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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.

**Figure 1.**

**Figure 2.**

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

\[ \begin{array}{c|c|c|c}
\text{Related Load} & \text{Loading} & \text{Un-loading} & \text{Drooping} \\
\hline
\text{Freq. Change} & 25\% & 50\% & 75\% & 100\% \\
\text{52.0 Hz} & +4\% & & & \\
\text{51.5 Hz} & +3\% & & & \\
\text{51.0 Hz} & +2\% & & & \\
\text{50.5 Hz} & +1\% & & & \\
\text{50.0 Hz} & 0\% & & & \\
\text{49.5 Hz} & -1\% & & & \\
\text{49.0 Hz} & -2\% & & & \\
\text{48.5 Hz} & -3\% & & & \\
\text{48.0 Hz} & -4\% & & & \\
\end{array} \]

*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 Shaft Generator

The shaft generator is a system where the generator is connected to the main engine shaft that also runs the main propulsion. The disadvantage is that the main engine must run at nominal speed even if full power to the propeller is not necessary.

With the shaft generator system power goes through the drives. One converts power from the generator to DC link, and the other makes a ship grid with constant 50 Hz or 60 Hz, thus there is no direct connection to the generator. The main engine can run at a more efficient speed without changing grid frequency.

One drive operates as an AFE on the generator side and the other operates on Island mode or Micro Grid mode on the grid side.

- The start command to generator side drive.
- Both drives can make DC charging if powered by +24 Vdc.
- When DC is at an 80% of nominal, the generator side and the grid side breakers close.
- The generator side AFE is started to boost DC first.
- The grid side Grid Converter is started and will synchronise to grid.
- The drives take power from the bypass, and the PMS opens the SG contactor.
- You can decrease the speed of the main diesel engine to be more economical.

NOTE! If it is necessary to have these systems in parallel, the system bus communication is reserved for parallel Micro Grid units on the grid side. The control must be arranged separately for each drive.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
1.5 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 Micro Grid 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 6.

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.

1.5.1 Quick Start Instructions

1. Connect the unit according to the Figure 6.
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.

1.5.2 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 6. Connection
1.6 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.
1.7 Main circuit breaker control (MCB)

The Micro Grid application controls the circuit breaker of the system with the relay output R02. 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=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.

*Nominal DC Voltage = Grid Nom Voltage (P2.1.1) * 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. MCB Feedback can be monitored from Status Word B10.

**NOTE!** If feedback is not used there will be three second forced delay on internally generated MCB feedback signal. MCB Feedback can be monitored from Status Word B10.
1.8 **Start Sequence**

![Start Sequence Diagram]

*Figure 7. AFE start sequence*
1.9  **Stop sequence**

![Stop sequence diagram](image)

**Figure 8.** *Stop sequence*
1.10 **AFE mode; Start Stop timing diagram**

Above example when "Standard" state machine is used. With "Basic" state machine operation is like in IO Control.
### 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: \(400\text{ Vac} \times 50\% \times 15\% \times 15\% = 4.5\text{ Vac}\)
- Total Increase: \(18\text{ Vac} + 4.5\text{ Vac} = 22.5\text{ Vac}\)

See also document: Voltage Compensation Vxxx.pdf.
1.12 OPT-D7

OPT-D7 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 APFIFF44 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

Update Note 3: If OPT-D7 PI voltage control is needed in uGrid mode, do not use versions V082 or V083.

V092
- Major Compatibility Issue: P2.1.7 System Nom. DC is initialized to unit nominal DC value.
  - 500 Vac unit: 675 Vdc
  - 690 Vac unit: 931 Vdc
  - When a transformer ratio other than 1:1 MCB closing limit was given and DC-Link Voltage reference had values based on grid voltage after transformer. This was causing reference handling problems when given AC values were in range of different voltage class unit.
  - DC Voltage Reference in AFE mode is based always to System Nom DC parameter.

V089
- Compatibility Issue: Voltage MotPot is adjusting now field weakening point voltage. Units have been changed from [V] to [%]. This enables more accurate adjustment and adjustment rate.

V087
- Minor Compatibility Issue: FB Actual Speed signal changed to use Filtered DC-Link Voltage signal (ID1108) instead of unfiltered DC Voltage signal.

V081
- Compatibility Issue: Parameters “PID Activation” and “FreqScaleMinA0” had same ID1807. “FreqScaleMinA0” DI changed to ID1809.
- Major Compatibility Issue: Fieldbus State Machine
  - See full details from latest manual.
  - Not Used -> Basic, As in Fieldbus manual
  - Standard -> NEW Standard, Application level, this was < V081 Basic, as in fieldbus manual.
  - FB Status and FB Control word modified to be more suitable for AFE use, following idea of ProfiDrive standard.

V080
- Minor compatibility issue: Monitoring and parameter values unified with other premium drive applications.

V128
- Minor compatibility issue: P2.7.8 Control Options2 B1 is no longer available, this has been replaced with P2.9.1.15 FaultWarnIndicat parameter.
2. Control I/O

Table 1. Minimum recommended I/O configuration.

<table>
<thead>
<tr>
<th>OPT-A1</th>
<th>Description</th>
<th>Terminal</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+10V_ref</td>
<td>+10V_ref</td>
<td>Reference voltage output</td>
</tr>
<tr>
<td>2</td>
<td>AI1+</td>
<td>AI1+</td>
<td>Analogue input 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 0-10V, R_i = 200Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 0-20mA, R_i = 2500Ω</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>AI2+</td>
<td>Analogue input 2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 0-10V, R_i = 200Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 0-20mA, R_i = 2500Ω</td>
</tr>
<tr>
<td>5</td>
<td>+24V</td>
<td>+24V</td>
<td>Control voltage output</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voltage for switches, etc. max 0.1 A</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>I/O ground</td>
<td>Ground for reference and controls</td>
</tr>
<tr>
<td>7</td>
<td>DIN1</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DIN2</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>DIN3</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CMA</td>
<td>Common for DIN 1–DIN 3</td>
<td>Connect to GND or +24V</td>
</tr>
<tr>
<td>11</td>
<td>+24V</td>
<td>Control voltage output</td>
<td>Voltage for switches (see #6)</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>I/O ground</td>
<td>Ground for reference and controls</td>
</tr>
<tr>
<td>13</td>
<td>DIN4</td>
<td>MCB Feedback</td>
<td>Programmable G2.2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 = MCB open</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 = MCB closed</td>
</tr>
<tr>
<td>14</td>
<td>DIN5</td>
<td>Quick Stop</td>
<td>Programmable G2.2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 = Quick Stop Active</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 = No Quick Stop</td>
</tr>
<tr>
<td>15</td>
<td>DIN6</td>
<td>Programmable G2.2.1</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>CMB</td>
<td>Common for DIN4–DIN6</td>
<td>Connect to GND or +24V</td>
</tr>
<tr>
<td>17</td>
<td>AO1+</td>
<td>Analogue output 1</td>
<td>Programmable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Range 0–20mA/R_o, max. 500Ω</td>
</tr>
<tr>
<td>18</td>
<td>AO1-</td>
<td>Digital output</td>
<td>Programmable P2.3.1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Open collector, I≤50mA, U≤48 VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPT-A2</th>
<th>Description</th>
<th>Terminal</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>RO1</td>
<td>Relay output 1</td>
<td>Programmable P2.3.1.2</td>
</tr>
<tr>
<td>22</td>
<td>RO1</td>
<td></td>
<td>Switching capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24 VDC / 8 A</td>
</tr>
<tr>
<td>23</td>
<td>RO1</td>
<td></td>
<td>250 VAC / 8A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>125 VDC / 0.4 A</td>
</tr>
<tr>
<td>24</td>
<td>RO2</td>
<td>Relay output 2</td>
<td>MCB control</td>
</tr>
<tr>
<td>25</td>
<td>RO2</td>
<td></td>
<td>This RO is not programmable.</td>
</tr>
<tr>
<td>26</td>
<td>RO2</td>
<td></td>
<td>Fixed for MCB Control (Close)</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
3. **“Terminal To Function” (TTF) Programming Principle“**

The programming principle of the input and output signals in the Multipurpose Control Application NXP as well as in the Pump and Fan Control Application (and partly in the other applications) is different compared to the conventional method used in other VACON® NX applications.

In the conventional programming method, Function to Terminal Programming Method (FTT), you have a fixed input or output that you define a certain function for. The applications mentioned above, however, use the Terminal to Function Programming method (TTF) in which the programming process is carried out the other way round: Functions appear as parameters which the operator defines a certain input/output for. See Warning on page 12.

3.1 **Defining an Input/Output for a Certain Function on Keypad**

Connecting a certain input or output with a certain function (parameter) is done by giving the parameter an appropriate value. The value is formed of the Board slot on the VACON® NX control board (see VACON® NX User Manual) and the respective signal number, see below.

**Example:** You want to connect the digital output function Reference fault/warning (parameter 2.3.3.7) to the digital output DO1 on the basic board NXOPTA1 (see VACON® NX User Manual).

First find the parameter 2.3.3.7 on the keypad. Press the Menu button right once to enter the edit mode. On the value line, you will see the terminal type on the left (DigIN, DigOUT, An.IN, An.OUT) and on the right, the present input/output the function is connected to (B.3, A.2 etc.), or if not connected, a value (0.#).

When the value is blinking, hold down the Browser button up or down to find the desired board slot and signal number. The program will scroll the board slots starting from 0 and proceeding from A to E and the I/O selection from 1 to 10.

Once you have set the desired value, press the Enter button once to confirm the change.
3.2 Defining a terminal for a certain function with NCDrive programming tool

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

![Screenshot of NCDrive programming tool; Entering the address code](image)

Figure 3.1. Screenshot of NCDrive programming tool; Entering the address code

Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

**Note:** The inputs, unlike the outputs, cannot be changed in RUN state.
4. Monitoring Signals

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

4.1 Monitoring Value Tables

4.1.1 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>V1.11</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>V1.12</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>V1.13</td>
<td>DC Voltage Act.</td>
<td>%</td>
<td>#.#</td>
<td>7</td>
<td>Same scaling as DC Voltage Ref.</td>
</tr>
<tr>
<td>V1.14</td>
<td>Total Current</td>
<td>A</td>
<td>Varies</td>
<td>1104</td>
<td>Filtered current</td>
</tr>
<tr>
<td>V1.15</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>V1.16</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>V1.17</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>V1.18</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>V1.19</td>
<td>Status Word</td>
<td>#</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>V1.10</td>
<td>Supply Frequency</td>
<td>Hz</td>
<td>#.#</td>
<td>1</td>
<td>Drive output frequency</td>
</tr>
<tr>
<td>V1.11</td>
<td>Supply Voltage</td>
<td>V</td>
<td>#.#</td>
<td>1107</td>
<td>Drive output voltage</td>
</tr>
<tr>
<td>V1.12</td>
<td>Line Frequency D7</td>
<td>Hz</td>
<td>#.#</td>
<td>1654</td>
<td>Measured line frequency</td>
</tr>
<tr>
<td>V1.13</td>
<td>Line Voltage D7</td>
<td>V</td>
<td>#</td>
<td>1650</td>
<td>Measured line voltage</td>
</tr>
<tr>
<td>V1.14</td>
<td>AC Voltage Reference</td>
<td>V</td>
<td>#</td>
<td>1556</td>
<td>Used AC Voltage Reference</td>
</tr>
<tr>
<td>V1.15</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>
### 4.1.2 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>
<tr>
<td>V1.2.2</td>
<td>Operation Mode</td>
<td></td>
<td>#</td>
<td>1615</td>
<td>0 = AFE 1 = Island 2 = Micro Grid</td>
</tr>
<tr>
<td>V1.2.3</td>
<td>Used Current Ref</td>
<td>%</td>
<td>#.#</td>
<td>1704</td>
<td>Used current reference is negated to parameter value. Made to compare values in NCDrive easier to Active current</td>
</tr>
<tr>
<td>V1.2.4</td>
<td>D7 Synch. Error</td>
<td></td>
<td>#</td>
<td>1659</td>
<td>Synchronisation error to external grid</td>
</tr>
<tr>
<td>V1.2.5</td>
<td>Cos Phi Actual</td>
<td></td>
<td>#.###</td>
<td>1706</td>
<td></td>
</tr>
<tr>
<td>V1.2.6</td>
<td>Unit Temperature</td>
<td>°C</td>
<td>#</td>
<td>1109</td>
<td></td>
</tr>
<tr>
<td>V1.2.7</td>
<td>Freq. Reference</td>
<td>Hz</td>
<td>#.#</td>
<td>1752</td>
<td>Used line frequency reference</td>
</tr>
<tr>
<td>V1.2.8</td>
<td>Current</td>
<td>A</td>
<td>Varies</td>
<td>1113</td>
<td>Unfiltered current</td>
</tr>
<tr>
<td>V1.2.9</td>
<td>Operation Hours</td>
<td>h</td>
<td>#.#</td>
<td>1856</td>
<td></td>
</tr>
<tr>
<td>V1.2.10</td>
<td>Reactive Current</td>
<td>%</td>
<td>#.#</td>
<td>1389</td>
<td>Reference</td>
</tr>
<tr>
<td>V1.2.11</td>
<td>Grid State</td>
<td></td>
<td>#</td>
<td>1882</td>
<td></td>
</tr>
<tr>
<td>V1.2.12</td>
<td>Mindex</td>
<td>%</td>
<td>#.#</td>
<td>1858</td>
<td>Modulation Index</td>
</tr>
<tr>
<td>V1.2.13</td>
<td>Phase U Current</td>
<td>A</td>
<td>Varies</td>
<td>39</td>
<td>rms, 1 second linear filtering</td>
</tr>
<tr>
<td>V1.2.14</td>
<td>Phase V Current</td>
<td>A</td>
<td>Varies</td>
<td>40</td>
<td>rms, 1 second linear filtering</td>
</tr>
<tr>
<td>V1.2.15</td>
<td>Phase W Current</td>
<td>A</td>
<td>Varies</td>
<td>41</td>
<td>rms, 1 second linear filtering</td>
</tr>
<tr>
<td>V1.2.16</td>
<td>DC-Link Current</td>
<td>A</td>
<td>Varies</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>V1.2.17</td>
<td>DC-Link ActCurr</td>
<td>%</td>
<td>#.#</td>
<td>1158</td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.3 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>
### 4.1.4 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. 1</td>
<td>°C</td>
<td>#,#</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>V1.4.13</td>
<td>PT100 Temp. 2</td>
<td>°C</td>
<td>#,#</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>V1.4.14</td>
<td>PT100 Temp. 3</td>
<td>°C</td>
<td>#,#</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>V1.4.15</td>
<td>PT100 Temp. 4</td>
<td>°C</td>
<td>#,#</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>V1.4.16</td>
<td>PT100 Temp. 5</td>
<td>°C</td>
<td>#,#</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>V1.4.17</td>
<td>PT100 Temp. 6</td>
<td>°C</td>
<td>#,#</td>
<td>71</td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.5 Master/Follower

