VACON APFIFF41 APPLICATION MANUAL

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12. Fault codes
1. ADVANCED HS APPLICATION - INTRODUCTION

Software APFIFF41, Advanced High Speed application. This application without license can go up to 599 Hz. With license maximum frequency is 7200 Hz.

If there is no need to go above 599 Hz its recommended to use APFIF599 Application.

1.1 General

This application is not backwards compatible. Please read the application change note or chapter 2 Version parameter compatibility issues in this application manual to see what needs to be noted when updating the application. See also the updated parameter description in NCDrive when commissioning.

Help is available in NCDrive through selecting “Variable Text” and pressing “F1”. Below an example from Identification parameter help text from the NCDrive.

<table>
<thead>
<tr>
<th>Index</th>
<th>Variable Text</th>
<th>Value</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 2.1.1</td>
<td>Supply Voltage</td>
<td>630</td>
<td>V</td>
<td>0</td>
<td>1000</td>
<td>1200</td>
</tr>
<tr>
<td>P 2.1.2</td>
<td>Motor Nom Volts</td>
<td>950</td>
<td>V</td>
<td>0</td>
<td>880</td>
<td>110</td>
</tr>
<tr>
<td>P 2.1.3</td>
<td>Motor Nom Freq</td>
<td>80.00</td>
<td>Hz</td>
<td>0</td>
<td>500.00</td>
<td>111</td>
</tr>
<tr>
<td>P 2.1.4</td>
<td>Motor Nom Speed</td>
<td>4800</td>
<td>rpm</td>
<td>0</td>
<td>2400</td>
<td>112</td>
</tr>
<tr>
<td>P 2.1.5</td>
<td>Motor Nom Current</td>
<td>2060</td>
<td>A</td>
<td>0</td>
<td>4100</td>
<td>113</td>
</tr>
<tr>
<td>P 2.1.6</td>
<td>Motor Nom Frq</td>
<td>1.05</td>
<td>Hz</td>
<td>0</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>P 2.1.7</td>
<td>Motor Nom Power</td>
<td>1.95</td>
<td>kW</td>
<td>0</td>
<td>2390</td>
<td>113</td>
</tr>
<tr>
<td>P 2.1.8</td>
<td>Motor Current</td>
<td>0</td>
<td>A</td>
<td>0</td>
<td>1420</td>
<td>0</td>
</tr>
<tr>
<td>P 2.1.9</td>
<td>Identification</td>
<td>0</td>
<td>No Action</td>
<td>0</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td>P 2.1.10</td>
<td>Motor Type</td>
<td>1</td>
<td>PMSM</td>
<td>0</td>
<td>1</td>
<td>630</td>
</tr>
</tbody>
</table>

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1.2 Basic Features

This application without license can go up to 599 Hz. With license maximum frequency is 7200 Hz.

Advanced HS application provides a wide range of parameters for controlling motors. It can be used for various kinds of different processes, where wide flexibility of I/O signals is needed and PID-control is not necessary (if you need PID-control functions, use the PID Control Application or Pump and Fan Control Application).

The frequency reference can be selected e.g. from the analogue inputs, joystick control, motor potentiometer and from a mathematical function of the analogue inputs. There are parameters also for Fieldbus communication. Multi-step speeds and jogging speed can also be selected if digital inputs are programmed for these functions.

Additional functions:

- Power limit functions
- Different power limits for motoring and generating side
- Master Follower function
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Brake monitoring input and actual current monitor for immediate brake close.
- Separate speed control tuning for different speeds and loads
- Inching function two different references
- Possibility to connect the FB Process data to any parameter and some monitoring values
- Analogue input 3 and 4 can control any parameter by ID number.
- Possibility to control single parameters with digital inputs.
- Redundant Profibus; possibility to connect two PB masters to control same drive, freezing of control values and changing control slot in case of FBFault.
2. VERSION PARAMETER COMPATIBILITY ISSUES

Compatibility issues V201 to older versions
- FreqRefInterp. TC: ID1780 - > ID1184
- Torque Scale: ID1601 - > ID1247
- DeadTimeComp. ID1580 - > ID1751
- DeadTimeContCurL ID1581 - > ID1752
- DeadTHWComp.Disa ID1704 - > ID1750
- ContrInSignal ID ID1582 - > ID1580
- Contrl Off Limit ID1583 - > ID1581
- Contrl On Limit ID1584 - > ID1582
- Contrl Off Value ID1585 - > ID1583
- Contrl On Value ID1586 - > ID1584
- ControlOutSignID ID1587 - > ID1585
- Control Mode ID1588 - > ID1586
- Control Filt TC ID1589 - > ID1721
- I/f Control Lim ID1608 - > ID1790
- I/f Current ID1609 - > ID1693
- FBFaultDelay ID1500 - > ID1850
- ID Control DI B1 ID1574 - > ID1277
- B10 Value ID1578 - > ID1193
- B11 Value ID1575 - > ID1182
- Ramp Rate ID1579 - > ID1112
- PB SW ID68 - > FB Status Word ID65
- TorqStabLimitRat ID1739 - > TorqueStabLimit ID1720

Note 1: When updating application, it is not recommended to use VACON® NCDrive parameter download function. Instead, upload the parameters from the unit and make comparison to the old parameter file, especially in cases when version number change is considerably high. Application is constantly developed, this includes changing parameter default values. If parameters are directly downloaded to drive, the improved default values will be lost.
3. COMMISSIONING NOTES

3.1 Frequency scale
This application support output frequency up to 7200 Hz. License Key is needed to exceed frequency 599 Hz.

