constant for frequency that is used Grid Code monitoring.

P.2.17.15.4 FRT Options 3400

P.2.17.15.5 Vac Stop Offset % 3337
With this is possible to give offset for Grid Code voltage in stop state.

P.2.17.15.6 Vac Run Offset % 3338
With this is possible to give offset for Grid Code voltage in run state.

P.2.17.15.7 Power Follower Hysteresis ID1529
Power follower hysteresis.

P.2.17.15.8 LVHighFiltTC ID3373

P.2.17.15.9 LineFreqLow TC ID3375

P.2.17.15.10 FRT Trig Level ID3382

P.2.17.15.11 Current x TC ID3409

P.2.17.15.12 LV Feedback Kp ID3420
P2.17.15.13  CurrentPrioritySel  ID3422

Select priority operation mode between Active Current, Reactive Current and Cos Phi Reference.

0 = Normal Operation
1 = Active Current Priority
2 = Reactive Current Priority
3 = Cos Phi Reference Priority
4 = Cos Phi and Reactive Current priority
6. **Keypad Control Parameters**

Unlike the parameters listed above, these parameters are located in the M3 menu of the control panel. The reference parameters do not have an ID number.

**P3.1 Control Place ID125 “Control Place”**

The active control place can be changed with this parameter. PC Control place can be only activated when from NCDrive when this parameter is set 2 / Keypad.

- 0 = PC Control, Activated by NCDrive
- 1 = I/O terminal
- 2 = Keypad
- 3 = Fieldbus
- 4 = SystemBus

On keypad control pressing Stop button more than a 2 second will open the MCB.

**P3.2 License Key ID1995 “License Key”**

Enter the licence key.

The standard AFE functions are available without a licence key. A licence key is not necessary for the frame FR4.
7. FB Status and Control in Detail

P2.10.19 State machine

1/ Basic

This mode makes fieldbus control operate as is explained in the fieldbus board manual.

Simple control word that is used in modes where the control word from fieldbus is used as such. For some fieldbus boards this requires bypass operation.

2/ Standard

This mode uses a ProfiDrive type state machine in the application level. It is possible to use this mode on fieldbus boards that do not have a state machine or have a possibility to bypass the state machine function on the option board.

3/ Vacon AFE 1

7.1 FB DC Reference

Fieldbus DC reference is available when the Grid Converter is in fieldbus control. The format is the same as in panel references. (11000 = 110 %). If reference is not used from fieldbus, set the “FBSpeedReference” to zero. When FB reference is zero, the drive will use DC Voltage Reference from keypad parameter.

7.2 State Machine: Basic

7.2.1 FB Control Word Basic

Table 17.

<table>
<thead>
<tr>
<th>FB Control Word: Basic</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Stop Request</td>
<td>Start Request</td>
<td>Use this for start and stop command</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b2 No Action</td>
<td>Fault Reset 0 &gt; 1</td>
<td>Use this for fault reset</td>
<td></td>
</tr>
<tr>
<td>b3 Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON</td>
<td>See P2.5.1.17 - 18</td>
<td></td>
</tr>
<tr>
<td>b4 Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.1.19 - 20</td>
<td></td>
</tr>
<tr>
<td>b5 Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.1.21 - 22</td>
<td></td>
</tr>
<tr>
<td>b6 Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.1.23 - 24</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B00: FALSE = Stop Request, TRUE = Start Request

Stop Request: Drive will stop modulating
Start Request: Drive will start modulating, rising edge needed after fault situation.

B02: FALSE = No Action, TRUE = Fault Reset

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**Fault Reset:** Resets active faults.

### 7.3 State Machine: Standard

#### 7.3.1 Control Word: Standard

Table 18.