<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>V1.5.1</td>
<td>SystemStatus</td>
<td></td>
<td>#</td>
<td>1819</td>
<td></td>
</tr>
<tr>
<td>V1.5.2</td>
<td>Master CW</td>
<td></td>
<td>#</td>
<td>93</td>
<td></td>
</tr>
</tbody>
</table>

<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>V1.5.3.1</td>
<td>Current D1</td>
<td>A</td>
<td>Varies</td>
<td>1820</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.2</td>
<td>Current D2</td>
<td>A</td>
<td>Varies</td>
<td>1821</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.3</td>
<td>Current D3</td>
<td>A</td>
<td>Varies</td>
<td>1822</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.4</td>
<td>Current D4</td>
<td>A</td>
<td>Varies</td>
<td>1823</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.5</td>
<td>Current D5</td>
<td>A</td>
<td>Varies</td>
<td>1824</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.6</td>
<td>Current D6</td>
<td>A</td>
<td>Varies</td>
<td>1825</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.7</td>
<td>Current D7</td>
<td>A</td>
<td>Varies</td>
<td>1826</td>
<td></td>
</tr>
<tr>
<td>V1.5.3.8</td>
<td>Current D8</td>
<td>A</td>
<td>Varies</td>
<td>1827</td>
<td></td>
</tr>
</tbody>
</table>

<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>V1.5.4.1</td>
<td>Status Word D1</td>
<td>#</td>
<td>1828</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.2</td>
<td>Status Word D2</td>
<td>#</td>
<td>1829</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.3</td>
<td>Status Word D3</td>
<td>#</td>
<td>1830</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.4</td>
<td>Status Word D4</td>
<td>#</td>
<td>1831</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.5</td>
<td>Status Word D5</td>
<td>#</td>
<td>1832</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.6</td>
<td>Status Word D6</td>
<td>#</td>
<td>1833</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.7</td>
<td>Status Word D7</td>
<td>#</td>
<td>1834</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.5.4.8</td>
<td>Status Word D8</td>
<td>#</td>
<td>1835</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.6 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>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 4.1.7 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>V1.7.1</td>
<td>Line Voltage D7</td>
<td>Hz</td>
<td>#,##</td>
<td>1654</td>
<td>Measured line voltage</td>
</tr>
<tr>
<td>V1.7.2</td>
<td>Line Frequency D7</td>
<td>V</td>
<td>#</td>
<td>1650</td>
<td>Measured line frequency</td>
</tr>
<tr>
<td>V1.7.3</td>
<td>Line Voltage THD</td>
<td>%</td>
<td>#,##</td>
<td>1670</td>
<td>Line voltage total harmonic distortion</td>
</tr>
<tr>
<td>V1.7.4</td>
<td>Line Voltage HF RMS</td>
<td>V</td>
<td>#,#</td>
<td>1671</td>
<td>RMS of high frequency components</td>
</tr>
</tbody>
</table>

### 4.1.8 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>V1.8.1</td>
<td>Current Limit</td>
<td>A</td>
<td>Varies</td>
<td>1954</td>
<td></td>
</tr>
</tbody>
</table>

### 4.1.9 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>
4.2 Description of Monitoring Values

4.2.1 Monitoring 1 Values

V1.1.1 DC-Link Voltage \( V \) ID1108
The measured DC voltage, filtered.

V1.1.2 DC Voltage Ref. \( \% \) ID1200
The DC voltage reference. Percentage value of P: System Nom DC. If System Nom DC is not given this is scaled to P: Grid Nom Voltage.

V1.1.3 DC Voltage Act. \( \% \) ID7
Actual DC Voltage. Percentage value of P: System Nom DC. If System Nom DC is not given this is scaled to P: Grid Nom Voltage.

V1.1.4 Total Current \( A \) ID 1113
The filtered current of the drive.

V1.1.5 Active Current \( \% \) 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 \( \% \) ID 1157
The reactive current of the regenerative drive in % of System Rated Current.

V1.1.7 Power kW \( kW \) 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 % \( \% \) 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.
**VI.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>DO Charge FALSE</td>
<td>DO Charge TRUE</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 active</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>Internal Charge Open</td>
<td>Charging Switch closed (internal)</td>
</tr>
<tr>
<td>b9</td>
<td>MCB Controlled open</td>
<td>MCB Controlled Closed</td>
</tr>
<tr>
<td>b10</td>
<td>MCB Feedback FALSE</td>
<td>MCB Feedback TRUE</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></td>
<td>uGrid Mode Active</td>
</tr>
</tbody>
</table>

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

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

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

The drive output voltage.

**VI.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.

**VI.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.
### VI.1.14 AC Voltage Reference

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>V</td>
<td>1556</td>
<td>The used AC voltage reference.</td>
</tr>
</tbody>
</table>

### VI.1.15 DC Voltage Max Limit

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td>1606</td>
<td>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.</td>
</tr>
</tbody>
</table>
4.2.2 Monitoring 2 values

V1.2.1 DC Voltage $V$ ID 44
The measured DC voltage, unfiltered.

V1.2.2 Operation Mode ID 1615
The active Grid Converter operation mode.
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 degree). 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 $^\circ C$ ID 1109
The heatsink temperature of the drive.

V1.2.7 Frequency Reference $Hz$ ID 1752
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 ID 1856
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 % ID 1389
The final reactive current reference.

V1.2.11 Grid State ID 1882
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 % ID 1874
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

V1.2.13 Phase U Current A ID39
V1.2.14 Phase V Current A ID40
V1.2.15 Phase W Current A ID41
Phase Currents rms value. 1 second linear filtering.

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

V1.2.17 DC-Link ActCurr % #,# ID1158
Calculated DC-Link Current in %.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
4.2.3 Fieldbus monitoring values

VI.3.1 FB Control Word ID 1160

The control word from fieldbus. The table below is for "2 / Vacon AFE 1" Selection (P2.10.19) 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>FB Control Word ID1160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
</tr>
<tr>
<td>-------</td>
</tr>
<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>
V1.3.2  **FB Status Word**  **ID 68**

This is referred as General Status Word in the fieldbus manual. See details in the fieldbus manual. See details from of FB Status Word from chapter 8.6 FB Status Word.

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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### V1.3.3 Fault Word 1

**ID 1172**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Fault(s)</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></td>
</tr>
<tr>
<td>B6</td>
<td>F14 Unit Over Temperature</td>
</tr>
<tr>
<td>B7</td>
<td>F16 Motor Temperature, F29 Thermistor, F56 PT100</td>
</tr>
<tr>
<td>B8</td>
<td>F10 Line Synch fault</td>
</tr>
<tr>
<td>B9</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>F52 Keypad or F52 PC communication fault</td>
</tr>
<tr>
<td>B12</td>
<td>F53 FieldBus fault</td>
</tr>
<tr>
<td>B13</td>
<td>F59 System Bus fault</td>
</tr>
<tr>
<td>B14</td>
<td>F54 Slot Communication fault</td>
</tr>
<tr>
<td>B15</td>
<td>F50 4mA fault</td>
</tr>
</tbody>
</table>

### V1.3.4 Fault Word 2

**ID 1173**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Fault(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>F11 Output phase</td>
</tr>
<tr>
<td>B1</td>
<td></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>F51 External fault</td>
</tr>
<tr>
<td>B7</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>F31 IGBT, F41 IGBT</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>F64 Main Switch State fault</td>
</tr>
<tr>
<td>B15</td>
<td></td>
</tr>
</tbody>
</table>
### V1.3.5 Warning Word 1 ID 1174

<table>
<thead>
<tr>
<th>Bits</th>
<th>Warning(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>W91 Short Circuit</td>
</tr>
<tr>
<td>B1</td>
<td></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>F14 Over 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>

### V1.3.6 FB Micro Grid CW1 ID 1700

Control for the Micro Grid operations.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</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>Reset MotPot</td>
</tr>
<tr>
<td></td>
<td>Same as P2.4.2.27</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>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
V1.3.7  **FB Micro Grid SW1    ID 1701**

Status of the Micro Grid operations.

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

V1.3.8  **Warning    ID 74**

The number of the last active warning.

V1.3.9  **Last Active Fault    ID 37**

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></td>
<td>At reference speed</td>
</tr>
<tr>
<td>b6</td>
<td></td>
<td>At Zero Speed</td>
</tr>
<tr>
<td>b7</td>
<td></td>
<td>Flux Ready</td>
</tr>
<tr>
<td>b8</td>
<td></td>
<td>TC Speed Limiter Active</td>
</tr>
<tr>
<td>b9</td>
<td>Encoder Direction</td>
<td>Counter clockwise</td>
</tr>
<tr>
<td>b10</td>
<td></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 Out**  
**ID 48**

Fieldbus value to control analogue output.
4.2.4 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**
ID 13

**V1.4.6 Analogue Input 2**
ID 14

**V1.4.7 Analogue Input 3**
ID 27

**V1.4.8 Analogue Input 4**
ID 28

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

4.2.5 Master Follower

V1.5.1 SB SystemStatus # ID1819

<table>
<thead>
<tr>
<th>System Bus Status Word ID1819</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
</tr>
<tr>
<td>b1 Drive 1 Ready</td>
</tr>
<tr>
<td>b2 Drive 1 Running</td>
</tr>
<tr>
<td>b3 Drive 1 Fault</td>
</tr>
<tr>
<td>b4</td>
</tr>
<tr>
<td>b5 Drive 2 Ready</td>
</tr>
<tr>
<td>b6 Drive 2 Running</td>
</tr>
<tr>
<td>b7 Drive 2 Fault</td>
</tr>
<tr>
<td>b8</td>
</tr>
<tr>
<td>b9 Drive 3 Ready</td>
</tr>
<tr>
<td>b10 Drive 3 Running</td>
</tr>
<tr>
<td>b11 Drive 3 Fault</td>
</tr>
<tr>
<td>b12</td>
</tr>
<tr>
<td>b13 Drive 4 Ready</td>
</tr>
<tr>
<td>b14 Drive 4 Running</td>
</tr>
<tr>
<td>b15 Drive 4 Fault</td>
</tr>
</tbody>
</table>
## V1.5.2 Master CW # ID93

<table>
<thead>
<tr>
<th>Master Control Word ID93</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
</tr>
<tr>
<td>b1</td>
</tr>
<tr>
<td>b2</td>
</tr>
<tr>
<td>b3 Fault Reset</td>
</tr>
<tr>
<td>b4 Start</td>
</tr>
<tr>
<td>b5 WD Pulse</td>
</tr>
<tr>
<td>b6</td>
</tr>
<tr>
<td>b7</td>
</tr>
<tr>
<td>b8 DIN RunEnable</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>

### 4.2.5.1 Currents

- **V1.5.3.1** Current D1 A Varies 1820
- **V1.5.3.2** Current D2 A Varies 1821
- **V1.5.3.3** Current D3 A Varies 1822
- **V1.5.3.4** Current D4 A Varies 1823
- **V1.5.3.5** Current D5 A Varies 1824
- **V1.5.3.6** Current D6 A Varies 1825
- **V1.5.3.7** Current D7 A Varies 1826
- **V1.5.3.8** Current D8 A Varies 1827

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### Statuses

**V1.5.4.1**  
*Status Word D1*  
# 1828

**V1.5.4.2**  
*Status Word D2*  
# 1829

**V1.5.4.3**  
*Status Word D3*  
# 1830

**V1.5.4.4**  
*Status Word D4*  
# 1831

**V1.5.4.5**  
*Status Word D5*  
# 1832

**V1.5.4.6**  
*Status Word D6*  
# 1833

**V1.5.4.7**  
*Status Word D7*  
# 1834

**V1.5.4.8**  
*Status Word D8*  
# 1835

---

#### Follower Drive status word

<table>
<thead>
<tr>
<th>b0</th>
<th>Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td>b2</td>
<td>Run</td>
</tr>
<tr>
<td>b3</td>
<td>Fault</td>
</tr>
<tr>
<td>b4</td>
<td></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></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>WD Pulse</td>
</tr>
</tbody>
</table>
4.2.6 Activation status

V1.6.1 Serial Number Key ID 1997
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 ID 1996
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 of the manufacturer (tech.supportVDF@vacon.com).
4.2.7 Line Monitoring

V1.7.1 Line Voltage D7 \( V \) ID 1650
This is the same signal as V1.1.12. See chapter 4.2.1.

V1.7.2 Line Frequency D7 \( Hz \) ID 1654
This is the same signal as V1.1.13. See chapter 4.2.1.

V1.7.3 Line Voltage THD \( \% \) ID 1670
Total Harmonic Distortion of the line voltage measurement when using the OPT-D7 option board in slot C.

V1.7.4 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.