3.2 Parameter download
Before downloading parameters to drive it is recommended to select first frequency range and after that download parameters to drive. Parameter to select frequency range is P2.1.12 Frequency Scale.
4. CONTROL I/O

Reference potentiometer
1...10 kΩ

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<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>±10Vdc</td>
<td>Reference voltage output. Voltage for potentiometer, etc.</td>
</tr>
<tr>
<td>2</td>
<td>A1+</td>
<td>Analogue input 1. Range: 0-10V, Rᵢ = 200Ω. Default range: Voltage 0 – 10V</td>
</tr>
<tr>
<td>3</td>
<td>A1-</td>
<td>I/O Ground. Ground for reference and controls</td>
</tr>
<tr>
<td>4</td>
<td>A2+</td>
<td>Analogue input 2. Range: 0-10V, Rᵢ = 2000Ω. Default range: Current 0 – 20 mA</td>
</tr>
<tr>
<td>5</td>
<td>A2-</td>
<td>Analogue input 2. Range: 0-10V, Rᵢ = 2000Ω. Default range: Current 0 – 20 mA</td>
</tr>
<tr>
<td>6</td>
<td>±24V</td>
<td>Control voltage output. Voltage for switches, etc. max 0.1 A</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>I/O ground. Ground for reference and controls</td>
</tr>
<tr>
<td>8</td>
<td>DIN1</td>
<td>Start forward. Programmable P2.2.7</td>
</tr>
<tr>
<td>9</td>
<td>DIN2</td>
<td>Start reverse. Programmable P2.2.7</td>
</tr>
<tr>
<td>10</td>
<td>DIN3</td>
<td>Fault reset. Programmable P2.2.2.7</td>
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<tr>
<td>11</td>
<td>CMA</td>
<td>Common for DIN 1...DIN 3. Connect to GND or ±24V</td>
</tr>
<tr>
<td>12</td>
<td>±24V</td>
<td>Control voltage output. Voltage for switches (see #6)</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>I/O ground. Ground for reference and controls</td>
</tr>
<tr>
<td>14</td>
<td>DIN4</td>
<td>Programmable P2.2.7</td>
</tr>
<tr>
<td>15</td>
<td>DIN5</td>
<td>Programmable P2.2.7</td>
</tr>
<tr>
<td>16</td>
<td>DIN6</td>
<td>Programmable P2.2.7</td>
</tr>
<tr>
<td>17</td>
<td>CMB</td>
<td>Common for DIN4—DIN6. Connect to GND or ±24V</td>
</tr>
<tr>
<td>18</td>
<td>AOA1+</td>
<td>Analogue output 1. Programmable P2.3.1.2</td>
</tr>
<tr>
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<td>AOA1-</td>
<td>Analogue output 1. Programmable P2.3.1.2</td>
</tr>
<tr>
<td>20</td>
<td>DOA1</td>
<td>Digital output. Programmable. Open collector, Iᵩ≤50mA, Uᵩ≤48 V DC</td>
</tr>
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<th>Description</th>
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<td>Relay output 1. Programmable G2.3.3</td>
</tr>
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<td>22</td>
<td>RO1</td>
<td>Switching capacity: 24 VDC / 8 A</td>
</tr>
<tr>
<td>23</td>
<td>RO1</td>
<td>250 VAC / 8 A</td>
</tr>
<tr>
<td>24</td>
<td>RO2</td>
<td>Relay output 2. Programmable G2.3.3</td>
</tr>
<tr>
<td>25</td>
<td>RO2</td>
<td>No function defined at default</td>
</tr>
<tr>
<td>26</td>
<td>RO2</td>
<td>No function defined at default</td>
</tr>
</tbody>
</table>

Table 4-1. Advance application default I/O configuration and connection example.

Note: See User Manual, chapter Control Connections, for hardware specification and configuration.

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

Jumper block X3:
CMA and CMB grounding

- CMB connected to GND
- CMA connected to GND
- CMB isolated from GND
- CMA isolated from GND
- CMB and CMA internally connected together, isolated from GND

= Factory default

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5. "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 14.

5.1 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's Manual, Chapter 6.2) 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's Manual, Chapter 6.2).

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.
5.2 Defining a terminal for a certain function with NCDrive programming tool

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

![Parameter Window](image)

**Figure 5-1. 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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
5.3 Defining unused inputs/outputs

All unused inputs and outputs must be given the board slot value 0 and the value 1 also for the terminal number. The value 0.1 is also the default value for most of the functions. However, if you want to use the values of a digital input signal for e.g. testing purposes only, you can set the board slot value to 0 and the terminal number to any number between 2...10 to place the input to a TRUE state. In other words, the value 1 corresponds to 'open contact' and values 2 to 10 to 'closed contact'.

In case of analogue inputs, giving the value 1 for the terminal number corresponds to 0% signal level, value 2 corresponds to 20%, value 3 to 30% and so on. Giving value 10 for the terminal number corresponds to 100% signal level.
6. ADVANCE HS APPLICATION – MONITORING VALUES

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 66 to 202. Parameter description includes more than is available in this application see parameter list what is available.

**Column explanations:**
- **Code** = Location indication on the keypad; Shows the operator the present parameter number
- **Parameter** = Name of parameter
- **Min** = Minimum value of parameter
- **Max** = Maximum value of parameter
- **Unit** = Unit of parameter value; Given if available
- **Default** = Value preset by factory
- **Cust** = Customer’s own setting
- **ID** = ID number of the parameter
- = On parameter code: Parameter value can only be changed after the FC has been stopped.
- = Apply the Terminal to Function method (TTF) to these parameters (see chapter 5)
- = Monitoring value is possible to control from fieldbus by ID number

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

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

The monitoring values are the actual values of parameters and signals as well as statuses and measurements.