<table>
<thead>
<tr>
<th>FB Control Word Standard</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Open CB</td>
<td>Charge DC</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>Stop Request</td>
<td>Run Request</td>
<td>Use this for start and stop command</td>
</tr>
<tr>
<td>b4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>No Action</td>
<td>Fault Reset (0 &gt; 1)</td>
<td>Use this for fault reset</td>
</tr>
<tr>
<td>b8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td>Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON</td>
<td>See P2.5.1.17 - 18 also WD Pulse</td>
</tr>
<tr>
<td>b12</td>
<td>Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.1.19 - 20</td>
</tr>
<tr>
<td>b13</td>
<td>Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.1.21 - 22</td>
</tr>
<tr>
<td>b14</td>
<td>Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.1.23 - 24</td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**B00:** FALSE = Open CB, TRUE = Charge DC

**Open CB:** The drive will stop modulating and open main circuit breaker.

**Charge DC:** The drive will start to precharge if the function is activated by a digital output and the control place is fieldbus. When charging is ready, the main circuit breaker is closed depending on "CB Close Mode" and "Enable CB Close" status. When the control place is not fieldbus, precharge is started at a normal start command.

**B03:** FALSE = Stop Request, TRUE = Start Request

**Stop Request:** The drive will stop.

**Start Request:** Start Command to the drive.

**B07:** FALSE = No Action, TRUE = Fault Reset

**Fault Reset:** Resets active faults.
7.4 State machine: Vacon AFE 1

7.4.1 Control Word: Vacon AFE 1

<table>
<thead>
<tr>
<th>FB Control Word Vacon AFE 1</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Open CB</td>
<td>Charge DC</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>Stop Request</td>
<td>Run Request</td>
<td>Use this for start and stop command</td>
</tr>
<tr>
<td>b4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>No Action</td>
<td>Fault Reset 0 &gt; 1</td>
<td>Use this for fault reset</td>
</tr>
<tr>
<td>b8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td>Field Bus Control Disable</td>
<td>Fieldbus Control Enable</td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td>Watchdog pulse FALSE</td>
<td>Watchdog pulse TRUE</td>
<td>0&gt;1&gt;0&gt;1...0.5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.</td>
</tr>
<tr>
<td>b12</td>
<td>Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.119 - 20</td>
</tr>
<tr>
<td>b13</td>
<td>Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.121 - 22</td>
</tr>
<tr>
<td>b14</td>
<td>Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.123 - 24</td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B00: FALSE = Open CB, TRUE = Charge DC
Open CB: The drive will stop modulating and open main circuit breaker.
Charge DC: The drive will start to precharge if the function is activated by a digital output and the control place is fieldbus. When charging is ready, the main circuit breaker is closed depending on “CB Close Mode” and “Enable CB Close” status.
When the control place is not fieldbus, precharge is started at a normal start command.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: The drive will stop.
Start Request: Start Command to the drive.

B07: FALSE = No Action, TRUE = Fault Reset
Fault Reset: Resets active faults.

B10: FALSE = FB Control disabled TRUE = FB Control Enabled
FB Control Disabled: The drive will not follow the main control word from fieldbus. If removed while running, the drive will stop.
FB Control Enabled: The drive follows the control word from fieldbus.

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High
Watchdog pulse: This pulse is used to monitor that PLC is alive. If the pulse is missing, the drive will go to FAULT state. This function is activated by P2.9.4.3 FB WD Delay. When the value is zero, the pulse is not monitored.
### 7.5 FB Status Word