4.2.8 Active Limits

V1.8.1 Current Limit ID 1954

4.2.9 PI Power Controller
Monitoring values for power controller in AFE mode

V1.9.1 PID Reference 20
Active Current reference

V1.9.2 PID Actual Value 21
Active current

V1.9.3 PID Output 23
PID controller output for DC Voltage reference, gives an offset for DC Voltage Reference.
5. **Parameter list**

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

5.1 **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></td>
<td></td>
<td></td>
<td></td>
<td>110</td>
<td>Set the nominal voltage of the grid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AFE: 500V: 500V</td>
<td>Vac</td>
<td>500V:400 690V:690</td>
<td></td>
<td></td>
<td>Set System Nominal DC P2.1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>380V: 500V</td>
<td>Vac</td>
<td>500V:400 690V:690</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>690V: 690V</td>
<td>Vac</td>
<td>500V:400 690V:690</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>525V:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.2</td>
<td>Grid Nom. Frequency</td>
<td></td>
<td>320</td>
<td>Hz</td>
<td>50.00</td>
<td>1532</td>
<td><strong>Micro Grid and Island mode</strong>: Grid Nominal Frequency AFE Mode: Initial start frequency.</td>
</tr>
<tr>
<td>P2.1.3</td>
<td>System Rated Current</td>
<td>0.0</td>
<td>113</td>
<td>A</td>
<td>Ih</td>
<td></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></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>213</td>
<td>kW</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.6</td>
<td>System Rated kW</td>
<td>0</td>
<td>116</td>
<td>kW</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.7</td>
<td>System Nominal DC</td>
<td>500V: 500V</td>
<td>500V:675</td>
<td>Vdc</td>
<td>500V:675 690V:931</td>
<td>1805</td>
<td>Used for DC Voltage reference and for MCB close limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>436</td>
<td>675</td>
<td>Vdc</td>
<td>690V:931</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>620</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.8</td>
<td>Parallel AFE</td>
<td>0</td>
<td>1501</td>
<td>0</td>
<td>1501</td>
<td></td>
<td>0 =Single AFE 1 =Parallel AFE Activation will set DC Drooping to 3%.</td>
</tr>
<tr>
<td>P2.1.9</td>
<td>Transformer: Grid Side U</td>
<td>0</td>
<td>1850</td>
<td>Vac</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.10</td>
<td>Transformer: Phase Shift</td>
<td>0</td>
<td>1851</td>
<td>Vac</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.1.11</td>
<td>Identification</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>631</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1 =Current measurement offset</td>
</tr>
</tbody>
</table>

5.2 **Reference handling**

Table 3. Reference handling, G2.2

<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>P2.2.1</td>
<td>DC Voltage Ref.</td>
<td></td>
<td>105%</td>
<td>%</td>
<td>110.00</td>
<td>1462</td>
<td>DC Voltage reference as % of System Nominal DC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>97Vdc</td>
<td>999Vdc</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>690V: 690V</td>
<td>1099Vdc</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 = System Rated Current. Positive =Inductive Negative =Capacitive</td>
</tr>
</tbody>
</table>

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

**Table 4. DC references, 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>P2.2.3.1</td>
<td>DC Voltage Drooping</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 Ramp 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>

### 5.2.2 Power / Frequency reference

**Table 5. Power / Frequency reference, G2.2.4**

<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>P2.2.4.1</td>
<td>Freq Droop 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>0</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></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></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>
</tbody>
</table>

### 5.2.3 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>2.2.4.11.1</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>2.2.4.11.2</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>2.2.4.11.3</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>2.2.4.11.4</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>2.2.4.11.5</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>2.2.4.11.6</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>2.2.4.11.7</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>2.2.4.11.8</td>
<td>BaseRefModePID</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1914</td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
## 5.2.4 Reference adjust

Table 7. Reference adjustment, G2.2.5

<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>P2.2.5.1</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>1E.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>1E.10</td>
<td>DigIn</td>
<td>0.1</td>
<td>1554</td>
<td></td>
</tr>
<tr>
<td>P2.2.5.4</td>
<td>MaxReactiveAdjust</td>
<td>0.0</td>
<td>100.0</td>
<td>%</td>
<td>25.0</td>
<td>1559</td>
<td></td>
</tr>
</tbody>
</table>
5.2.5 **AC Voltage Reference**

_Table 8. AC voltage reference, G2.2.6_

<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>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>2.00 Hz/s if Range 50 Hz</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>V</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>Hz</td>
<td>11.5</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>V</td>
<td>11.0</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>Hz</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>Hz</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>Voltage MotPot Reset</td>
<td>0</td>
<td>1</td>
<td>%</td>
<td>0</td>
<td>1640</td>
<td>0 = No Action 1 = At Stop State</td>
</tr>
<tr>
<td>P2.2.6.12</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 = Keep Zero Q</td>
</tr>
<tr>
<td>P2.2.6.13</td>
<td>Reset Zero Q Delay</td>
<td>0.00</td>
<td>120.00</td>
<td>%</td>
<td>0.00</td>
<td>1642</td>
<td>0.00 = No Reset</td>
</tr>
</tbody>
</table>

5.3 **Ramp Control**

_Table 9. Ramp control, G2.3_

<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>P2.3.1</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>

5.4 **Input Signals**

5.4.1 **Basic settings**

_Table 10. Basic settings, G2.4.1_

<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>P2.4.1.1</td>
<td>Start/Stop Logic</td>
<td>0</td>
<td>2</td>
<td>%</td>
<td>0</td>
<td>300</td>
<td>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 CB Close</td>
</tr>
<tr>
<td>P2.4.1.2</td>
<td>Input Inversion</td>
<td>0</td>
<td>65535</td>
<td>%</td>
<td>4</td>
<td>1091</td>
<td></td>
</tr>
</tbody>
</table>
## 5.4.2 Digital Inputs

Table 11. Digital inputs, G2.4.2

<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>P2.4.2.1</td>
<td>Start Signal 1</td>
<td>0</td>
<td>E.10</td>
<td>A.1</td>
<td>403</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.2</td>
<td>Start Signal 2</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.3</td>
<td>Open MCB</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1600</td>
<td></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>0.1</td>
<td>1453</td>
<td></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>0.1</td>
<td>414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.6</td>
<td>Ext Fault 1</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.7</td>
<td>Ext Fault 2</td>
<td>0</td>
<td>E.10</td>
<td>0.2</td>
<td>406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.8</td>
<td>Run Enable</td>
<td>0</td>
<td>E.10</td>
<td>0.2</td>
<td>407</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.9</td>
<td>NET Synchronisation</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.10</td>
<td>NET Close Enabled</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1705</td>
<td></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>0.1</td>
<td>1604</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.12</td>
<td>NET Contactor FB</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1660</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.13</td>
<td>Forced AFE Mode</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1540</td>
<td></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>0.2</td>
<td>750</td>
<td></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>0.1</td>
<td>1708</td>
<td></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>0.1</td>
<td>1710</td>
<td></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>0.1</td>
<td>1711</td>
<td></td>
<td>Only active when P2.11.1 is in 6/FRee select</td>
</tr>
<tr>
<td>P2.4.2.18</td>
<td>AFE Mode 3</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1712</td>
<td></td>
<td>Only active when P2.11.1 is in 6/FRee select</td>
</tr>
<tr>
<td>P2.4.2.19</td>
<td>Quick Stop</td>
<td>0</td>
<td>E.10</td>
<td>0.2</td>
<td>1213</td>
<td></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>0.2</td>
<td>1179</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.21</td>
<td>RR Enable</td>
<td>0</td>
<td>E.10</td>
<td>0.2</td>
<td>1896</td>
<td></td>
<td>Disables final Run Command</td>
</tr>
<tr>
<td>P2.4.2.22</td>
<td>I/O Terminal Control</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>409</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.23</td>
<td>Keypad Control</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>410</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.24</td>
<td>Fieldbus Control</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>411</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.25</td>
<td>Enable MCB Close</td>
<td>0</td>
<td>E.10</td>
<td>0.2</td>
<td>1619</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.4.2.26</td>
<td>Reset P/Hz MotPot Adjust</td>
<td>0</td>
<td>E.10</td>
<td>0.1</td>
<td>1608</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 5.4.3 Analogue Input 1

Table 12. Analogue input 1, G2.4.3

<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>P2.4.3.1</td>
<td>A1 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>A1 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>P2.4.3.3</td>
<td>A1 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>A1 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>A1 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>A1 reference scaling, minimum value</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>A1 reference scaling, maximum value</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>A1 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1507</td>
<td></td>
</tr>
</tbody>
</table>

### 5.4.4 Analogue Input 2

Table 13. Analogue input 2, G2.4.4

<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>P2.4.4.1</td>
<td>A2 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>A2 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td>329</td>
<td></td>
</tr>
<tr>
<td>P2.4.4.3</td>
<td>A2 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>A2 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>A2 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>A2 reference scaling, minimum value</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>A2 reference scaling, maximum value</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>A2 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1511</td>
<td></td>
</tr>
</tbody>
</table>

### 5.4.5 Analogue Input 3

Table 14. Analogue input 2, G2.4.5

<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>P2.4.5.1</td>
<td>A3 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>A3 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>A3 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>A3 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>A3 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>A3 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>A3 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>A3 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1509</td>
<td></td>
</tr>
</tbody>
</table>
5.4.6 Analogue input 4

Table 15. Analogue input 2, G2.4.4

<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>P2.4.6.1</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>

5.5 Output signals

5.5.1 Digital output signals

Table 16. Digital output signals, G2.5.1

<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></td>
<td>0.1</td>
<td>1218</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></td>
<td>0.1</td>
<td>1219</td>
<td></td>
</tr>
<tr>
<td>P2.5.1.3</td>
<td>Ready</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>432</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></td>
<td>0.1</td>
<td>433</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></td>
<td>0.1</td>
<td>434</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></td>
<td>0.1</td>
<td>435</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></td>
<td>0.1</td>
<td>442</td>
<td></td>
</tr>
<tr>
<td>P2.5.1.8</td>
<td>Overtemperature Warn.</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>439</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></td>
<td>0.1</td>
<td>436</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></td>
<td>0.1</td>
<td>1709</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></td>
<td>0.1</td>
<td>1605</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></td>
<td>0.1</td>
<td>1753</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></td>
<td>0.1</td>
<td>1568</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></td>
<td>0.1</td>
<td>1684</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></td>
<td>0.1</td>
<td>1686</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></td>
<td>0.1</td>
<td>1687</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></td>
<td>0.1</td>
<td>455</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></td>
<td>891</td>
<td>891</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></td>
<td>0.1</td>
<td>456</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></td>
<td>892</td>
<td>892</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></td>
<td>0.1</td>
<td>457</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></td>
<td>893</td>
<td>893</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></td>
<td>0.1</td>
<td>169</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></td>
<td>894</td>
<td>894</td>
<td>Select parameter to control</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 5.5.2 Delayed D0 1

**Table 17. Delayed digital output 1, G2.5.2**

<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 D01 signal to the digital output of your choice with this parameter.</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>P2.5.2.2</td>
<td>D01 Content</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>312</td>
<td></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>P2.5.2.3</td>
<td>D01 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>P2.5.2.4</td>
<td>D01 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>1216</td>
<td></td>
</tr>
</tbody>
</table>

### 5.5.3 Delayed D0 2

**Table 18. Delayed digital output 2, G2.5.3**

<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>489</td>
<td></td>
<td>Connect the delayed D02 signal to the digital output of your choice with this parameter.</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>P2.5.3.2</td>
<td>D02 Content</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>490</td>
<td></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>P2.5.3.3</td>
<td>D02 ON Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>491</td>
<td>0.00 = On delay not in use</td>
</tr>
<tr>
<td>P2.5.3.4</td>
<td>D02 OFF Delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>492</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>
### 5.5.4 Analogue output 1

Table 19. Analogue output signal 1, G2.5.4

<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>Connect the AO1 signal to the analogue output of your choice with this parameter.</td>
<td></td>
</tr>
<tr>
<td>P2.5.4.2</td>
<td>Iout Content</td>
<td>0</td>
<td>11</td>
<td>1/ O/P Freq</td>
<td>307</td>
<td>0 = Not used 1 = DC Voltage 2 = Drive Current 3 = Output Voltage 4 = Active Current 5 = Power 6 = Reactive Current 7 = Power Bidirectional 8 = AI1 9 = AI2 10 = FB Analogue Output 11 = Line Voltage 12 = FreqOut, bidirectional 13 = Value Control Out</td>
<td></td>
</tr>
<tr>
<td>P2.5.4.3</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>P2.5.4.4</td>
<td>Iout Invert</td>
<td>0</td>
<td>1</td>
<td>0/ No Inversion</td>
<td>309</td>
<td>0 = Not inverted 1 = Inverted</td>
<td></td>
</tr>
<tr>
<td>P2.5.4.5</td>
<td>Iout Minimum</td>
<td>0</td>
<td>1</td>
<td>0/ 0 mA</td>
<td>310</td>
<td>0 = 0 mA 1 = 4 mA</td>
<td></td>
</tr>
<tr>
<td>P2.5.4.6</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>P2.5.4.7</td>
<td>Iout Offset</td>
<td>-100</td>
<td>100</td>
<td>%</td>
<td>0</td>
<td>375</td>
<td>Add -100 to 1000% to the analogue output.</td>
</tr>
</tbody>
</table>
### 5.5.5 Analogue output 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>P2.5.5.1</td>
<td>Iout 2 signal AnOUT:0.1 AnOUT:E.10 AnOUT:A.1</td>
<td></td>
<td></td>
<td></td>
<td>464</td>
<td></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></td>
<td></td>
<td>307</td>
<td>0 = Not used 1 = DC Voltage 2 = Drive Current 3 = Output Voltage 4 = Active Current 5 = Power 6 = Reactive Current 7 = Power Bidirectional 8 = AI1 9 = AI2 10 = FB Analogue Output 11 = Line Voltage 12 = FreqOut, bidirectional 13 = 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>1</td>
<td>308</td>
<td>0 = No filtering</td>
</tr>
<tr>
<td>P2.5.5.4</td>
<td>Iout Invert</td>
<td>0</td>
<td>1</td>
<td></td>
<td>309</td>
<td></td>
<td>0 = Not inverted 1 = Inverted</td>
</tr>
<tr>
<td>P2.5.5.5</td>
<td>Iout Minimum</td>
<td>0</td>
<td>1</td>
<td></td>
<td>310</td>
<td></td>
<td>0 = 0 mA 1 = 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></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></td>
<td>Add -100 to 1000% to the analogue output.</td>
</tr>
</tbody>
</table>