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>Form.</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.1</td>
<td>Output frequency</td>
<td>Hz</td>
<td>#.##</td>
<td>1</td>
<td>Output frequency to motor</td>
</tr>
<tr>
<td>V1.2</td>
<td>Frequency reference</td>
<td>Hz</td>
<td>#.##</td>
<td>25</td>
<td>Frequency reference to motor control</td>
</tr>
<tr>
<td>V1.3</td>
<td>Motor speed</td>
<td>rpm</td>
<td>#</td>
<td>2</td>
<td>Motor speed in rpm</td>
</tr>
<tr>
<td>V1.4</td>
<td>Motor current</td>
<td>A</td>
<td>Varies</td>
<td>3</td>
<td>1 s linear filtering</td>
</tr>
<tr>
<td>V1.5</td>
<td>Motor torque</td>
<td>%</td>
<td>##</td>
<td>4</td>
<td>In % of Motor nominal torque</td>
</tr>
<tr>
<td>V1.6</td>
<td>Motor Power</td>
<td>%</td>
<td>##</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>V1.7</td>
<td>Motor voltage</td>
<td>V</td>
<td>#.##</td>
<td>6</td>
<td>Calculated motor voltage</td>
</tr>
<tr>
<td>V1.8</td>
<td>DC link voltage</td>
<td>V</td>
<td>#</td>
<td>7</td>
<td>Measured DC voltage, filtered.</td>
</tr>
<tr>
<td>V1.9</td>
<td>Unit temperature</td>
<td>ºC</td>
<td>#</td>
<td>8</td>
<td>Heatsink temperature</td>
</tr>
<tr>
<td>V1.10</td>
<td>Motor temperature</td>
<td>%</td>
<td>#</td>
<td>9</td>
<td>Calculated motor temperature</td>
</tr>
<tr>
<td>V1.11</td>
<td>Analogue input 1</td>
<td>%</td>
<td>#.##</td>
<td>13</td>
<td>AI1, unfiltered.</td>
</tr>
<tr>
<td>V1.12</td>
<td>Analogue input 2</td>
<td>%</td>
<td>#.##</td>
<td>14</td>
<td>AI2, unfiltered.</td>
</tr>
<tr>
<td>V1.13</td>
<td>Analogue input 3</td>
<td>%</td>
<td>#.##</td>
<td>18</td>
<td>AI3, unfiltered.</td>
</tr>
<tr>
<td>V1.14</td>
<td>Analogue input 4</td>
<td>%</td>
<td>#.##</td>
<td>26</td>
<td>AO1</td>
</tr>
<tr>
<td>V1.15</td>
<td>Analogue Out 1</td>
<td>%</td>
<td>#.##</td>
<td>28</td>
<td>AO2</td>
</tr>
<tr>
<td>V1.16</td>
<td>Analogue Out 2</td>
<td>%</td>
<td>#.##</td>
<td>31</td>
<td>AO3</td>
</tr>
<tr>
<td>V1.17</td>
<td>Analogue Out 3</td>
<td>%</td>
<td>#.##</td>
<td>32</td>
<td>AO4</td>
</tr>
<tr>
<td>V1.18</td>
<td>DIN1, DIN2, DIN3</td>
<td>15</td>
<td>Digital input statuses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.19</td>
<td>DIN4, DIN5, DIN6</td>
<td>16</td>
<td>Digital input statuses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.20</td>
<td>Torque reference</td>
<td>%</td>
<td>#.##</td>
<td>18</td>
<td>Used Torque Reference</td>
</tr>
<tr>
<td>V1.21</td>
<td>Sensor Max Temperature</td>
<td>ºC</td>
<td>#.##</td>
<td>42</td>
<td>Highest temperature of OPTB8 board. 4 s filtering.</td>
</tr>
<tr>
<td>G1.22</td>
<td>Multimonitoring items</td>
<td></td>
<td></td>
<td></td>
<td>Displays three selectable monitoring values</td>
</tr>
</tbody>
</table>