<table>
<thead>
<tr>
<th>Status Word ID68</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>DC Charge Disabled</td>
<td>Ready to DC Charge</td>
<td>Drive own DC charge function disabled if FALSE</td>
</tr>
<tr>
<td>b1</td>
<td>Not ready to operate</td>
<td>Ready to operate</td>
<td>DC Charged and main CB closed.</td>
</tr>
<tr>
<td>b2</td>
<td>Not Running</td>
<td>Running</td>
<td>Drive in Run state</td>
</tr>
<tr>
<td>b3</td>
<td>No Fault</td>
<td>Fault</td>
<td>Fault Active</td>
</tr>
<tr>
<td>b4</td>
<td>Run Disabled</td>
<td>Run Enabled</td>
<td>Run Enable</td>
</tr>
<tr>
<td>b5</td>
<td>Quick stop active</td>
<td>Quick stop not active</td>
<td>Quick stop active</td>
</tr>
<tr>
<td>b6</td>
<td>CB Control OK</td>
<td>CB Control NOT OK</td>
<td>CB Requested open but DC stays high</td>
</tr>
<tr>
<td>b7</td>
<td>No Warning</td>
<td>Warning</td>
<td>Warning Active</td>
</tr>
<tr>
<td>b8</td>
<td>DC Act. &lt;= DC Ref.</td>
<td>DC Act. = DC Ref.</td>
<td>DC at reference</td>
</tr>
<tr>
<td>b9</td>
<td>No FB Control request</td>
<td>FB Control Active</td>
<td>FB Control request accepted</td>
</tr>
<tr>
<td>b10</td>
<td>DC Below Limit</td>
<td>DC Above Limit</td>
<td>DC above set limit</td>
</tr>
<tr>
<td>b11</td>
<td>SWID.Bit selection B11</td>
<td>P2.13.22 SWB11 ID.Bit</td>
<td>SWID.Bit selection B11</td>
</tr>
<tr>
<td>b12</td>
<td>SWID.Bit selection B12</td>
<td>P2.13.23 SWB12 ID.Bit</td>
<td>SWID.Bit selection B12</td>
</tr>
<tr>
<td>b13</td>
<td>SWID.Bit selection B13</td>
<td>P2.13.24 SWB13 ID.Bit</td>
<td>SWID.Bit selection B13</td>
</tr>
<tr>
<td>b14</td>
<td>SWID.Bit selection B14</td>
<td>P2.13.25 SWB14 ID.Bit</td>
<td>SWID.Bit selection B14</td>
</tr>
<tr>
<td>b15</td>
<td>Watchdog feedback</td>
<td>Watchdog feedback</td>
<td>WD Feedback pulse</td>
</tr>
</tbody>
</table>

SM = Profibus board State Machine

**B00: FALSE = DC Charge Disabled, TRUE = Ready to DC Charge**
- **DC Charge Disabled**: Fault active, CB requested open, for example, by "Open CB" Command or Quick Stop.
- **DC Charge Enabled**: No fault active and no request to open CB.

**B01: FALSE = Not Ready To Operate, TRUE = Ready To Operate**
- **Not Ready To Operate**: CB not closed or not allowed to close.
- **Ready To Operate**: CB closed.

**B02: FALSE = Drive is not operating, TRUE = Drive is operational**
- **Drive is not operating**: The drive is not in RUN state (not modulating)
- **Drive is operational**: The drive is in RUN state and modulating.

**B03: FALSE = No Fault, TRUE = Fault Present**
- **No Fault**: The drive is not on FAULT state.
- **Fault Present**: The drive is in FAULT state.

**B04: FALSE = Run Disabled, TRUE = Run Enabled**
- **Run Disabled**: The drive does not receive Run Enable command, for example from the Run Enable digital input.
- **Run Enabled**: Run Command is enabled.

**B05: FALSE = Quick Stop Activated, TRUE = Quick Stop Not Activated**
- **Quick Stop Activated**: Quick Stop command is active.
- **Quick Stop Not Activated**: Quick stop command is not active.
B0: FALSE = CB Control OK, TRUE = CB Control Not OK
CB Control OK: CB control and the drive internal status are the same.
CB Control Not OK: The drive internal status to close the circuit breaker is high but the application logic requests for the circuit breaker to open. This can be the case when CB has been opened but DC is connected to battery system. DC must be discharged, or CB must close.

B07: FALSE = No Warning, TRUE = Warning Present
No Warning: There is no warning, or the warning has disappeared again.
Warning Present: The drive operates, but there is an active warning.

B08: FALSE = DC Voltage out of tolerance TRUE = DC Voltage within tolerance
DC Error Out Of Tolerance Range
DC Error Within Tolerance Range

B09: FALSE = No Control Requested, TRUE = Control Requested
No Control Requested: Control by the automation system is not possible, only possible at the device or by another interface.
Control Requested: The automation system is requested to assume control.

B10: FALSE = DC Not Reached, TRUE = DC Reached Or Exceeded
DC Not Reached: DC is below P.2.5.7.4 DC Voltage Supervision Limit.
DC Reached Or Exceeded: DC is above P.2.5.7.4 DC Voltage Supervision Limit.

B11: FALSE = SWID.Bit selection B11, TRUE = SWID.Bit selection B11
SWID.Bit selection B11 Low: Selected bit is low.
SWID.Bit selection B11 High: Selected bit is high.

B12: FALSE = SWID.Bit selection B12, TRUE = SWID.Bit selection B12
SWID.Bit selection B12 Low: Selected bit is low.
SWID.Bit selection B12 High: Selected bit is high.