## 5.5.6 Analogue output 3

Table 21. Analogue output signal 3, G2.5.6

<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>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></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></td>
<td>0 / No Inversion</td>
<td>309</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></td>
<td>0 / 0 mA</td>
<td>310</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 1000% to the analogue output.</td>
</tr>
</tbody>
</table>

## 5.5.7 Options

Table 22. Output signal options, G2.5.7

<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>P2.5.7.1</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</td>
<td>Hz</td>
<td>0.00</td>
<td>1809</td>
<td></td>
</tr>
<tr>
<td>P2.5.7.3</td>
<td>Freq Scale Max AO</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>50.00</td>
<td>1808</td>
<td></td>
</tr>
<tr>
<td>P2.5.7.4</td>
<td>DC Supervision Limit</td>
<td>0</td>
<td>1500</td>
<td>V</td>
<td></td>
<td>1454</td>
<td></td>
</tr>
<tr>
<td>P2.5.7.5</td>
<td>MCB Close Mode</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>1607</td>
<td></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>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.6 LIMIT SETTINGS

5.6.1 CURRENT LIMIT

Table 23. Current limit settings, G2.6.1

<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>P2.6.1.1</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>SC Voltage Limit</td>
<td>0.00</td>
<td>150.00</td>
<td>%</td>
<td>80.00</td>
<td>1518</td>
<td>Generating Active Current limit.</td>
</tr>
<tr>
<td>P2.6.1.6</td>
<td>Output Active Current</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300</td>
<td>1290</td>
<td>Generating Active Current limit.</td>
</tr>
<tr>
<td>P2.6.1.7</td>
<td>Input Active Current</td>
<td>0</td>
<td>300</td>
<td>%</td>
<td>300</td>
<td>1289</td>
<td>Motoring Active Current limit.</td>
</tr>
<tr>
<td>P2.6.1.8</td>
<td>Over Current Trip Limit</td>
<td>0</td>
<td>1000</td>
<td>%</td>
<td>0,0</td>
<td>1094</td>
<td>Software over current limit F1 S4. 0 = Disabled.</td>
</tr>
</tbody>
</table>

5.6.2 POWER LIMIT

Table 24. Power limit settings, G2.6.2

<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>P2.6.2.1</td>
<td>Output Power Limit</td>
<td>0.0</td>
<td>300.0</td>
<td>%</td>
<td>300.0</td>
<td>1288</td>
<td></td>
</tr>
<tr>
<td>P2.6.2.2</td>
<td>Input Power Limit</td>
<td>0.0</td>
<td>300.0</td>
<td>%</td>
<td>300.0</td>
<td>1287</td>
<td></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</td>
<td>0.00</td>
<td>100.00</td>
<td>Hz</td>
<td>0.0</td>
<td>1703</td>
<td>0.00 = Not Used.</td>
</tr>
</tbody>
</table>

5.6.3 FREQUENCY LIMIT

Table 25. Frequency limit settings, G2.6.3

<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>P2.6.3.1</td>
<td>Line High Trip Limit</td>
<td>0.00</td>
<td>120.00</td>
<td>Hz</td>
<td>75.00</td>
<td>1716</td>
<td>F10 immediately if above</td>
</tr>
<tr>
<td>P2.6.3.2</td>
<td>Line Low Trip Limit</td>
<td>0.00</td>
<td>120.00</td>
<td>Hz</td>
<td>25.00</td>
<td>1717</td>
<td>F10 immediately if below</td>
</tr>
</tbody>
</table>

5.6.4 MICRO GRID

Table 26. Micro grid limit settings, G2.6.4

<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>P2.6.4.1</td>
<td>Current limit Min</td>
<td>-300.0</td>
<td>0.0</td>
<td>%</td>
<td></td>
<td></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></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></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></td>
<td></td>
<td>1623</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.5</td>
<td>Current limit ts</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td></td>
<td>1625</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.6</td>
<td>Current Limit Max</td>
<td>0.0</td>
<td>10.00</td>
<td>%</td>
<td></td>
<td>1890</td>
<td></td>
</tr>
<tr>
<td>P2.6.4.7</td>
<td>Current Limit To Zero</td>
<td>0</td>
<td>10</td>
<td></td>
<td></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/
5.6.5  **DC VOLTAGE**

Table 27. DC voltage limit settings, G2.6.5

<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>P2.6.5.1</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>P2.6.5.2</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>
</tbody>
</table>

5.7  **DRIVE CONTROL**

Table 28. Drive control, G2.7

<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>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>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 2.7.6</td>
<td>Modulator Type</td>
<td>0</td>
<td>4</td>
<td></td>
<td>1</td>
<td>1516</td>
<td></td>
</tr>
<tr>
<td>P 2.7.7</td>
<td>Control Options 1</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1707</td>
<td></td>
</tr>
<tr>
<td>P 2.7.8</td>
<td>Control Options 2</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1798</td>
<td></td>
</tr>
<tr>
<td>P 2.7.9</td>
<td>Operation Time</td>
<td>0</td>
<td>2^32</td>
<td></td>
<td>0</td>
<td>1855</td>
<td></td>
</tr>
</tbody>
</table>

5.7.1  **AFE CONTROL**

Table 29. AFE control, G2.7.10

<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>
<tbody>
<tr>
<td>P2.7.10.1</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>P2.7.10.2</td>
<td>Synch Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>2000</td>
<td>1457</td>
<td></td>
</tr>
<tr>
<td>P2.7.10.3</td>
<td>Synch Ti</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>50</td>
<td>1458</td>
<td></td>
</tr>
<tr>
<td>P2.7.10.4</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>P2.7.10.5</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>
<tr>
<td>P2.7.10.6</td>
<td>Synch. Kp Start</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>4000</td>
<td>1300</td>
<td></td>
</tr>
<tr>
<td>P2.7.10.7</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>P2.7.10.8</td>
<td>Voltage Ctrl Ti</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>50</td>
<td>1452</td>
<td></td>
</tr>
</tbody>
</table>

5.8  **MASTER/FOLLOWER**

<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>P2.8.1</td>
<td>MF Mode</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1324</td>
<td></td>
</tr>
<tr>
<td>P2.8.2</td>
<td>SB Comm Fault</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1062</td>
<td></td>
</tr>
</tbody>
</table>
### 5.9 Protections

#### 5.9.1 General

**Table 30. General protection settings, G2.9.1**

<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>P2.9.1.1</td>
<td>Thermistor Fault Response</td>
<td>0</td>
<td>3</td>
<td>2 / Fault</td>
<td>732</td>
<td>0 = No response 1 = Warning 2 = Fault, stop acc. stop mode 3 = Fault, stop by coasting</td>
<td></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>As Par. P2.9.1.4</td>
<td></td>
</tr>
<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>As Par. P2.9.1.4</td>
<td></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></td>
<td>2</td>
<td>1505</td>
<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>0 = No Action 1 = Open MCB</td>
<td></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>1 = Warning 2 = Fault</td>
<td></td>
</tr>
<tr>
<td>P2.9.1.9</td>
<td>Reactive Error Trip Limit</td>
<td>-300</td>
<td>300</td>
<td>%</td>
<td>7.5</td>
<td>1759</td>
<td></td>
</tr>
<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>
<tr>
<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>0 = No Action 1 = Warning 2 = Fault</td>
<td></td>
</tr>
<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>
<td>0 = No Action 1 = Warning 2 = Fault</td>
<td></td>
</tr>
<tr>
<td>P2.9.1.13</td>
<td>Reactive Current Limit</td>
<td>0</td>
<td>2</td>
<td>1 / Warning</td>
<td>1981</td>
<td>0 = No Action 1 = Warning 2 = Fault</td>
<td></td>
</tr>
<tr>
<td>P2.9.1.14</td>
<td>FaultWarnIndicat</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td></td>
<td>0 = Static 1 = Toggle 2 = Marine</td>
<td></td>
</tr>
</tbody>
</table>
### 5.9.2 Temperature Sensor Protections

*Table 31. Temperature sensor protection settings, 2.9.2*

<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>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></td>
<td>0</td>
<td>739</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></td>
<td>2</td>
<td>740</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 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>P2.9.2.4</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 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>P2.9.2.5</td>
<td>No. of uses inputs on board 2</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>743</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>P2.9.2.6</td>
<td>Response to temperature fault</td>
<td>0</td>
<td>3</td>
<td></td>
<td>2</td>
<td>766</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>P2.9.2.7</td>
<td>Board 2 warning limit</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>120.0</td>
<td>745</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>P2.9.2.8</td>
<td>Board 2 fault limit</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>130.0</td>
<td>746</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>P2.9.2.9</td>
<td>Channel 1B Warn</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>764</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>P2.9.2.9</td>
<td>Channel 1B Fault</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>765</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>P2.9.2.9</td>
<td>Channel 1C Warn</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>768</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>P2.9.2.9</td>
<td>Channel 1C Fault</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>769</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>P2.9.2.9</td>
<td>Channel 2B Warn</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>770</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>P2.9.2.9</td>
<td>Channel 2B Fault</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>771</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>P2.9.2.9</td>
<td>Channel 2C Warn</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>772</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>P2.9.2.9</td>
<td>Channel 2C Fault</td>
<td>-30.0</td>
<td>200.0</td>
<td>°C</td>
<td>0.0</td>
<td>773</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>
</tbody>
</table>

### 5.9.3 Earth fault

*Table 32. Earth fault protection settings, G2.9.3*

<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>P2.9.3.1</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>
<td></td>
</tr>
</tbody>
</table>

### 5.9.4 Fieldbus fault

*Table 33. Fieldbus protection settings, G2.9.4*

<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>P2.9.4.1</td>
<td>FB Fault response</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</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>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 5.9.5 External Fault

**Table 34. External fault settings, G2.9.5**

<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>P2.9.5.1</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>
<td></td>
</tr>
</tbody>
</table>

### 5.9.6 Grid Voltage D7

**Table 35. Grid voltage protections settings, G2.9.6**

<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>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>
<td></td>
</tr>
</tbody>
</table>

### 5.9.7 Grid Frequency

**Table 36. Grid frequency protections settings, G2.9.7**

<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>P2.9.7.1</td>
<td>Freq. Supply Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1627</td>
<td></td>
</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>
<td></td>
</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>
<td></td>
</tr>
</tbody>
</table>

### 5.9.8 Voltage

**Table 37. Supply voltage protection settings, G2.9.8**

<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>P2.9.8.1</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>P2.9.8.2</td>
<td>Voltage Low Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>75.00</td>
<td>1891</td>
<td></td>
</tr>
<tr>
<td>P2.9.8.3</td>
<td>Voltage Low Warning Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>1880</td>
<td></td>
</tr>
<tr>
<td>P2.9.8.4</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>
</tr>
<tr>
<td>P2.9.8.5</td>
<td>Voltage High Trip Limit</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>130.00</td>
<td>1992</td>
<td></td>
</tr>
</tbody>
</table>

### 5.9.9 Over Load

**Table 38. Over load protection settings, G2.9.9**

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### D7 Protections

**Table 39. D7 protection settings, G2.9.10**

<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>
<tbody>
<tr>
<td>P2.9.10.1</td>
<td>THD response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1672</td>
<td>No Action</td>
</tr>
<tr>
<td>P2.9.10.2</td>
<td>THD warning limit</td>
<td>0</td>
<td>5000</td>
<td>%</td>
<td>600</td>
<td>1673</td>
<td>Warning</td>
</tr>
<tr>
<td>P2.9.10.3</td>
<td>THD fault limit</td>
<td>0</td>
<td>5000</td>
<td>%</td>
<td>1000</td>
<td>1674</td>
<td>Fault</td>
</tr>
<tr>
<td>P2.9.10.4</td>
<td>HF RMS response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1675</td>
<td>No Action</td>
</tr>
<tr>
<td>P2.9.10.5</td>
<td>HF RMS warning limit</td>
<td>0</td>
<td>4000</td>
<td>V</td>
<td>200</td>
<td>1676</td>
<td>Warning</td>
</tr>
<tr>
<td>P2.9.10.6</td>
<td>HF RMS fault limit</td>
<td>0</td>
<td>4000</td>
<td>V</td>
<td>600</td>
<td>1677</td>
<td>Fault</td>
</tr>
</tbody>
</table>

### Extra

**Table 40. Extra protection settings, G2.9**

<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>P2.9.11</td>
<td>Fault Simulation</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1569</td>
<td></td>
</tr>
<tr>
<td>P2.9.12</td>
<td>Reset datalogger</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1857</td>
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</tr>
</tbody>
</table>