*Table 6.1. Monitoring values*
### 6.1.1 Monitoring values 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>V1.23.1</td>
<td>Current</td>
<td>A</td>
<td>Varies</td>
<td>1113</td>
<td>Unfiltered motor current</td>
</tr>
<tr>
<td>V1.23.2</td>
<td>Torque</td>
<td>%</td>
<td>#.#</td>
<td>1125</td>
<td>Unfiltered motor torque</td>
</tr>
<tr>
<td>V1.23.3</td>
<td>DC Voltage</td>
<td>V</td>
<td>#</td>
<td>44</td>
<td>Unfiltered DC link voltage</td>
</tr>
<tr>
<td>V1.23.4</td>
<td>Application Status Word</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1.23.5</td>
<td>Encoder 1 Frequency</td>
<td>Hz</td>
<td>#.#</td>
<td>1124</td>
<td>Unfiltered</td>
</tr>
<tr>
<td>V1.23.6</td>
<td>Output Power</td>
<td>kw</td>
<td>Varies</td>
<td>1508</td>
<td>Unfiltered electrical power</td>
</tr>
<tr>
<td>V1.23.7</td>
<td>Measured temperature 1</td>
<td>Cº</td>
<td>#.#</td>
<td>50</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.8</td>
<td>Measured temperature 2</td>
<td>Cº</td>
<td>#.#</td>
<td>51</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.9</td>
<td>Measured temperature 3</td>
<td>Cº</td>
<td>#.#</td>
<td>52</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.10</td>
<td>Measured temperature 4</td>
<td>Cº</td>
<td>#.#</td>
<td>69</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.11</td>
<td>Measured temperature 5</td>
<td>Cº</td>
<td>#.#</td>
<td>70</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.12</td>
<td>Measured temperature 6</td>
<td>Cº</td>
<td>#.#</td>
<td>71</td>
<td>4 s filtering.</td>
</tr>
<tr>
<td>V1.23.13</td>
<td>ABS Encoder Revolutions</td>
<td>r</td>
<td>#</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>V1.23.14</td>
<td>ABS Encoder Position</td>
<td></td>
<td></td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>V1.23.15</td>
<td>Actual Torque Reference</td>
<td>%</td>
<td>#.#</td>
<td></td>
<td>Final torque reference from speed control and/or torque control</td>
</tr>
<tr>
<td>V1.23.16</td>
<td>Final Frequency</td>
<td>Hz</td>
<td>#.#</td>
<td>1131</td>
<td>Final reference to speed controller.</td>
</tr>
<tr>
<td>V1.23.17</td>
<td>Step response</td>
<td>Hz</td>
<td>#.#</td>
<td>1132</td>
<td></td>
</tr>
<tr>
<td>V1.23.18</td>
<td>Encode 2 Frequency</td>
<td>Hz</td>
<td>#.#</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>V1.23.19</td>
<td>ID Run Status</td>
<td></td>
<td></td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>V1.23.20</td>
<td>Pole Pair Number</td>
<td></td>
<td></td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>V1.23.21</td>
<td>CosPhiActual</td>
<td></td>
<td>#.#</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>V1.23.22</td>
<td>PowerAngle</td>
<td>Deg</td>
<td></td>
<td>1617</td>
<td></td>
</tr>
<tr>
<td>V1.23.23</td>
<td>PeakMagnetFlux</td>
<td></td>
<td></td>
<td>1618</td>
<td></td>
</tr>
<tr>
<td>V1.23.24</td>
<td>Identfail</td>
<td></td>
<td></td>
<td>98</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-2. Monitoring values 2*
### 6.1.2 FieldBus Monitoring values

<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>V1.24.1</td>
<td>FB Control Word</td>
<td></td>
<td></td>
<td>1160</td>
<td></td>
</tr>
<tr>
<td>V1.24.2</td>
<td>FB Status Word</td>
<td></td>
<td></td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>V1.24.3</td>
<td>FB Torque Reference</td>
<td>%</td>
<td>#,#</td>
<td>1140</td>
<td>Default Control of FB PD 1</td>
</tr>
<tr>
<td>V1.24.4</td>
<td>FB Limit Scaling</td>
<td>%</td>
<td>#,#</td>
<td>46</td>
<td>Default Control of FB PD 2</td>
</tr>
<tr>
<td>V1.24.5</td>
<td>FB Adjust Reference</td>
<td>%</td>
<td>#,#</td>
<td>47</td>
<td>Default Control of FB PD 3</td>
</tr>
<tr>
<td>V1.24.6</td>
<td>FB Analog Output</td>
<td>%</td>
<td>#,#</td>
<td>48</td>
<td>Default Control of FB PD 4</td>
</tr>
<tr>
<td>V1.24.7</td>
<td>FB Motor Current</td>
<td>A</td>
<td>#,#</td>
<td>45</td>
<td>Motor current (drive independent) given with one decimal point</td>
</tr>
<tr>
<td>V1.24.8</td>
<td>Fault Word 1</td>
<td></td>
<td></td>
<td>1172</td>
<td></td>
</tr>
<tr>
<td>V1.24.9</td>
<td>Fault Word 2</td>
<td></td>
<td></td>
<td>1173</td>
<td></td>
</tr>
<tr>
<td>V1.24.10</td>
<td>Warning Word 1</td>
<td></td>
<td></td>
<td>1174</td>
<td></td>
</tr>
<tr>
<td>V1.24.11</td>
<td>Last Active Fault</td>
<td></td>
<td></td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>V1.24.12</td>
<td>Din Status Word</td>
<td></td>
<td></td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>V1.24.13</td>
<td>Din Status Word 2</td>
<td></td>
<td></td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>V1.24.14</td>
<td>MC Status</td>
<td></td>
<td></td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>V1.24.15</td>
<td>Last Active Warning</td>
<td></td>
<td></td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>V1.24.16</td>
<td>Shaft Rounds</td>
<td></td>
<td></td>
<td>1170</td>
<td></td>
</tr>
<tr>
<td>V1.24.17</td>
<td>Shaft Angle</td>
<td></td>
<td></td>
<td>1169</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6-3. FieldBus Monitoring values**

### 6.1.3 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>V1.25.1</td>
<td>SN CRC</td>
<td></td>
<td></td>
<td>1997</td>
<td>Serial number key</td>
</tr>
</tbody>
</table>

### 6.1.4 PI Control Monitoring values

<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>V1.26.1</td>
<td>PI Reference</td>
<td></td>
<td></td>
<td>20</td>
<td>Used PI Reference</td>
</tr>
<tr>
<td>V1.26.2</td>
<td>PI Actual Value</td>
<td></td>
<td></td>
<td>21</td>
<td>PI Actual value</td>
</tr>
<tr>
<td>V1.26.3</td>
<td>PI Output</td>
<td></td>
<td></td>
<td>23</td>
<td>PI Output before scaling</td>
</tr>
<tr>
<td>V1.26.4</td>
<td>PI Output Scaled</td>
<td></td>
<td></td>
<td>1807</td>
<td>Scaled PI Output This is used for ID connection</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.1.5 Monitoring values

V1.1 Output frequency [#,## Hz] ID1
Output frequency to motor, updated at 10 ms time level.

V1.2 Frequency reference [#,## Hz] ID 25
Frequency reference to motor control, after speed share function. updates at 1 ms time level.