B13: FALSE = SWID.Bit selection B13, TRUE = SWID.Bit selection B13
SWID.Bit selection B13 Low: Selected bit is low.
SWID.Bit selection B13 High: Selected bit is high.

B14: FALSE = SWID.Bit selection B14, TRUE = SWID.Bit selection B14
SWID.Bit selection B14 Low: Selected bit is low.
SWID.Bit selection B14 High: Selected bit is high.

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 the communication status from the drive.
8. Problem solving

While proper information is needed from the problem, it is 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).

<table>
<thead>
<tr>
<th>Type</th>
<th>Signal Name</th>
<th>Actual</th>
<th>Unit</th>
<th>Mi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Status Word</td>
<td>1890</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>DC Voltage Act.</td>
<td>119.81</td>
<td>Decimal</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Active Current</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Reactive Current</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Line Voltage GC</td>
<td>100.42</td>
<td>60,00</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Line Freq. GC</td>
<td>100</td>
<td>60,00</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Line State</td>
<td>3991.2</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Value</td>
<td>Mindex</td>
<td>99.5</td>
<td>%</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Figure 18. The recommended signals for NCDrive*

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 a 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 is 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 is also helpful to have a single line diagram from the system where problem is faced.

*Figure 19. Datalogger window opening and Service Info upload.*
9. Fault codes

This chapter includes all the fault codes. However, some faults are not possible in the AFE mode. With other faults, the description can be different when compared to a standard AC drive.

F1 Over current fault
The drive has detected a high current in the output phase.
S1 = Hardware trip.
Current above 4*Ih
S3 = Current controller supervision.
Current limit too low or current peak value too high.

Possible cause
- Sudden change in grid frequency.
- Sudden change in grid voltage.
- Short circuit in grid while Short Circuit function is not active.

Correcting measures
- Check grid conditions load.
- Activate Short Circuit function.

F2 Overvoltage fault
DC link voltage has exceeded the drive protection limits.
S1 = Hardware trip.
500 Vac unit DC voltage above 911 Vdc
690 Vac unit DC voltage above 1200 Vdc
S2 = Overvoltage control supervision (only 690 Vac unit).
DC voltage has been above 1100 Vdc for too long.

Possible cause and solutions
- Sudden change in supply voltage or frequency.
- Unstable DC power source in uGrid mode.
- Wrong Grid frequency.

Correcting measures
- Check supply voltage.
- Check DC source.
- Check grid conditions.
**F3 Earth fault**

Earth fault protection makes sure that the sum of the motor phase currents is 0. The over current protection is always working and protects the AC drive from earth faults with high currents.

S1 = Sum of output phase current is not zero.

**Possible cause**
- No transformer on the input/output side.
- Insulation failure.

**Correcting measures**
- Contact factory.

**F5 Charge switch**

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

S1 = Charge switch was open when the start command was given.

**Possible cause**
- Charge switch was open when the start command was given.
- Reset the fault and restart.

**Correcting measures**
- Check the connection of the feedback from charging relay
- If the fault re-occurs, contact your local distributor.

**F6 Emergency stop**

Emergency stop command has been given by using a special option board.

**F7 Saturation fault**

S1 = Hardware failure.

**Possible cause and solutions**

**Correcting measures**
- Check the isolation resistance and the resistance on the brake resistor.
- Check the capacitors.
F8 System Fault

A system fault indicates that there are several different fault situations in the drive operation.

- 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 is broken.
- FR9 and the bigger drives, which includes not star coupler, ASIC board (VB00451), is broken.
- FR8 and smaller drives: control board is broken.
- FR8 and smaller drives: if there are boards VB00449 / VB00450, the fault can be there.

S1 = Reserved
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 synchronisation 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

Possible cause and solutions

Correcting measures

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**F9 Undervoltage fault**

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

- S1 = DC link too low during the run.
- S2 = No data from the power unit.
- S3 = Undervoltage control supervision.

**Possible cause**
- Too low a supply voltage.
- AC drive internal fault.
- One of the input fuses is broken.
- External charge switch has not been closed.

**Correcting measures**
- In case of temporary supply voltage break, reset the fault and restart the AC drive.
- Check supply voltage.
- Check the operation of the DC charge.
- Contact your local distributor.