### Fieldbus

**Table 41. Fieldbus settings, G2.10**

<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>
<tbody>
<tr>
<td>P2.10.1</td>
<td>FB Actual Value Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>44</td>
<td>1853</td>
</tr>
<tr>
<td>P2.10.2</td>
<td>FB Data Out1 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1104</td>
<td>852</td>
</tr>
<tr>
<td>P2.10.3</td>
<td>FB Data Out2 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1508</td>
<td>853</td>
</tr>
<tr>
<td>P2.10.4</td>
<td>FB Data Out3 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1172</td>
<td>854</td>
</tr>
<tr>
<td>P2.10.5</td>
<td>FB Data Out4 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1173</td>
<td>855</td>
</tr>
<tr>
<td>P2.10.6</td>
<td>FB Data Out5 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>56</td>
<td>856</td>
</tr>
<tr>
<td>P2.10.7</td>
<td>FB Data Out6 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1174</td>
<td>857</td>
</tr>
<tr>
<td>P2.10.8</td>
<td>FB Data Out7 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1125</td>
<td>858</td>
</tr>
<tr>
<td>P2.10.9</td>
<td>FB Data Out8 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>1157</td>
<td>859</td>
</tr>
<tr>
<td>P2.10.10</td>
<td>FB Data Out9 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>558</td>
</tr>
<tr>
<td>P2.10.11</td>
<td>FB Data Out10 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>559</td>
</tr>
<tr>
<td>P2.10.12</td>
<td>FB Data Out11 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>560</td>
</tr>
<tr>
<td>P2.10.13</td>
<td>FB Data Out12 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>561</td>
</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>
<td>--------------</td>
<td>---------------------------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>---------</td>
<td>----</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>P2.10.14</td>
<td>FB Data Out13 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>562</td>
<td></td>
</tr>
<tr>
<td>P2.10.15</td>
<td>FB Data Out14 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>563</td>
<td></td>
</tr>
<tr>
<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>
</tr>
<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>
<td></td>
</tr>
<tr>
<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>
<td></td>
</tr>
<tr>
<td>P2.10.19</td>
<td>FB Data In 2 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>877</td>
<td></td>
</tr>
<tr>
<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>
</tr>
<tr>
<td>P2.10.21</td>
<td>FB Data In 4 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>879</td>
<td></td>
</tr>
<tr>
<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>
<td></td>
</tr>
<tr>
<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>
</tr>
<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>
</tr>
<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>
</tr>
<tr>
<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>
<td></td>
<td>0</td>
<td>551</td>
<td></td>
</tr>
<tr>
<td>P2.10.28</td>
<td>FB Data In 11 Sel</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>552</td>
<td></td>
</tr>
<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>
</tr>
<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>3</td>
<td></td>
<td>2</td>
<td>896</td>
<td>0 = Basic, 1 = Standard, 2 = Vacon AFE 1, 3 = Vacon AFE 2</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>SWB11.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>SWB12.ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1908</td>
<td></td>
</tr>
<tr>
<td>P2.10.41</td>
<td>SWB13.ID.Bit</td>
<td>0.00</td>
<td>2000.15</td>
<td></td>
<td>0.00</td>
<td>1909</td>
<td></td>
</tr>
<tr>
<td>P2.10.42</td>
<td>SWB14.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>
<td></td>
</tr>
</tbody>
</table>
5.11 Micro Grid

Table 42. Micro Grid, G2.11

<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>P2.11.1</td>
<td>Control Mode</td>
<td>0</td>
<td>6</td>
<td>0 / AFE</td>
<td>1531</td>
<td></td>
<td>0 = AFE&lt;br&gt;1 = Island&lt;br&gt;2 = Micro Grid&lt;br&gt;3 = Island-AFE&lt;br&gt;4 = Island-Micro Grid&lt;br&gt;5 = Island-Micro Grid (Reserved)&lt;br&gt;6 = FreeSelect</td>
</tr>
<tr>
<td>P2.11.2</td>
<td>Frequency Droop</td>
<td>1</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>React. current drooping in % of P2.1</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&lt;br&gt;1 = Zero Power F/O&lt;br&gt;2 = Drooping&lt;br&gt;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>0 = Not used&lt;br&gt;1 = Active&lt;br&gt;Use 1000 ms as a starting point.</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&lt;br&gt;1 = Active&lt;br&gt;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>0 = Not used&lt;br&gt;1 = Active&lt;br&gt;Use 1000 ms as a starting point.</td>
</tr>
<tr>
<td>P2.11.8</td>
<td>Generator Speed Control Yi</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>32000</td>
<td>1724</td>
<td>0 = Not used&lt;br&gt;1 = Active&lt;br&gt;Use 1000 ms as a starting point.</td>
</tr>
</tbody>
</table>

5.11.1 Free Select

Table 43. Micro Grid free select settings, G2.11.9

<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></td>
<td>0 / AFE</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></td>
<td>1 / Island</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></td>
<td>2 / Micro Grid</td>
<td>1713</td>
<td></td>
</tr>
</tbody>
</table>
5.12 Synchronisation to external grid

Table 44. Synchronization to external grid settings, G2.12

<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>P2.12.1</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>
</table>

5.13 Reserved
## 5.14 ID control functions

### 5.14.1 Value control

Table 45. Power reference input signal selection, G2.14.1

<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>P2.14.1.1</td>
<td>Control Input Signal ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1580</td>
<td></td>
</tr>
<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></td>
<td>1581</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.3</td>
<td>Control Input On Limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1582</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.4</td>
<td>Control Output Off Value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1583</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.5</td>
<td>Control Output On Value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1584</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></td>
<td>1585</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.7</td>
<td>Control Mode</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td>1586</td>
<td>0 = 5R ABS 1 = Scale ABS 2 = Scale INV ABS 3 = 5R 4 = Scale 5 = 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></td>
<td>1721</td>
<td></td>
</tr>
</tbody>
</table>

### 5.14.2 DIN ID control 1

Table 46. DIN ID control parameters, G2.14.2

<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>P2.14.2.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1570</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></td>
<td>1571</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></td>
<td>1572</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></td>
<td>1573</td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>

### 5.14.3 DIN ID control 2

Table 47. DIN ID control parameters, G2.14.3

<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></td>
<td>1574</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></td>
<td>1575</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></td>
<td>1592</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></td>
<td>1593</td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.14.4 DIN ID control 3

Table 48. DIN ID control parameters, G2.14.4

<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>P2.14.4.1</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>

5.14.5 DIN ID control 4

Table 49. DIN ID control parameters, G2.14.5

<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>P2.14.5.1</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>
</tr>
</tbody>
</table>

5.14.6 Signal Fault function

Table 50. Signal Fault Function, G2.14.6

<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>P2.14.6.1</td>
<td>Fault Signal ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1941</td>
<td>Signal to be monitored</td>
</tr>
<tr>
<td>P2.14.6.2</td>
<td>Fault Mode</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td></td>
<td>1942</td>
<td></td>
</tr>
<tr>
<td>P2.14.6.3</td>
<td>High Fault Limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>32000</td>
<td></td>
<td>1943</td>
<td></td>
</tr>
<tr>
<td>P2.14.6.4</td>
<td>Low Fault Limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>-32000</td>
<td></td>
<td>1944</td>
<td></td>
</tr>
</tbody>
</table>

5.15 Auto reset

Table 51. Auto reset parameters, G2.15

<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>P2.15.1</td>
<td>Wait Time</td>
<td>0.00</td>
<td>60.00</td>
<td>s</td>
<td>5.00</td>
<td></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></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></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></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></td>
<td>725</td>
<td></td>
</tr>
</tbody>
</table>

5.16 Grid voltage PI

Table 52. Grid voltage PI function parameters, G2.16

<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></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></td>
<td>118</td>
<td>PI controller gain</td>
</tr>
<tr>
<td>P2.16.3</td>
<td>PI controller l-time</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.05</td>
<td></td>
<td>119</td>
<td>PI controller l-time</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 5.17 Keypad control (Control panel: menu M3)

Table 53. 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&lt;br&gt;1 = I/O terminal&lt;br&gt;2 = Keypad (Default)&lt;br&gt;3 = Fieldbus&lt;br&gt;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>

### 5.18 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.

### 5.19 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.
6. DESCRIPTION OF PARAMETERS

6.1 BASIC PARAMETERS

2.1.1 Grid Nominal Voltage \( V \) ID 110

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 \( Hz \) ID 1532

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.

![Figure 10](image-url)
2.1.3 *System Rated Current*  \( A \)  \( ID \) 113
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 \( I_h \) 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*  \( ID \) 120
Enter the system rated Cos Phi.

2.1.5 *System Rated kVA*  \( ID \) 213
Enter the system rated kVA.

2.1.6 *System Rated kW*  \( kW \)  \( ID \) 116
Set the the rated active power of the system.

2.1.7 *Nominal DC*  \( ID \) 1805
This value is used as a reference point for DC Voltage reference. Grid Nominal Voltage is not used because System Nominal DC may not be connected to Grid Nominal Voltage.
Recommended to set to highest DC Source voltage of the system to have common reference point.
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*  \( ID \) 1501
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.
6.1.1 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 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 will give correct DC-Link Voltage.

2.1.9 Transformer GC Side Voltage \( ID \ 1850 \)

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

2.1.10 Transformer Grid Side Voltage \( ID \ 1851 \)

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

2.1.11 Transformer Phase Shift \( ID \ 1852 \)

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](image)

**Figure 11.**

P2.1.7 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/
6.2 Reference Handling

2.2.1 DC Voltage Reference ID 1462

This parameter sets the DC Voltage reference in % of the P2.1.7 System Nom. DC.

Final DC Voltage Ref (V1.1.2) = System Nom. DC * DC Voltage Reference

The DC Voltage will be maintained at this level when the regenerative unit is running.

There is an internal limitation to reference: For 500V units the maximum limit is 797 Vdc and for 690V units the maximum limit is 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: NXA1500B_ _ _ _ _W)

**NOTE!** When transformer 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 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 ID 1459

This parameter sets the reference for the reactive current in % of the System Rated 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.
6.2.1 DC Reference Tuning

2.2.3.1 DC Drooping ID 620

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 12.](image)

2.2.3.2 DC Voltage Ramp Rate ID 1199

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 13.](image)

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.2.3.3 DC Voltage Reference Filter TC ID 1760

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 showing different reference filters](image)

*Figure 14.*

2.2.3.4 DC Reference Offset ID 1776

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

6.2.2 Power /frequency reference

2.2.4.1 Frequency Drooping Offset ID 1791

This parameter is used to adjust the base frequency for drooping purposes. For example, if drooping is set to 2 Hz this parameter 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) ID 417

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) ID 418
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 ID 1533
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 15.
2.2.4.7 *BaseReference Ramp Rate*  
**ID 1536**

This parameter defines the increase rate of the base current reference when the reference is changed or the drive is started.

![Diagram showing BaseReference Ramp Rate](image)

*Figure 16.*

2.2.4.8 *Base Reference to Zero*  
**ID 1537**

This parameter defines in which situations Base Current Reference is set to the value of ID1538 BaseRefAtStop.

0 = No action.
1 = Reference set to ID1538 when at STOP state.
2 = Reference set to ID1538 when AFE mode is active.
3 = Reference set to ID1538 when AFE mode is active or drive in STOP state.

2.2.4.9 *Base Reference at Stop State*  
**ID 1538**

Base reference on situation selected by ID1537 Base Reference to Zero. Reference is ramped after start command to ID1533. 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 (Power); MotPot Reset*  
**ID 367**

Select reset function for motor potentiometer function, i.e. Power Reference.

0 = No action.
1 = MotPot power adjustment is reset at stop state.
2 = MotPot power adjustment is reset when operation mode is AFE.
3 = MotPot power adjustment is reset at stop state or operation mode is AFE.
6.2.3 **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.

### 2.2.4.11.1 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.

### 2.2.4.11.2 PID Kp  **ID1911**

Gain for PID controller.

### 2.2.4.11.3 PID Ti  **ID1906**

Integration time for PID controller.

### 2.2.4.11.4 PID DC Low  **ID1903**

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

### 2.2.4.11.5 PID DC High  **ID1904**

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

2.2.4.1.7 **Reference Up Rate**  %/s  **ID1811**
Power reference ramp rate when decreasing the reference. Setting negative value will bypass reference ramping.

2.2.4.1.8 **BaseRefModePID**  **ID1914**
  
  0 = Active Current  
  1 = DC-Link Current

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

2.2.4.1.9 **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.

2.2.4.1.10 **Zero Error Limit**  **ID1843**
When PI Error is below this value regulation is stopped with delay (5* Ti).

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

### 6.2.4 Reference Adjust Functions

6.2.4.1 **Reactive Current Reference**

2.2.5.1 **Reactive Adjust Rate**  **ID 1557**
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)**  **ID 1553**
Select a digital input to increase the reactive reference with a set ramp rate.

2.2.5.3 **Reactive Ref Down (DigIn)**  **ID 1554**
Select a digital input to increase the reactive reference with a set ramp rate.

2.2.5.4 **MaxReactiveAdjust**  **ID 1559**
Maximum adjustment that MotPot function can make to reactive current reference.
6.2.4.2  AC Voltage Reference

**P2.2.6.1 Voltage at field weakening point**  ID 603

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**  ID 602

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**  ID 1790

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 %**  ID 1460

**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 %**  ID 1461

**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 %

$400\,\text{Vac} \times 30.0\% \times 15.0\% = 18\,\text{Vac}$. Increase of voltage from reactive current.

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

$P2.2.6.6$ **Inductor Losses** %  $ID\ 1465$

**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 %

$400\,\text{Vac} \times 50.0\% \times 15.0\% \times 15.0\% = 4.5\,\text{Vac}$. Increase of voltage from active current.

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 -> $422.5\,\text{Vac}$.

$2.2.6.7$ **Voltage Down (DigIn)**  $ID\ 1551$

Select a digital input to decrease the supply voltage with a set ramp rate.

$2.2.6.8$ **Voltage Up (DigIn)**  $ID\ 1550$

Select a digital input to increase the supply voltage with a set ramp rate.

$2.2.6.9$ **Voltage Adjust Rate**  $ID\ 1555$

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**  $ID\ 1639$

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.

$2.2.4.12$ **Start Voltage Mode**  $ID\ 1641$
This parameter selects 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.

3 = Keep Zero Reactive Power
The drive will follow the line voltage exactly, 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 or Voltage Motor potentiometer.

2.2.4.13 Reset Zero Q Delay ID 1642
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.

6.3 Ramp Control

P2.3.1 Ramp Time ID 103
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 ID 232
This parameter defines the frequency range where the ramp time is related. Starting from zero frequency.
6.4 Input signals

6.4.1 Basic settings

P2.4.1.1 Start/Stop Logic Selection ID 300 “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.

![Figure 17. Start pulse/Stop pulse.](image)

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”
2.4.2.2 **Input Inversion**  
*ID 1091*

Bit selection to invert input signal logic.

- **B00** = INV Open Contactor
- **B01** = INV Ext. Fault 1
- **B02** = INV Ext. Fault 2
- **B03** = INV Enable CB Close

### 6.4.2 Digital Input Signals

#### 2.4.2.1 **Start Signal 1**  
*ID 403*

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**  
*ID 404*

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**  
*ID 1600*

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**  
*ID 1453*

This parameter defines which digital input is used to 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.

**NOTE!** Missing feedback signal prevent drive going to ready state. MCB Feedback can be monitored from Status Word B10.