V1.3 Motor speed [ # rpm] ID 2
Motor speed in rpm

V1.4 Motor current [A] ID 3
Open loop:
1's linear filtering.

Closed Loop:
32 ms filtering

Drive Synch Operation Master drive
This value is the total current of the system divided by number of drives in the system (SbLastID). SbLastId cannot be changed; it needs to be set according to how many drives are linked with system bus.

Drive Synch Operation Follower drive
This value is the current of the drive’s own power unit.

Current scaling in different size of units
Note: ID45, usually in Process data OUT 3 is scaled to be with one decimal always.

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Size</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 – 240 Vac</td>
<td>NX0001 – NX0011</td>
<td>100 – 0,01A</td>
</tr>
<tr>
<td>208 – 240 Vac</td>
<td>NX0012 – NX0420</td>
<td>10 – 0,1A</td>
</tr>
<tr>
<td>208 – 240 Vac</td>
<td>NX0530</td>
<td>1 – 1A</td>
</tr>
<tr>
<td>380 – 500 Vac</td>
<td>NX0003 – NX0007</td>
<td>100 – 0,01A</td>
</tr>
<tr>
<td>380 – 500 Vac</td>
<td>NX0009 – NX0300</td>
<td>10 – 0,1A</td>
</tr>
<tr>
<td>380 – 500 Vac</td>
<td>NX0385 – NX2643</td>
<td>1 – 1A</td>
</tr>
<tr>
<td>525 – 690 Vac</td>
<td>NX0004 – NX0013</td>
<td>100 – 0,01A</td>
</tr>
<tr>
<td>525 – 690 Vac</td>
<td>NX0018 – NX0261</td>
<td>10 – 0,1A</td>
</tr>
<tr>
<td>525 – 690 Vac</td>
<td>NX0325 – NX1500</td>
<td>1 – 1A</td>
</tr>
</tbody>
</table>
VI.5  Motor torque  %  ID 4  
In % of Motor nominal torque

Open loop  
1 s linear filtering

Closed Loop  
32 ms filtering

Drive Synch Operation Follower drive  
This value is the torque of the drive’s own power unit related to set motor nominal current.

VI.6  Motor Power  %  ID 5  
Calculated motor power

VI.7  Motor voltage  V  ID 6  
Calculated motor voltage

VI.8  DC link voltage  V  ID 7  
Measured DC voltage, filtered.

VI.9  Unit temperature  °C  ID 8  
Heatsink temperature

VI.10  Motor temperature  %  ID 9  
Calculated motor temperature  
105 % is tripping limit if response is fault.

VI.11  Analogue input 1%  ID 13

VI.12  Analogue input 2%  ID 14

Unfiltered analogue input level.  
0 % = 0 mA / 0 V, -100 % = -10 V, 100 % = 20 mA / 10 V.  
Monitoring scaling is determined by the option board parameter.

VI.13  Analogue input 3%  ID 27

VI.14  Analogue input 4%  ID 28

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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
V1.15  Analogue Out 1  %  ID 26
V1.16  Analogue Out 2  %  ID 50
V1.17  Analogue Out 3  %  ID 51
  Analogue Output value 0 % = 0 mA / 0 V, 100 % = 20 mA / 10 V

V1.18  DIN1, DIN2, DIN3  ID 15
V1.19  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>

V1.20  Torque reference  %  ID 18
  Torque reference value before load share.

V1.21  PT-100 Temperature  Cº  ID 42
  Highest temperature of OPTB8 board. 4 s filtering.
6.1.6 Monitoring values 2

V1.23.1 Current A ID 1113
Unfiltered motor current, recommended signal for NCDrive monitoring.

Drive Synch Operation Master drive
This value is the total current of the system divided by number of drives in the system (SbLastID). SbLastID cannot be changed; it needs to be set according to how many drives are linked with system bus.

Drive Synch Operation Follower drive
This value is current of drive own power unit.

V1.23.2 Torque % ID 1125
Unfiltered motor torque, recommended signal for NCDrive monitoring.

V1.23.3 DC Voltage V ID 44
Unfiltered DC link voltage, recommended signal for NCDrive monitoring.

V1.23.4 Application Status Word ID 43
Application Status Word combines different drive statuses to one data word. Recommended signal for NCDrive monitoring.

<table>
<thead>
<tr>
<th>Application Status Word ID43</th>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Flux not ready</td>
<td>Flux ready (&gt;90 %)</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>Direction Forward</td>
<td>Direction Reverse</td>
</tr>
<tr>
<td>b5</td>
<td>Emergency Stop Active</td>
<td>Emergency 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></td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td>No DC Brake</td>
<td>DC Brake is active</td>
</tr>
<tr>
<td>b12</td>
<td>No Run Request</td>
<td>Run Request</td>
</tr>
<tr>
<td>b13</td>
<td>No Limit Controls Active</td>
<td>Limit control Active</td>
</tr>
<tr>
<td>b14</td>
<td>External Brake Control OFF</td>
<td>External Brake Control ON</td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V1.23.5 Encoder 1 Frequency Hz ID 1124
Encoder frequency after filter. P2.8.4.6 Encoder1FiltTime.