**F10 Line Synchronization Fault**

- S1 = Phase supervision diode supply.
- S2 = Phase supervision active front end.
- S3 = Grid Converter operation, frequency outside frequency limits (G2.6.3).

**Possible cause:**
- Input line phase is missing.
- No grid to be synchronized
- Slow power increase in a grid and limit controllers has activated.
- Power or current limits too low for the active load.

**Correcting measures**
- Check supply voltage, fuses and cable.
- Check drive dimensioning against grid power requirements.
- Check that power or current limits are sufficient.

**F11 Line phase supervision**

**Possible cause:**
- Current measurement has detected that there is no current in one phase, or one phase current is considerably different from other phases.

**Correcting measures**
- Check the line cable and the fuses.
**F12  Brake chopper supervision**

Brake chopper supervision generates pulses to the brake resistor for response. If no response is received within set limits, a fault is generated.

**Possible cause:**
- No brake resistor is installed.
- The brake resistor is broken.
- Brake chopper failure.

**Correcting measures:**
- Check the brake resistor and the cabling.
- If these are ok, the chopper is faulty. Contact your local distributor.

**F13  Drive undertemperature fault**

Possible cause:
- Heatsink temperature is under \(-10^\circ C\)

**Correcting measures:**
- Add cabinet heater to prevent too cold temperatures and condensation.

**F14  Drive overtemperature fault**

Possible cause:
- Heatsink temperature is above the acceptable limits. See the user manual for the temperature limit. Overtemperature warning is issued before the actual trip limit is reached.

**Correcting measures**
- Check correct amount and flow of cooling air.
- Check the heatsink for dust.
- Check ambient temperature.
- Make sure that switching frequency is not too high in relation to ambient temperature and motor load.

**F22  EEPROM checksum fault**

Possible cause:
- Parameter save fault.
- Faulty operation.
- Component failure.

**Correcting measures:**
- If the fault re-occurs, contact your local distributor.
F24 **Counter fault**

**Possible cause:**
- Values displayed on the counters are incorrect.

**Correcting measures:**
- Have a critical attitude towards values shown on the counters.

F25 **Microprocessor watchdog fault**

**Possible cause:**
- Start-up of the drive has been prevented.
- Run request is ON when a new application is loaded to the drive.

**Correcting measures:**
- Reset the fault and restart.
- If the fault re-occurs, contact your local distributor.

F26 **Start-Up prevention**

**Possible cause:**
- Start-up of the drive has been prevented.
- Run request is ON when a new application is loaded to drive

**Correcting measures:**
- Cancel the prevention of the start-up if this can be done safely.
- Remove Run Request.

F29 **Thermistor fault**

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

**Possible cause:**
- LCL is overheated.
- Thermistor cable is broken.

**Correcting measures:**
- Check LCL cooling and load.
- 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 overtemperature protection has detected too high a short term overload current.

Possible cause:
- Too high a load.
- Identification run has not been made, which causes the motor to start undermagnetised.

Correcting measures:
- Check the load.
- Check the motor size.
- Make an Identification Run.

**F32  Fan cooling**

Possible cause:
- Cooling fan of the AC drive does not start when ON command is given.

Correcting measures:
- Contact your local distributor.

**F37  Device change**

Option board or power unit is changed.

Possible cause:
- New device of same type and rating.

Correcting measures:
- Reset. The device is ready for use.

**F38  Device added**

Option board is added.

Correcting measures:
- Reset. The device is ready for use. Old board settings will be used.

**F39  Device removed**

Possible cause:
- Option board is removed.

Correcting measures:
- Reset. The device is no longer available.
F40  *Device unknown*
An unknown option board or drive.
S1 = Unknown device.
S2 = Power1 not same type as Power2.

**Correcting measures:**
- Contact your local distributor.

F41  *IGBT temperature*
IGBT inverter bridge overtemperature protection has detected too high a short term overload current.

**Correcting measures:**
- Check the load.
- Check the motor size.
- Make an Identification Run.

F42  *Brake resistor overtemperature*
S1: Brake resistor high temperature.
Calculation for an internal brake resistor has exceeded the tripping limit. If the internal brake resistor is not in use, set the brake chopper parameter in System menu to *Not connected*.
S2: Brake resistor resistance is too high.
S3: Brake resistor resistance is too low.
S4: No brake resistor detected.