**NOTE!** If feedback is not used there will be three second forced delay on internally generated MCB feedback signal. MCB Feedback can be monitored from Status Word B10.
2.4.2.5 Fault Reset ID 414
Contact closed: all faults are reset. Rising edge.

2.4.2.6 Ext Fault 1 ID 405
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 ID 406
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 ID 407
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.
6.4.2.1  Synchronization to external grid

Synchronization logic is activated when digital output P2.5.11 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 grid synchronization](image)

*Figure 18.*

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 $\theta_{2}=\text{TRUE}$ 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**  
*ID 1896*  
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.

6.4.2.2 **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.

![Diagram of control place selection priority order](image)

*Figure 19. Control place selection priority order*

P2.4.2.22 **Control from I/O terminal**  
*ID 409*  
"I/O Term Control"  
Contact closed: force the control place to I/O terminal.

P2.4.2.23 **Control from Keypad**  
*ID 410*  
"Keypad Control"  
Contact closed: force the control place to keypad.

P2.4.2.24 **Control from Fieldbus**  
*ID 411*  
"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**  
*ID 1619*  
"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. With Control Options 2 B00 MCB is also opened without need to discharge DC link

**P2.4.2.26 Reset P/Hz MotPot Adjust**  **ID 1608**  **“Reset P/Hz MPot”**

This input will reset adjustment made with Motor Potentio meter function to Power/Hz reference.
6.4.3 Analogue inputs 1-4

2.4.3.1 AI1 signal selection  
2.4.4.1 AI2 signal selection  
2.4.5.1 AI3 signal selection  
2.4.6.1 AI4 signal selection

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  
2.4.4.2 Analogue input 2 signal filtering time  
2.4.5.2 Analogue input 3 signal filtering time  
2.4.6.2 Analogue input 4 signal filtering time

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

2.4.3.3 AI1 custom setting minimum  
2.4.3.4 AI1 custom setting maximum  
2.4.4.3 AI2 custom setting minimum  
2.4.4.4 AI2 custom setting maximum  
2.4.5.3 AI3 custom setting minimum  
2.4.5.4 AI3 custom setting maximum  
2.4.6.3 AI4 custom setting minimum  
2.4.6.4 AI4 custom setting maximum

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

Figure 20.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.4.3.5  **AI1 signal inversion**  ID 387 “AI1 Signal Inv”

2.4.4.5  **AI2 signal inversion**  ID 398 “AI2 Signal Inv”

2.4.5.5  **AI3 signal inversion**  ID 151 “AI3 Signal Inv”

2.4.6.5  **AI4 signal inversion**  ID 162 “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
6.4.3.1 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 ID 303 "AI1 Scale Min"
2.4.3.7 Analogue input 1, maximum value ID 304 "AI1 Scale Max"
2.4.4.6 Analogue input 2, minimum value ID 393 "AI2 Scale Min"
2.4.4.7 Analogue input 2, maximum value ID 394 "AI2 Scale Max"
2.4.5.6 Analogue input 3, minimum value ID 1037 "AI3 Scale Min"
2.4.5.7 Analogue input 3, maximum value ID 1038 "AI3 Scale Max"
2.4.6.6 Analogue input 4, minimum value ID 1039 "AI4 Scale Min"
2.4.6.7 Analogue input 4, maximum value ID 1040 "AI4 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 AI1 Controlled ID ID 1507 "AI1 Control. ID"
2.4.4.8 AI2 Controlled ID ID 1511 "AI2 Control. ID"
2.4.5.8 AI3 Controlled ID ID 1509 "AI3 Control. ID"
2.4.6.8 AI4 Controlled ID ID 1510 "AI4 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.

Figure 23.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.5 Output Signals

6.5.1 Digital Output Signals

2.5.1.1 Main Circuit Breaker 1 Close Control  ID 1218  “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  ID 1219  “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  ID 432
The AC drive is ready to operate.

2.5.1.4 Run  ID 433
The AC drive operates (the drive is modulating).

2.5.1.5 Fault  ID 434
A fault trip has occurred.

2.5.1.6 Fault, Inverted  ID 435
No fault trip has occurred.

2.5.1.7 At Reference  ID 444
The output frequency has reached the set reference. In AFE mode, when DC voltage level is on setpoint.

2.5.1.8 Overtemperature Warning  ID 439
The heatsink temperature exceeds unit temperature warning limit.

2.5.1.9 Warning  ID 436
A general warning signal. The warning will go low when the reset command is given.

2.5.1.10 Circuit Breaker 2 Close Control  ID 1709  “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  ID 1605
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  ID 1753
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

ID 1568 "DC Charge"

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

ID 1684

Drive has a warning and or fault active. This indication needs to be reset separately even if the situation is over.

2.5.1.15 Ready For Start

ID 1686

The drive has no interlock for starting the charging and going to RUN state.

2.5.1.16 Quick Stop Active

ID 1687

The drive has received a quick stop command.

6.5.1 Fieldbus digital inputs connection

P2.5.1.17 Fieldbus input data 1

ID 455 "FB Dig Input 1"

P2.5.1.19 Fieldbus input data 2

ID 456 "FB Dig Input 2"

P2.5.1.21 Fieldbus input data 3

ID 457 "FB Dig Input 3"

P2.5.1.23 Fieldbus input data 4

ID 169 "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

ID 891 "FB Dig 1 Par ID"

P2.5.1.20 Fieldbus digital input 2 parameter

ID 892 "FB Dig 2 Par ID"

P2.5.1.22 Fieldbus digital input 3 parameter

ID 893 "FB Dig 3 Par ID"

P2.5.1.24 Fieldbus digital input 4 parameter

ID 894 "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).
6.5.2 Delayed digital output 1 & 2

2.5.2.1 Dig. Out 1 Signal  ID 486
2.5.3.1 Dig. Out 2 Signal  ID 489

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

2.5.2.2 DO1 Content   ID 312
2.5.3.2 DO2 Content   ID 490

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

2.5.2.3 DO1 ON Delay   ID 487
2.5.3.3 DO2 ON Delay   ID 491
2.5.2.4 DO1 OFF Delay  ID 488
2.5.3.4 DO2 OFF Delay  ID 492

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

![Signal delays diagram](image-url)

Figure 24. Digital outputs 1 and 2, on- and off-delays
2.5.2.5  ID.Bit Free DO  ID 1216
2.5.3.5  ID.Bit Free DO  ID 1217

Select the signal for controlling the DO. The parameter must be set in the format xxx.yy where xxx 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.

6.5.3  Analogue output 1 & 2 & 3

2.5.4.1  Iout 1 signal  ID 464
2.5.5.1  Iout 2 signal  ID 471
2.5.6.1  Iout 3 signal  ID 478

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

2.5.4.2  Iout 1 Content  ID 307
2.5.5.2  Iout 2 Content  ID 472
2.5.6.2  Iout 3 Content  ID 479

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
2.5.4.3  Iout 1 Filter Time  ID 308
2.5.5.3  Iout 2 Filter Time  ID 473
2.5.6.3  Iout 3 Filter Time  ID 480

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.

---

2.5.4.4  Iout 1 Invert  ID 309
2.5.5.4  Iout 2 Invert  ID 474
2.5.6.4  Iout 3 Invert  ID 481

Inverts the analogue output signal:
- Maximum output signal = Minimum set value.
- Minimum output signal = Maximum set value.
2.5.4.5  *iout 1 Minimum*  ID 310  
2.5.5.5  *iout 2 Minimum*  ID 475  
2.5.6.5  *iout 3 Minimum*  ID 482  

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

![Figure 27.](image)

2.5.4.6  *iout 1 Scale*  ID 311  
2.5.5.6  *iout 3 Scale*  ID 476  
2.5.6.6  *iout 4 Scale*  ID 483  

A scaling factor for an analogue output.  

![Figure 28.](image)
2.5.4.7  \textit{lout 1 Offset}  \quad \textit{ID 375}
2.5.5.7  \textit{lout 2 Offset}  \quad \textit{ID 477}
2.5.6.7  \textit{lout 3 Offset}  \quad \textit{ID 484}

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

\begin{figure}[h]
\centering
\includegraphics[width=0.7\textwidth]{figure29.png}
\caption{Figure 29.}
\end{figure}

\subsection{Options}

\begin{itemize}
\item \textbf{P2.5.7.1 Output Inversion  \quad ID 1806}
  
  With this parameter it is possible to select which output signals are inverted.

  \begin{itemize}
  \item B00 = +1 = Inver Common Alarm
  \item B01 = +2 = Invert Common Warning
  \item B02 = +4 = Invert delayed output 1
  \item B03 = +8 = Invert delayed output 2
  \end{itemize}

\item \textbf{P2.5.7.2 Freq Scale Min AO  \quad ID 1807}
  
  This parameter is used to scale the analogue output function 12 / 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.

\item \textbf{P2.5.7.3 Freq Scale Max AO  \quad ID 1808}
  
  This parameter is used to scale the analogue output function 12 / 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.
\end{itemize}
**P2.5.7.4 DC Supervision Limit ID 1454**

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 ID 1607**

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.

3 = DC Voltage, Start Command or Pre-Charge Command from FB

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. This mode will also close MCB from FB Control Word B0 if DC-Link voltage is at required level.

**P2.5.7.6 MCB At Stop Command ID 1685**

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 ID 1513**

The parameter defines the delay when RO2 is closed after the drive has determined that MCB can be closed.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.6 Limit Settings

6.6.1 Current limits

2.6.1.1 Current Limit  
**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 ($I_{SCC}$).

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 $I_s$.

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  
**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 ($I_{SCD}$).

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

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_n)
Current Limit (I_{SCC}): 693 A (I_s)
Short Circuit Detection Level (I_{SCD}): \( \frac{693}{385} \times 1.25 = 319 \% \)

Short Circuit detection
Three phase
Fault: F91 Short Circuit

Figure 30.

2.6.1.3 Short Circuit Time
\textit{ID 1515}

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

Three phase short circuit timer needs also that voltage is below P: “Short Circuit Fault Voltage Level” before timer is started. Biphase faults monitors only the P: “Short Circuit Fault Voltage Level”

2.6.1.4 High Frequency Current Limit
\textit{ID 1517}

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_n, 50 % over load currents are needed for air cooled units. Liquid cooled units I_n 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 1 / 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 \textit{ID 1518}

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.

![Figure 31.](image)

2.6.1.6 Output Active Current Limit \textit{ID 1290}

This parameter sets the active current limit for the generator side operation of the regenerative unit. 100.0% is equal to nominal power, defined by System Rated Current.

2.6.1.7 Input Active Current Limit \textit{ID 1289}

This parameter sets the active current limit for the motoring side operation of the regenerative unit. 100.0% is equal to nominal power, defined by System Rated Current.

2.6.1.8 Software Over Current fault level \textit{ID1094}

Software level Over Current Protection. This is instantaneous value, related to P2.1.3 System Rated Current. ($P_{2.1.3} \times \sqrt{2}$). Drive stops to F1 Over Current Sub Code S4

6.6.2 Power limits

2.6.2.1 Output Power Limit \textit{ID 1288}

Output Power Limit, considers voltage variation on a grid and adjust Output Active Current limit to keep power same.

2.6.2.2 Input Power Limit \textit{ID 1287}

Input Power Limit, considers voltage variation on a grid and adjust Input Active Current limit to keep power same.

2.6.2.3 Power Limit Increase Rate \textit{ID 1502 “Limit.Inc.Rate”}

This parameter defines the limit increase rate. The limit will start to decrease immediately.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.6.2.4 High Frequency Power Limit Function**  
*ID 1703*

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.

### 6.6.3 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  
*ID 1717*

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  
*ID 1716*

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.

![Diagram](image-url)

Figure 32.
### Micro Grid Limits

#### 2.6.4.1 Current Limit Minimum \( ID \ 1621 \)
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 \( ID \ 1622 \)
An active current limit from DC to AC direction. This limit affects the Island and uGrid operation modes but not the AFE operation mode.

![Figure 33](image1)

#### 2.6.4.3 Maximum Limit Increase Rate \( ID \ 1502 \)
This parameter defines the increase rate for the current limit from DC to AC direction.

![Figure 34](image2)

#### 2.6.4.4 Current Limit Kp \( ID \ 1623 \)
The gain for the current limit operation.
2.6.4.5 Current Limit Ti  
*ID 1625*

The integration time for the current limit operation.

2.6.4.6 Current Limit Max Minimum  
*ID 1890*

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  
*ID 1539*

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.

6.6.5 DC voltage regulators

P2.6.5.1 Under Voltage Limit  
*ID 1524*

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.

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

500 Vac unit: \(439 \, V_{dc} = 500 \, V_{ac} \times 1.35 \times 65,00 \, %\)

690 Vac unit: \(605 \, V_{dc} = 690 \, V_{ac} \times 1.35 \times 65,00 \, %\)

P2.6.5.2 Over Voltage limit  
*ID 1523*

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.

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

500 Vac unit: \(810 \, V_{dc} = 500 \, V_{ac} \times 1.35 \times 120,00 \, %\)

690 Vac unit: \(1117 \, V_{dc} = 690 \, V_{ac} \times 1.35 \times 120,00 \, %\)
**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.Set” 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
6.7 Drive control

2.7.1 Switching Frequency ID 601
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 ID 1463
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 5th and 7th 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.
B10 = Fuse burning mode when operating with parallel power sources.
   Does not set voltage to immediately to zero when short circuit trigger happens.
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:
   \[ DC \text{ Voltage} = \text{Estimated Supply Voltage} \times 1.35 \times DC \text{ Reference} \]
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 ID 1464
This packed bit word is made for enabling/disabling different control options for the regeneration control.
B11 = New Current Controller.
   More robust when current exceed current limit in normal operation.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.7.4 **AFE Options 3**  
**ID 1466**  
This packed bit word is made for enabling/disabling different control options for the regeneration control.

2.7.5 **Start Delay**  
**ID 1500**  
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.

![Figure 35](image)

2.7.6 **Modulator Type**  
**ID 1516**  
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.