V1.23.6 Output Power kw ID 1508
Unfiltered electrical drive output power.
<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Unit</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Measured temperature 1</td>
<td>°C</td>
<td>51</td>
</tr>
<tr>
<td>52</td>
<td>Measured temperature 3</td>
<td>°C</td>
<td>69</td>
</tr>
<tr>
<td>70</td>
<td>Measured temperature 5</td>
<td>°C</td>
<td>71</td>
</tr>
<tr>
<td>72</td>
<td>Measured temperature 6</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Separate measurement from two PT100 board. The signal has 4 s filtering time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>ABS Encoder Revolutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>ABS Encoder Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1180</td>
<td>Actual Torque Reference</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>1131</td>
<td>Final Frequency Reference</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>1132</td>
<td>Step response</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Encoder 2 Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>ID Run Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Pole Pair Number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Cos Phi Actual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1617</td>
<td>Power Angle</td>
<td>Deg</td>
<td></td>
</tr>
</tbody>
</table>

**V1.23.13 ABS Encoder Revolutions**
Absolute encoder revolution information.

**V1.23.14 ABS Encoder Position**
Absolute encoder position within one rotation. See encoder manual for scaling.

**V1.23.15 Actual Torque Reference**
Final torque reference from speed control and torque control. Also includes torque step and acceleration compensation factors.

**V1.23.16 Final Frequency Reference**
Final reference to speed controller. After ramp generator and after Speed Step function, used for closed loop speed tuning when used together with Encoder 1 frequency.

**V1.23.17 Step response**
Frequency error. Compares ramp output to actual encoder frequency with 0.001 Hz accuracy. Can be used for speed control tuning in closed loop control.

**V1.23.18 Encoder 2 Frequency**
Estimated Cos Phi.

**V1.23.19 ID Run Status**
Status of identification run. Bits are set if items are done successfully.

**V1.23.20 Pole Pair Number**
Pole pair number of the motor.

**V1.23.21 Cos Phi Actual**
Estimated Cos Phi.

**V1.23.22 Power Angle**
Deg

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
VI.23.23  Peak Magnet Flux  
ID 1618

VI.23.24  Ident Failure Code  [Ident Fail. Code]  
ID 98

Failure code for failed identification:

1 = Current measurement offset  
2 = Identification current level  
3 = Acceleration time too long  
4 = Identification frequency reference not reached  
5 = Too low or high magnetization current  
6 = Flux curve outside expected levels  
7 = PMSM, Encoder zero position  
8 = Too low maximum frequency limit  
9 = PMSM, encoder zero pulse not found.  
10 = Ls Identification timeout  
11 = Ls Identification current
6.1.7 FieldBus Monitoring values

**V1.24.1 FB Control Word ID1160**

Control word used in bypass mode. See P2.13.22 and option board ByPass.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
<th>Value = 0</th>
<th>Value = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF</td>
<td>ON, Reset after Fault or b1 and b2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Emergency stop by coast</td>
<td>ON, On normal operation: Keep TRUE</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Emergency stop by ramp</td>
<td>ON, On normal operation: Keep TRUE</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>STOP REQUEST</td>
<td>RUN REQUEST</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Force ramp to Zero</td>
<td>Enable Ramp,</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Freeze Ramp</td>
<td>Enable Ramp,</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Force Ref to Zero</td>
<td>Enable Ramp,</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>No Action</td>
<td>FAULT RESET (0 -&gt; 1)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>No Action</td>
<td>Inching 1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>No Action</td>
<td>Inching 2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Disable Profibus control</td>
<td>Enable Profibus control</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON (Watchdog pulse)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>No Action</td>
<td>No Action</td>
<td></td>
</tr>
</tbody>
</table>

**V1.24.2 FB Status Word ID65**

Profibus type status word. Generated in the application level. Needs to be selected with P2.14.19 GSW to be used. When needed with profibus board, operation mode needs to be set to ByPass in option board and with P2.14.22 ProfiBus Mode select: 2 / ProfiDrive.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
<th>Value = 0</th>
<th>Value = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not ready to switch on</td>
<td>Ready to switch on</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Not ready to operate</td>
<td>Ready to operate</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Not Running</td>
<td>Running</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>No Fault</td>
<td>Fault</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Coast stop Active</td>
<td>Coast stop not active</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Quick stop active</td>
<td>Quick stop not active</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Switch not inhibited</td>
<td>Switch on inhibit</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>No Warning</td>
<td>Warning</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Speed error</td>
<td>Speed At Reference</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>No FB Control request</td>
<td>FB Control Active</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Fout &lt; Fmax</td>
<td>Fout &gt; Fmax</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>not used</td>
<td>not used</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>not used</td>
<td>not used</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>not used</td>
<td>not used</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>not used</td>
<td>not used</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON (Watchdog pulse)</td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
VI.24.3  **FB Torque Reference % ID 1140**
Torque reference value from fieldbus
Default Control of FB PD 1

VI.24.4  **FB Limit Scaling % ID 46**
Limit scaling input value from fieldbus.
Default Control of FB PD 2.

VI.24.5  **FB Adjust Reference % ID 47**
Reference adjustment value from fieldbus.
Default Control of FB PD 3.

VI.24.6  **FB Analog Output % ID 48**
Fieldbus value to control analogue output.
Default Control of FB PD 4.

VI.24.7  **FB Motor Current A ID 45**
Motor current (drive independent) given with one decimal point.

VI.24.8  **Fault Word 1 ID 1172**
Different faults are collected to two words that can be read from fieldbus or with NCDrive PC software.