F44  *Device changed (Default param.)*
**Possible cause:**
- Option board or power unit is changed.
- New device of different type or different rating from the previous one.

**Correcting measures:**
- Reset.
- Set the option board parameters again if option board was changed. Set the drive parameters again if the power unit was changed.

F45  *Device added (Default param.)*
**Possible cause:**
- Option board of different type added.

**Correcting measures:**
- Reset.
- Set the option board parameters again.
**F50 4mA supervision**

Possible cause:
- Current at the analogue input is below 4mA.
- Signal source has failed.
- Control cable is broken or loose.

Correcting measures:
- Check the current loop circuitry.

**F51 External fault**

Possible cause:
- Digital input fault.

Correcting measures:
- Remove fault situation from the external device.

**F52 Keypad communication**

Possible cause:
- The connection between the control panel (Keypad) or NCDrive and the AC drive is broken.

Correcting measures:
- Check control panel connection and possible control panel cable.

**F53 Fieldbus communication fault on slot D**

Possible cause:
- The data connection between the fieldbus Master and the fieldbus board is broken.
- Watchdog pulse is missing from PLC, if Control Slot selector is 0, or set for slot D.

Correcting measures:
- Check installation.
- If installation is correct, contact your local distributor.

**F54 Slot fault**

Possible cause:
- Defective option board or slot.

Correcting measures:
- Check the board and the slot.
- Contact your local distributor.
F56  PT100 temperature fault
The PT100 protection function is used to measure temperature and give a warning and/or a fault when the set limits are exceeded. The marine application supports two PT100 boards. One can be used for the motor winding and the other for the motor bearings.

Possible cause:
- Temperature limit values set for the PT100 board parameters have been exceeded.
Correcting measures:
- Find the cause of temperature rise.

F57  Identification (Not implemented)
Identification run has failed.

Possible cause:
- There was load on the motor shaft when making the identification run with a rotating motor.
- Motoring or generator side torque/power limits are too low to achieve a stable run.

Correcting measures:
- Run command was removed before the identification was ready.
- Motor is not connected to the AC drive.
- There is load on the motor shaft.

F58  Mechanical brake (Not implemented)
This fault is generated when the acknowledge signal from the brake is used. If the status of the signal is opposite from the control signal for a longer period of time than the delay defined with P2.15.11 Brake Fault Delay, a fault is generated.

Correcting measures:
- Check the condition and connections of the mechanical brake.

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:
- The cooling circulation of a liquid-cooled drive has failed.

Correcting measures:
- Check reason for cooling failure from the external system.

F62  Run Disabled
A Run Disable warning signal is issued when a Run Enable signal has been removed from the I/O.
**F63  Quick stop**

Possible cause:
- A command has been given from a digital input or the fieldbus to make a quick stop.

Correcting measures:
- A new run command is accepted after the quick stop is reset.

**F64  MCB State Fault**

This function monitors the MCB status. Feedback status should correspond to the control signal. The delay to fault is defined by P2.9.1.13 MCB Fault Delay for A2 and A3. A4 is immediately.

A1: Code given by V084 and older versions.
A2: MCB open while request is to close.
A3: MCB closed while request is to open.
A4: MCB opened externally while AFE unit was in run state.

Possible cause:
- Main circuit breaker has opened while drive controls it to close.
- Main circuit breaker has closed while drive controls it to be open.

Correcting measures:
- Check the main circuit breaker function.

**F65  PT100 board 2**

The PT100 protection function is used to measure temperature and give a warning and/or a fault when the set limits are exceeded. The marine application supports two PT100 boards. One can be used for the motor winding and the other for the motor bearings.

Possible cause:
- The temperature limit values set for the PT100 board parameters have been exceeded.
- The number of inputs selected is higher than what is actually connected.
- PT100 cable is broken.

**F67  Fieldbus communication fault on slot E**

Possible cause:
- The data connection between the fieldbus Master and the fieldbus board is broken.
- Watchdog pulse is missing from PLC, if Control Slot Selector is 0, or set for slot E.

Correcting measures:
- Check installation.
- If installation is correct contact your local distributor.

**F68  D7 Voltage or frequency fault**

This monitors Grid frequency and voltage for synchronization function.