### 2.7.7 Control Options 1  
**ID 1707**

- **B00** = +1 = Reserved
- **B01** = +2 = Reserved
- **B02** = +4 = Reserved
- **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 P2.9.6.2 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.
- **B12** = +4096 = Reserved.
- **B13** = +8192 = Use angle information of the drive for SG synchronisation.

### 2.7.8 Control Options 2  
**ID 1798**

- **B00** = +1 = Enable CB Close (DI and FB), will also open MCB, without need of discharge DC link.
- **B01** = +2 = No longer available, use P2.9.1.5 FaultWarnIndicat
- **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.
- **B03** = +8 = Reserved
- **B04** = +16 = Disable uGrid mode low DC-Link power blackout prevention function.
This will disable uGrid low DC-Link voltage power limitation based on DC-Link voltage. Enables to keep correct Supply Frequency but Reactive Current is not behaving as in normal power sources. Basically same operation than Island mode but this will have drooping functions active.

**B05 = +32** =Double sampling. Reduces aliasing in current measurement but increases system load slightly. May be used on battery system where having accurate zero current reference is important.

### 2.7.9 Operation Time \( ID \ 1855 \)

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:

XX (Years) XX (Months) XX (Days) XX (Hours) XX Minutes

1211292359 -> 12 years, 11 months, 29 days, 23 hours and 59 minutes.
6.7.1 AFE Control

P2.7.10.1 Dynamic Support Kp  ID 1797

P2.7.10.2 Synch Kp  ID 1457
This parameter sets the gain of the synchronisation controller used to synchronise the switching to the supply.

P2.7.10.3 Synch Ti  ID 1458
This parameter sets the time constant of the controller used to synchronise the switching to the supply (15 equals 7ms).

P2.7.10.4 Active Current Kp  ID 1455
This parameter sets the gain of the controller for the active current of the regenerative unit.

P2.7.10.5 Active Current Ti  ID 1456
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  ID 1300

P2.7.10.7 Voltage Control Kp  ID 1451
This parameter sets the gain for the DC link PI voltage controller.

P2.7.10.8 Voltage Control Ti  ID 1452
This parameter sets the time constant in ms of the DC link PI controller.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.8 Master Follower

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

**Figure 1.** System bus physical connections with the OPT-D2 board

**P2.8.1 Master/Follower selection ID1324 “MF Mode”**

Select the Master Follower mode. When the drive is a follower, the Run Request command is monitored from Master but all references are selectable by parameters.

- **0** = No Communication
  - System bus is deactivated
- **1** = Master
  - Drive sends control word to follower drive.
- **2** = Follower
  - Drive receives control word from Master and sends some diagnostic information to the Master drive.

**P2.8.2 SB Comm Fault ID1082**

Select drive response for system bus communication fault.
6.9 Protections

6.9.1 General settings

2.9.1.1 Thermistor Fault Response ID 732

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 ID 1757

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

2.9.1.3 Overvoltage Response ID 1755

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

2.9.1.4 CoolingFlt.Delay ID 751

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 ID 1505

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 ID 1522

When the drive charging options are used, this parameter defines the maximum time limit for charging.
2.9.1.7  **MCB at Fault**  
*ID 1699*  
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

2.9.1.8  **Quick Stop Response**  
*ID 1758*  
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

2.9.1.9  **Reactive Error Trip Limit**  
*ID 1759*  
Limit for the reactive current for the line fault detection, when the reactive current is less than the value of parameter Line Synch fault.

2.9.1.10  **MCB Fault Delay**  
*ID 1521*  
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.

2.9.1.11  **Line Phase Supervision**  
*ID 702*  
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

2.9.1.12  **Response to the 4mA reference fault**  
*ID 700*  
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 (2 V or 4 mA). 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

2.9.1.13  **Reactive Current Limit Response**  
*ID 1981*  
This function can be used to generate a fault or a warning when the reactive current exceeds 110% value.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
0 = No response
1 = Warning
2 = Fault

P2.9.1.14 FaultWarnIndicat ID1940

With this parameter it's possible to select how warning and fault indication are handled to digital outputs and to fieldbus

0 = Static
   Static signal, as long as warning or fault is active

1 = Toggle
   New fault or warning toggles signal for one second.

2 = Marine
   Signal toggles in new fault or warning and status needs to be reset to get signal down.
6.9.2 Temperature Sensor Protections

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.

P2.9.2.1 Number of used inputs in board 1

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.

P2.9.2.2 Board 1 Temperature 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

P2.9.2.3 Board 1 warning 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).

P2.9.2.5 Board 1 fault limit

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).
P2.9.2.5 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

P2.9.2.6 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

P2.9.2.7 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).

P2.9.2.8 Board2 fault limit  ID746 “Board2 FaultLim”
Set here the limit at which the second temperature sensor board fault (F61) will be activated. When individual warning and fault limits are activated this is second board first channel (2A).
6.9.2.1 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.
2.9.2.5 Number of PT100 2 inputs in use ID 743 “PT100 2 Numbers”
If you have a two PT100 input boards installed in your AC drive, you can select the
number of PT100 inputs in use on 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 = PT100 input 1
2 = PT100 input 1 & 2
3 = PT100 input 1 & 2 & 3
4 = PT100 input 2 & 3
5 = PT100 input 3

2.9.2.6 PT100 2 Warning Limit ID 745 “PT100 2 Warn. Lim”
Set the limit at which the second PT100 warning will be activated.

2.9.2.7 PT100 2 Fault Limit ID 746 “PT100 2 Fault Lim”
Set the limit at which the second PT100 fault (F61) will be activated.

6.9.3 Earth fault
2.9.3.1 EarthFlt Response ID 1756
2 = Fault
3 = Fault, Open MCB
4 = Fault, Open NET CB
5 = Fault, Open Main & NET CB

2.9.3.2 EarthFaultLevel ID 1333
This parameter defines the maximum level of earth current in % of the unit current.

6.9.4 Fieldbus
2.9.4.1 Fieldbus Fault Slot D Response ID 733
2.9.4.2 Fieldbus Fault Slot E Response ID 761
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 ID 1354
Delay time to a fieldbus fault when the pulse from PLC is missing. Setting the time to
zero will disable the monitoring function.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.9.5 External Fault

2.9.5.1 Response to External Fault 1  ID 701  “External Fault 1”

2.9.5.2 Response to External Fault 2  ID 1504  “External Fault 2”
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.

0 = No response
1 = Warning
2 = Fault

2.9.5.3 External fault delay  ID 1506
Defines the delay for an external fault, and affects both external fault inputs.

6.9.6 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  ID 1626
0 = No response
1 = Warning
2 = Fault

OPT-D7 Grid Voltage D7
Fault: F92 D7 Voltage

Supply Voltage
VoltsHighWarnLim
VoltsHighTripLim
VoltsLowWarnLim
VoltsLowTripLim
VoltageTripDelay

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

Figure 2.
**P2.9.6.2 Voltage Low Warning Limit**  
ID 1893  
Low limit for a warning indication. A percentage value from a set supply voltage parameter.

**P2.9.6.3 Voltage Low Trip Limit**  
ID 1899  
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**  
ID 1895  
High limit for a warning indication. A percentage value from a set supply voltage parameter.

**P2.9.6.5 Voltage High Trip Limit**  
ID 1799  
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**  
ID 1898  
Delay to a fault when the voltage has exceeded the fault levels.

**6.9.7 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.

![Diagram](https://via.placeholder.com/150)

*Figure 3.*
P2.9.7.1  Freq. Supply Response  ID 1627
0 = No response  
1 = Warning  
2 = Fault

P2.9.7.2  Freq. D7 Response  ID 1628
0 = No response  
1 = Warning  
2 = Fault

P2.9.7.3  Freq. Low Warning Limit  ID 1780
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  ID 1781
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  ID 1783
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  ID 1784
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  ID 1785
Delay to a fault when the frequency has exceeded the fault levels.

6.9.8  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  ID 1629
0 = No response  
1 = Warning  
2 = Fault

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.9.8.2 Voltage Low Trip Limit**  
*ID 1891*  
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**  
*ID 1880*  
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 High Warning Limit**  
*ID 1881*  
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**  
*ID 1992*  
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.

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 4.*

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.9.9 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 10000.

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 5.](image)

2.9.9.1 Response to over load ID 1838 "OverLoadResponse"

0 = No response
1 = Warning
2 = Fault

2.9.9.2 Over Load Signal ID 1837 "OverLoadSignal"

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

2.9.9.3 Over Load Maximum Input ID 1839 "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.

6.9.10 **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.
6.9.11 Extra
2.9.11 Fault Simulation  ID 1569  “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.

\[
\begin{align*}
B00 &= +1 = \text{Simulates an over current fault (F1)} \\
B01 &= +2 = \text{Simulates an over voltage fault (F2)} \\
B02 &= +4 = \text{Simulates an under voltage fault (F9)} \\
B03 &= +8 = \text{Simulates an output phase supervision fault (F11)} \\
B04 &= +16 = \text{Simulates an earth fault (F3)} \\
B05 &= +32 = \text{Simulates a system fault (F8)} \\
B06 &= +64 = \text{Free} \\
B07 &= +128 = \text{Simulates an over temperature warning (W14)} \\
B08 &= +256 = \text{Simulates an over temperature fault (F14)} \\
B09 &= +512 = \text{Reserved}
\end{align*}
\]

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

\[
\begin{align*}
B06 &= +64 = \text{Free} \\
B07 &= +128 = \text{Simulates an over temperature warning (W14)} \\
B08 &= +256 = \text{Simulates an over temperature fault (F14)} \\
\end{align*}
\]

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.

2.9.12 Reset Datalogger  ID 1569  “Reset Datalogger”

With this parameter it is possible to reset the datalogger to its defaults.
6.10 **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.

2.10.18  
**GSW Data**  
_ID 897_  
With this parameter it is possible to select which data is sent in FBGeneralStatusWord.
2.10.19  **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.

3: Vacon AFE 2
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. More extensive control than Vacon AFE 1 state machine selection.

2.10.20  **FB Ref Min**  
**ID 850**

2.10.21  **FB Ref Max**  
**ID 851**

The minimum and maximum limits for fieldbus DC Voltage Reference.

2.10.22  **Control Slot selector**  
**ID 1440**

This parameter defines which slot is used as the main control place when two fieldbus boards have been installed in the drive. When values 6-7 are selected the drive can use the Fast fieldbus mode if a fieldbus board with proper support for it is inserted in slot D or E. 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).
6 = Slot D with Fast fieldbus mode.
7 = Slot E with Fast fieldbus mode.
8 = Slot D with Extended fieldbus mode (16 process data variables).
9 = Slot E with Extended fieldbus mode (16 process data variables).
2.10.23  SW ID.Bit selection B11  ID 1907
2.10.24  SW ID.Bit selection B12  ID 1908
2.10.25  SW ID.Bit selection B13  ID 1909
2.10.26  SW ID.Bit selection B14  ID 1910

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

2.10.27  uGrid CW B12 parameter  ID 891 "uCW B12"
2.10.28  uGrid CW B13 parameter  ID 892 "uCW B13"
2.10.29  uGrid CW B14 parameter  ID 893 "uCW B14"
2.10.30  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.
6.11 Micro Grid

2.11.1 Control Mode ID 1531

Select the AFE operation mode.

0 = AFE
Standard AFE functionality, no licence 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 ID 1543

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

![Figure 6.](image)

2.11.3 Voltage Droop ID 1535

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.

![Figure 7.](image)

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2.11.4 Start Power Mode
ID 1503
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
ID 1541
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.

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

P2.11.6 Generator Mechanical Time Constant
ID 1722
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
ID 1723
Simulated diesel generator speed control gain.

P2.11.8 Generator Speed Control Ti
ID 1724
Simulated diesel generator speed control Ti.
6.11.1.2 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.

![Diagram](https://via.placeholder.com/150)

Figure 8.

2.11.10.1 AFE Mode 1 ID 1616

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

0=AFE
1=Island
2=Micro Grid

2.11.10.2 AFE Mode 2 ID 1617

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

0=AFE
1=Island
2=Micro Grid

2.11.10.3 AFE Mode 3 ID 1618

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

0=AFE
1=Island
2=Micro Grid
6.12 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 \hspace{1cm} ID 1601

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 \hspace{1cm} ID 1611

Use of P:Synch. Offset does 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 \hspace{1cm} ID 1612

Island mode line sync gain. Init =500.

2.12.4 Synch Ti \hspace{1cm} ID 1613

Reserved (not in use)

2.12.5 Synch.Hysteresis \hspace{1cm} ID 1614

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

2.12.6 Contactor Delay \hspace{1cm} ID 1624

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 \hspace{1cm} ID 1618

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

0 =Stay Run
1 =Stop

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.13 RESERVED
6.14 **ID functions**

Here you will find the functions that use the parameter ID number to control and monitor the signal.

### 6.14.1 Value control

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

**P2.14.1.1 Control Input Signal ID**  
ID 1580  
"CtrlInsSignal ID"

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

**P2.14.1.2 Control Off Limit**  
ID 1581  
"Ctrl Off Limit"

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

**P2.14.1.3 Control On Limit**  
ID 1582  
"Ctrl On Limit"

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

**P2.14.1.4 Control Off Value**  
ID 1583  
"Ctrl 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**  
ID 1584  
"Ctrl 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**  
ID 1585  
"CtrlOutSignal ID"

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**  
ID 1586  
"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.

Figure 9.

2 = Scale ABS Inverted

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

Figure 10.

3 = SR

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

4 = Scale ABS

Input values is scaled linearly between On and Off values.

5 = Scale Inverted

Inverted value is scaled linearly between On and Off values.