<table>
<thead>
<tr>
<th>Fault Word 1 ID1172</th>
<th>Fault</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Over Current or IGBT</td>
<td>F1, F31, F41</td>
</tr>
<tr>
<td>b1</td>
<td>Over Voltage</td>
<td>F2</td>
</tr>
<tr>
<td>b2</td>
<td>Under Voltage</td>
<td>F9</td>
</tr>
<tr>
<td>b3</td>
<td>Motor Stalled</td>
<td>F15, F80</td>
</tr>
<tr>
<td>b4</td>
<td>Earth Fault</td>
<td>F3</td>
</tr>
<tr>
<td>b5</td>
<td>Motor Under Load</td>
<td>F17</td>
</tr>
<tr>
<td>b6</td>
<td>Drive over temperature</td>
<td>F14</td>
</tr>
<tr>
<td>b7</td>
<td>Over Temperature</td>
<td>F16, F56, F29</td>
</tr>
<tr>
<td>b8</td>
<td>Input Phase</td>
<td>F10</td>
</tr>
<tr>
<td>b9</td>
<td>Brake resistor over temperature</td>
<td>F42 (Not implemented)</td>
</tr>
<tr>
<td>b10</td>
<td>Device Changed</td>
<td>F37, F38, F39, F40, F44, F45 (Not implemented)</td>
</tr>
<tr>
<td>b11</td>
<td>Keypad or PCC control</td>
<td>F52</td>
</tr>
<tr>
<td>b12</td>
<td>FieldBus</td>
<td>F53</td>
</tr>
<tr>
<td>b13</td>
<td>SystemBus</td>
<td>F59</td>
</tr>
<tr>
<td>b14</td>
<td>Slot</td>
<td>F54</td>
</tr>
<tr>
<td>b15</td>
<td>4 mA</td>
<td>F50</td>
</tr>
</tbody>
</table>
### V1.24.9 Fault Word 2

#### ID 1173

<table>
<thead>
<tr>
<th>Fault</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Output phase</td>
</tr>
<tr>
<td>b1</td>
<td>Charge Switch</td>
</tr>
<tr>
<td>b2</td>
<td>Encoder</td>
</tr>
<tr>
<td>b3</td>
<td>Inverter</td>
</tr>
<tr>
<td>b4</td>
<td>Reserved</td>
</tr>
<tr>
<td>b5</td>
<td>EEPROM</td>
</tr>
<tr>
<td>b6</td>
<td>External</td>
</tr>
<tr>
<td>b7</td>
<td>Brake Chopper</td>
</tr>
<tr>
<td>b8</td>
<td>Watch Dog</td>
</tr>
<tr>
<td>b9</td>
<td>IGBT</td>
</tr>
<tr>
<td>b10</td>
<td>Brake</td>
</tr>
<tr>
<td>b11</td>
<td>Fan Cooling</td>
</tr>
<tr>
<td>b12</td>
<td>Application</td>
</tr>
<tr>
<td>b13</td>
<td>Control fault</td>
</tr>
<tr>
<td>b14</td>
<td>Main Switch Open</td>
</tr>
<tr>
<td>b15</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

### V1.24.10 Warning Word 1

#### ID 1174

<table>
<thead>
<tr>
<th>Fault</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Motor stalled</td>
</tr>
<tr>
<td>b1</td>
<td>Motor over temperature</td>
</tr>
<tr>
<td>b2</td>
<td>Motor under load</td>
</tr>
<tr>
<td>b3</td>
<td>Input phase loss</td>
</tr>
<tr>
<td>b4</td>
<td>Output phase loss</td>
</tr>
<tr>
<td>b5</td>
<td>Safe disable</td>
</tr>
<tr>
<td>b6</td>
<td>FieldBus communication fault in slot D</td>
</tr>
<tr>
<td>b7</td>
<td>FieldBus communication fault in slot E</td>
</tr>
<tr>
<td>b8</td>
<td>Drive over temperature</td>
</tr>
<tr>
<td>b9</td>
<td>Analogue input &lt;4mA</td>
</tr>
<tr>
<td>b10</td>
<td>Reserved</td>
</tr>
<tr>
<td>b11</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>b12</td>
<td>Run disabled</td>
</tr>
<tr>
<td>b13</td>
<td>Not used</td>
</tr>
<tr>
<td>b14</td>
<td>Mechanical Brake</td>
</tr>
<tr>
<td>b15</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
V1.24.11  Fault History  ID 37
Fault number of the last active fault.

V1.24.12  Din Status Word  ID 56

V1.24.13  Din Status Word 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>

V1.24.14  MC Status  ID 64
This is the value that is also send to fieldbus on those fieldbus that do not use own state machine.

<table>
<thead>
<tr>
<th>Motor Control Status Word</th>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Not in Ready state</td>
<td>Ready</td>
<td></td>
</tr>
<tr>
<td>b1 Not Running</td>
<td>Running</td>
<td></td>
</tr>
<tr>
<td>b2 Direction Clockwise</td>
<td>Counterclockwise</td>
<td></td>
</tr>
<tr>
<td>b3 No Fault</td>
<td>Fault</td>
<td></td>
</tr>
<tr>
<td>b4 No Warning</td>
<td>Warning</td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td>At reference speed</td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td>At Zero Speed</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>Flux Ready</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td>TC Speed Limiter Active</td>
<td></td>
</tr>
<tr>
<td>b9 Encoder Direction</td>
<td>Counterclockwise</td>
<td></td>
</tr>
<tr>
<td>b10 Under Voltage Fast stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b11 No DC brake</td>
<td>DC Brake is active</td>
<td></td>
</tr>
<tr>
<td>b12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td>Restart delay active</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VI.24.15 Warning ID 74
Last active warning.

VI.24.16 Shaft Rounds ID 1170
Rounds information from incremental encoder. The value is reset when 24 Vdc is
removed from the drive.

VI.24.17 Shaft Angle ID 1169
Angle information from incremental encoder. The value is reset when 24 Vdc is
removed from the drive.

6.1.8 Activation
VI.25.1 SN CRC ID1997
Serial number key of power unit

6.1.9 PI Control monitoring
This PI control uses ID numbers for input and output signal. See detail in PI Control chapter.

VI.26.1 PI Reference ID20
Used PI Reference, reference is selected by ID number.