Possible cause:
- OPT-D7 measurements are not within limits.

**F69  OPT-D7 Missing**
OPT-D7 board is not present for the function that is requested.

**Possible cause:**
**Correcting measures:**

**F70  Supply Voltage**
Supply voltage is not inside of set hysteresis. Not to be confused with OPT-D7 protections.

**F71  LCL Temperature**
LCL Temperature has reached the warning limit.

**Possible cause:**
**Correcting measures:**

**F72  License**
Licence has not been given or licence key is wrong

**Possible cause:**
**Correcting measures:**
**F73  Supply Frequency**
Supply frequency is not inside of set hysteresis, set in G2.9.7. Not to be confused with OPT-D7 protections that will give F93 D7 Frequency.

Possible cause:
- Slow power increase in a grid and limit controllers activated.
- Power or current limits too low for the active load.
- Not sufficient DC voltage to keep grid voltage, compensated by lowering Supply Frequency to avoid reactive current.

Correcting measures
- Check drive dimensioning against grid power requirements.
- Check that power or current limits are sufficient.
- Check that sufficient DC voltage is available for the unit.

**F77  DC Ground Fault**
Digital input indicated that system has a DC Ground Fault

Possible cause:
- Digital input has triggered DC Ground Fault indication in the drive.

Correcting measures
- Check reason for DC Ground Fault indication.

**F80  Charging Fault**
The drive has not reached the required DC voltage at time set to MCB.

Possible cause:
- Charging circuit not operational.
- High load in DC link.
- Low voltage in supply for charging circuit.

Correcting measures:
- Check charging current

**F81  External Fault 2**
Digital input fault.

Possible cause:

Correcting measures:
- Remove fault situation from external device.

**F83  Over Load**
Over Load protection has reached tripping limit. See Chapter 5.9.9 Over Load Protection.
F89  Grid Side Fault
In Master-Follower Mode Grid side drive has an active fault that is shown in master drive as a fault.
Possible cause:
Correcting measures:

F91  Short Circuit
Drive has operated against current limit for more than short circuit time.
By phase fault detection has seen low voltage for more than short circuit time.
Warning comes immediately when current is at current limit, fault comes after the short circuit time.

A1: Code given by V089 and older versions.
A2: Bi Phase
A3: Three Phase

Possible cause:
- There is a short circuit in the grid.

Correcting measures:

F92  D7 Voltage
Measured voltage is not within limits set in the protection group Grid Voltage D7
Possible cause:
- Voltage reference is below set limit.
- Supply Voltage is below set limit.
- There is a short circuit in the grid.
- OPT-D7 is installed but not connected.
  • Monitoring can be disabled with Control Options.

F93  D7 Frequency
Measured frequency is not within limits set in protection group Grid Frequency.
Possible cause:
- OPT-D7 is installed but measurements are not connected.
  • Monitoring can be disabled with Control Options.
- Grid frequency has gone outside the set limits.

F95  Grid Code
Grid Code tripping limit has been reached.
A1: Grid Code license wrong or not give.
A2: Line Voltage High Level 1
A3: Line Voltage High Level 2
A4: Line Voltage Low Level 1
A5: Line Voltage Low Level 2
A6: Line Frequency High Level 1
A7: Line Frequency High Level 2
A8: Line Frequency Low Level 1
A9: Line Frequency Low Level 2
A10: LVRT Three Phase trip.
A11: LVRT Bi-Phase trip
A12: Separate limits or forded trip
A13: Line Frequency change rate trip.
A14: 10 Min Average high voltage trip
F15: Grid Code enabled but no OPT-D7 installed.
A16: Line Voltage High 3 Trip
A17: Line Voltage Low 3 Trip
A18: Line Frequency High 3 Trip
A19: Line Frequency Low 3 Trip
A20: Anti-Islanding Trip
A21: Bi-Phase High Voltage 1 Trip
A22: Bi-Phase High Voltage 2 Trip
A23: Bi-Phase High Voltage 3 Trip
A24: Bi-Phase Low Voltage 1 Trip
A25: Bi-Phase Low Voltage 2 Trip
A26: Bi-Phase Low Voltage 3 Trip
A27: Line Voltage Low 4 Trip
A28. Bi-Phase Low Voltage 4 Trip