P2.14.18 Control Signal Filtering TC ID 1586 “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.
6.14.2 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 12.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.1 ID Control Digital Input 1</td>
<td>ID 1570</td>
<td>&quot;ID Control DIN&quot;</td>
</tr>
<tr>
<td>P2.14.3.1 ID Control Digital Input 2</td>
<td>ID 1574</td>
<td>&quot;ID Control DIN&quot;</td>
</tr>
<tr>
<td>P2.14.4.1 ID Control Digital Input 3</td>
<td>ID 1578</td>
<td>&quot;ID Control DIN&quot;</td>
</tr>
<tr>
<td>P2.14.5.1 ID Control Digital Input 3</td>
<td>ID 1930</td>
<td>&quot;ID Control DIN&quot;</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.2 DIN Controlled ID</td>
<td>ID 1571</td>
<td>&quot;Controlled ID&quot;</td>
</tr>
<tr>
<td>P2.14.3.2 DIN Controlled ID</td>
<td>ID 1575</td>
<td>&quot;Controlled ID&quot;</td>
</tr>
<tr>
<td>P2.14.4.2 DIN Controlled ID</td>
<td>ID 1579</td>
<td>&quot;Controlled ID&quot;</td>
</tr>
<tr>
<td>P2.14.5.2 DIN Controlled ID</td>
<td>ID 1931</td>
<td>&quot;Controlled ID&quot;</td>
</tr>
</tbody>
</table>

Select a parameter ID controlled by ID1570.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.3 Value for Low digital input (FALSE)</td>
<td>ID 1572</td>
<td>&quot;FALSE Value&quot;</td>
</tr>
<tr>
<td>P2.14.3.3 Value for Low digital input (FALSE)</td>
<td>ID 1576</td>
<td>&quot;FALSE Value&quot;</td>
</tr>
<tr>
<td>P2.14.4.3 Value for Low digital input (FALSE)</td>
<td>ID 1587</td>
<td>&quot;FALSE Value&quot;</td>
</tr>
<tr>
<td>P2.14.5.3 Value for Low digital input (FALSE)</td>
<td>ID 1932</td>
<td>&quot;FALSE Value&quot;</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.4 Value for High digital input (TRUE)</td>
<td>ID 1573</td>
<td>&quot;TRUE Value&quot;</td>
</tr>
<tr>
<td>P2.14.3.4 Value for High digital input (TRUE)</td>
<td>ID 1577</td>
<td>&quot;TRUE Value&quot;</td>
</tr>
<tr>
<td>P2.14.4.4 Value for High digital input (TRUE)</td>
<td>ID 1588</td>
<td>&quot;TRUE Value&quot;</td>
</tr>
<tr>
<td>P2.14.4.4 Value for High digital input (TRUE)</td>
<td>ID 1933</td>
<td>&quot;TRUE Value&quot;</td>
</tr>
</tbody>
</table>

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.
6.14.3 Signal Fault Function

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

P2.14.6.1 Fault Signal ID ID1941

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

P2.14.6.2 Fault Mode ID1942

Select response when signal exceeds set low or high limit.

0 = No Action
1 = Warning generated in Run state
2 = Fault generated in Run state
3 = Warning generated in stop and run state
4 = Fault generated in stop and run state.

P2.14.6.3 High Fault Limit ID1943

Set here the signal high limit when trigger is made for fault or warning, note the decimals are also needed from original signal. e.g. frequency limit 50.25 Hz is set as 5025.

P2.14.6.4 Low Fault Limit ID1944

Set here the signal low limit when trigger is made for fault or warning. Note the decimals are also needed from original signal. e.g. frequency limit 50.25 Hz is set as 5025.
6.15  **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.
6.16 Grid voltage PI controller

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

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.

P2.15.1 PI Activation ID 1807
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.

P2.15.2 PI Controller Gain ID 118
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.

P2.15.3 PI Controller I-time ID 119
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.

P2.15.4 PI Max Adjust ID 360
This parameter defines maximum adjustment that PI controller can made to voltage.

6.16.1 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 ID 1630
P2.16.5.2 PI Frequency High Limit ID 1631
P2.16.5.3 PI Voltage Low Limit ID 1632
P2.16.5.4 PI Voltage High Limit ID 1633
7. 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 ID 125 “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 Licence Key ID 1995 “Licence 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.
8. FB Status and Control in Detail

<table>
<thead>
<tr>
<th>P2.10.19 State machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/ Basic</td>
</tr>
<tr>
<td>2/ Standard</td>
</tr>
<tr>
<td>3/ Vacon AFE 1</td>
</tr>
<tr>
<td>3/ Vacon AFE 2</td>
</tr>
</tbody>
</table>

8.1 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.
### 8.2 State Machine: Basic

#### 8.2.1 FB Control Word Basic

Table 54.

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Stop Request</td>
<td>Start Request</td>
<td>Use this for start and stop command</td>
</tr>
<tr>
<td>b1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>No Action</td>
<td>Fault Reset 0 &gt; 1</td>
<td>Use this for fault reset</td>
</tr>
<tr>
<td>b3</td>
<td>Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON</td>
<td>See P2.5.1.17 - 18</td>
</tr>
<tr>
<td>b4</td>
<td>Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.1.19 - 20</td>
</tr>
<tr>
<td>b5</td>
<td>Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.1.21 - 22</td>
</tr>
<tr>
<td>b6</td>
<td>Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.1.23 - 24</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  
**Fault Reset:** Resets active faults.
8.3 State Machine: Standard
8.3.1 Control Word: Standard

Table 55.

<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.
8.4 State machine: Vacon AFE 1

8.4.1 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 P2.5.1.19 - 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.

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.
### 8.5 Control Word: Vacon AFE 2 Profile (3)

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>B00 DC Charge</td>
<td>0=Open MCB. 1=Close DC charge contactor. MCB closed automatically, see B01.</td>
</tr>
<tr>
<td>B01 MCB Close Enable</td>
<td>0=Disable Closing of MCB (Also opens if Control Options.B0=TRUE) 1=Enable Closing of MCB (Works also for reclosing)</td>
</tr>
<tr>
<td>B02 Quick Stop</td>
<td>0=Quick Stop 1=No Quick Stop</td>
</tr>
<tr>
<td>B03 Run</td>
<td>0=AFE is stopped 1=AFE is started</td>
</tr>
<tr>
<td>B04 Output Power Limit to Zero</td>
<td>0=Output Power Limit to Zero (7%) 1=Output Power Limit =P2.5.2.1</td>
</tr>
<tr>
<td>B05 Disable Power Increase, Input or Output</td>
<td>0=Disable increase of power. 1=Power limits defined by G2.5.2</td>
</tr>
<tr>
<td>B06 Input Power Limit to Zero</td>
<td>0=Input Power Limit to Zero (7%) 1=Output Power Limit =P2.5.2.2</td>
</tr>
<tr>
<td>B07 Reset</td>
<td>0&gt;1 Reset fault.</td>
</tr>
<tr>
<td>B08 DC Voltage Ref B00</td>
<td>B00</td>
</tr>
<tr>
<td>B09 DC Voltage Ref B01</td>
<td>1</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=1×0×1...0,5 sec square wave clock. This is used to check data communication between fieldbus master and the drive.</td>
</tr>
<tr>
<td>B12 FB DIN2</td>
<td>Can be used to control RO or directly parameter by ID number. G2.4.1</td>
</tr>
<tr>
<td>B13 FB DIN3</td>
<td>Can be used to control RO or directly parameter by ID number. G2.4.1</td>
</tr>
<tr>
<td>B14 FB DIN4</td>
<td>Can be used to control RO or directly parameter by ID number. G2.4.1</td>
</tr>
<tr>
<td>B15 Reserved for future use.</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 13.*
B00: FALSE = Open MCB, TRUE = PreCharge DC
Open MCB: Opens MCB if closed, stops precharging if charging is active through the drive.
PreCharge DC: Drive will start precharge if function activated by digital output and control place is fieldbus. When control place is not fieldbus precharging is started from normal start command.

B01: MCB Close Enable
FALSE: MCB Closing is disabled in fieldbus control. MCB Remains open when if DC voltage is above closing limit.
TRUE: MCB Closing is enabled in fieldbus control. This bit can be true all the time if function is not needed.

B02: Quick Stop
FALSE: Drive will stop modulation immediately and open MCB immediately.
TRUE: Quick stop is not active and normal operation is possible.

B03: FALSE = Stop Request, TRUE = Start Request
Stop Request: Drive will stop.
Start Request: Start Command to the drive. Rising edge needed for start.

B04: Output Power Limit to Zero
FALSE: Output power limit is reduced to 7% if parameter limit is higher.
TRUE: Power limit is defined by power limit parameters.

B05: Disable Power Increase, Input or Output
FALSE: Power is limited to actual power, power can’t increase when this bit is active.
TRUE: Power limit is defined by power limit parameters.

B06: Input Power Limit to Zero
FALSE: Input power limit is reduced to 7% if parameter limit is higher.
TRUE: Power limit is defined by power limit parameters.

B07: FALSE = No significance, TRUE = Fault Acknowledge
Fault Acknowledge: The group signal is acknowledged with a positive edge.

B08: FALSE = No Function, TRUE = DC Ref 1
B09: FALSE = No Function, TRUE = DC Ref 2

<table>
<thead>
<tr>
<th>DC Ref</th>
<th>FB Reference</th>
<th>110,00 %</th>
<th>115,00 %</th>
<th>120,00 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>B08</td>
<td>FALSE</td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>B09</td>
<td>FALSE</td>
<td>FALSE</td>
<td>TRUE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

B10: FALSE = FB Control disabled, TRUE = FB Control Enabled
FB Control Disabled: Drive will not follow main control word from Fieldbus. If removed while running drive will make coasting stop.
FB Control Enabled: Drive follows control word from fieldbus.

B11: FALSE = FB WD Pulse Low, TRUE = FB WD Pulse High
Watch dog pulse: This pulse is used to monitor that PLC is alive. If pulse is missing drive will go to fault state. This function is activated by P2.7.6 FB WD Delay. When value is zero pulse is not monitored.
## 8.6 FB Status Word

<table>
<thead>
<tr>
<th>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>SW1D.Bit selection B11</td>
<td>P2.13.22 SW11 ID.Bit</td>
<td>SW1D.Bit selection B11</td>
</tr>
<tr>
<td>b12</td>
<td>SW1D.Bit selection B12</td>
<td>P2.13.23 SW12 ID.Bit</td>
<td>SW1D.Bit selection B12</td>
</tr>
<tr>
<td>b13</td>
<td>SW1D.Bit selection B13</td>
<td>P2.13.24 SW13 ID.Bit</td>
<td>SW1D.Bit selection B13</td>
</tr>
<tr>
<td>b14</td>
<td>SW1D.Bit selection B14</td>
<td>P2.13.25 SW14 ID.Bit</td>
<td>SW1D.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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
B06: 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 P2.5.7.4 DC Voltage Supervision Limit.
DC Reached Or Exceeded: DC is above P2.5.7.4 DC Voltage Supervision Limit.

B11: FALSE = SW ID.Bit selection B11, TRUE = SW ID.Bit selection B11
SW ID.Bit selection B11 Low: Selected bit is low.
SW ID.Bit selection B11 High: Selected bit is high.

B12: FALSE = SW ID.Bit selection B12, TRUE = SW ID.Bit selection B12
SW ID.Bit selection B12 Low: Selected bit is low.
SW ID.Bit selection B12 High: Selected bit is high.

B13: FALSE = SW ID.Bit selection B13, TRUE = SW ID.Bit selection B13
SW ID.Bit selection B13 Low: Selected bit is low.
SW ID.Bit selection B13 High: Selected bit is high.

B14: FALSE = SW ID.Bit selection B14, TRUE = SW ID.Bit selection B14
SW ID.Bit selection B14 Low: Selected bit is low.
SW ID.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.
### 8.7 FB Micro Grid Control Word 1 ID1700

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Start As Island</td>
<td>If B11 = False, mode changed in STOP state.</td>
</tr>
<tr>
<td>b1 Start As Micro Grid</td>
<td>If B11 = False, mode changed in STOP state.</td>
</tr>
<tr>
<td>b2 Start synchronisation D7</td>
<td>Synchronization to external grid with OPT-D7</td>
</tr>
<tr>
<td>b3 Power Down</td>
<td>Same as P2.2.6.2</td>
</tr>
<tr>
<td>b4 Power Up</td>
<td>Same as P2.2.6.3</td>
</tr>
<tr>
<td>b6 Reset MotPot</td>
<td>Same as P2.4.2.27</td>
</tr>
<tr>
<td>b7 Live Mode Control</td>
<td>Operation mode is changed in Run State</td>
</tr>
<tr>
<td>b8 Enable FB Control Mode</td>
<td>B0 and B1, is controllable from FB otherwise parameter</td>
</tr>
<tr>
<td>b9 P2.10.27 uCW B12</td>
<td></td>
</tr>
<tr>
<td>b10 P2.10.28 uCW B12</td>
<td></td>
</tr>
<tr>
<td>b11 P2.10.29 uCW B12</td>
<td></td>
</tr>
<tr>
<td>b12 P2.10.30 uCW B12</td>
<td></td>
</tr>
</tbody>
</table>
9. 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>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Status Word</td>
<td>61342</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>DC Voltage Act.</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Active Current</td>
<td>9.3</td>
<td></td>
<td></td>
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<tr>
<td>Value</td>
<td>Reactive Current</td>
<td>6.3</td>
<td></td>
<td></td>
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<tr>
<td>Value</td>
<td>Supply Frequency</td>
<td>60</td>
<td>Hz</td>
<td>45.00</td>
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<tr>
<td>Value</td>
<td>Supply Voltage</td>
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<td>V</td>
<td>300.0</td>
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<td>Value</td>
<td>Line Frequency D7</td>
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<tr>
<td>Value</td>
<td>Line Voltage D7</td>
<td>400</td>
<td>V</td>
<td>300</td>
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</table>

*Figure 14. 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 15. Datalogger window opening and Service Info upload.*
10. 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 overcurrent 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.

- S1 = Reserved
- Disturbance. Reset the unit and try again.
- If there is star coupler in the unit, check the fibre connections and phase order.
- Driver board or IGBT 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.

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**
**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 cables and 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°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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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 **Microprosessor 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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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  **Licence**
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.

**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.

- 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.

**F97 Signal Trip**

Freely selectable signal monitoring value has exceeded set limit levels.