VI.26.2 PI Actual Value ID21
PI Actual value. Actual input is selected by ID number.

VI.26.3 PI Output ID23
PI Output before scaling. This value uses PI Out High and Low for limiting.

VI.26.4 PI Output Scaled ID1807
Scaled PI Output.
This is used for ID connection. Scaling function is used to scale value more
suitable for connected signal. e.g. when output is connected to torque limit
actual value need to be -1000 ...+1000 (-100,0 %..+100,0 %) But PI Out High and
Low can be from -30000...+30000 to have more accurate PI control.
### 7. PARAMETER LIST

#### 7.1 Basic parameters

<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>
</table>
| P2.1.1 | Frequency Scale            | 0    | 6    | 1    | 523     |      |    | 0 = 0,000 – 32,000 Hz  
1 = 0,00 – 320,00 Hz  
2 = 0,0 – 599,0 Hz  
3 = 0,0 – 1900,0 Hz  
4 = 0,0 – 3200,0 Hz  
5 = 0,0 – 5200 Hz  
6 = 0,0 – 7200 Hz |
| P2.1.2 | RPM Format                 | 0    | 4    | 0    | 1852    |      |    | 0 = Default  
1 = #,# rpm  
2 = # rpm  
3 = #,# krpm  
4 = #,# krpm |
| P2.1.3 | Minimum frequency          | 0,00 |      |      | 101     |      |    | Note: If \( f_{\text{max}} > \) than the motor synchronous speed, check suitability for motor and drive system |
| P2.1.4 | Maximum frequency          | P2.1.1 | 320,00 | Hz  | 50,00   | 102  |    | Note: Check the rating plate of the motor. Note also used connection Delta/Star |
| P2.1.5 | Motor nominal voltage      | 180  | 690  | V    | 110     |      |    | Check the rating plate of the motor. Note also used connection Delta/Star |
| P2.1.6 | Motor nominal frequency    | 8,00 | 320,00 | Hz  | 111     |      |    | Check the rating plate of the motor. Note also used connection Delta/Star |
| P2.1.7 | Motor nominal speed        | 24   | 20 000 | rpm | 112     |      |    | The default applies for a 4-pole motor and a nominal size frequency converter. |
| P2.1.8 | Motor nominal current      | 0,1 \( \times \) | \( l_H \)  | 2 \( \times \) | \( l_H \) | 113  |    | Check the rating plate of the motor. |
| P2.1.9 | Motor cos \( \phi \)        | 0,30 | 1,00 | A    | 120     |      |    | Check the rating plate of the motor. |
| P2.1.10| Motor Nominal Power        | 0,0  | 3200,0 | kW  | 116     |      |    | Check the rating plate of the motor. |
| P2.1.11| Magnetizing current        | 0,00 | 100,00 | A   | 612     |      |    | 0,00 A = Drive uses estimated value from motor name plate values |
| P2.1.12| Identification             | 0    | 11   | 0    | 631     |      |    | 0 = No action  
1 = Identification w/o run  
2 = Identification with run  
3 = Encoder ID Run  
4 = Identify All  
5 = Absolute encoder, locked rotor |
| P2.1.13| Motor type                 | 0    | 1    | 0    | 650     |      |    | 0 = Induction Motor  
1 = PMS Motor |
| P2.1.14| Supply Voltage             | 0    | 1000 | Vac  | 1201    |      |    |                                                                          |

*Table 7-1. Basic parameters G2.1*
### 7.2 Reference Handling

#### 7.2.1 Basic Settings

<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>P2.2.1</td>
<td>Torque Scale</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1207</td>
<td>0</td>
<td>=1000 =100,0 %</td>
</tr>
<tr>
<td>P2.2.2</td>
<td>I/O Reference</td>
<td>0</td>
<td>16</td>
<td></td>
<td>0</td>
<td>117</td>
<td>0</td>
<td>1=AI1 2=AI2 3=AI1+AI2 4=AI2-AI1 5=AI1xAI2 6=AI1 joystick 7=AI2 joystick 8=Keypad 9=Fieldbus 10=Motor potentiometer 11=AI1, AI2 minimum 12=AI1, AI2 maximum 13=Max frequency 14=AI1/AI2 selection 15=Encoder 1 16=Encoder 2</td>
</tr>
<tr>
<td>P2.2.3</td>
<td>Keypad reference selector</td>
<td>0</td>
<td>9</td>
<td>8</td>
<td>121</td>
<td></td>
<td></td>
<td>0=AI1 1=AI2 2=AI1+AI2 3=AI1-AI2 4=AI2-AI1 5=AI1xAI2 6=AI1 joystick 7=AI2 joystick 8=Keypad 9=Fieldbus</td>
</tr>
<tr>
<td>P2.2.4</td>
<td>Fieldbus control reference</td>
<td>0</td>
<td>9</td>
<td></td>
<td>9</td>
<td>122</td>
<td>0</td>
<td>See par. 2.2.2</td>
</tr>
<tr>
<td>P2.2.5</td>
<td>I/O Reference 2</td>
<td>0</td>
<td>16</td>
<td></td>
<td>1</td>
<td>131</td>
<td>0</td>
<td>See ID117 &amp; ID422</td>
</tr>
<tr>
<td>P2.2.6</td>
<td>Speed Share</td>
<td>-300.00</td>
<td>320.00</td>
<td>Hz</td>
<td>10.00</td>
<td>1241</td>
<td>10.00</td>
<td>1248</td>
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<tr>
<td>P2.2.7</td>
<td>Load Share</td>
<td>0.00</td>
<td>500.0</td>
<td>%</td>
<td>100.00</td>
<td>1248</td>
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<td>1248</td>
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### 7.2.2 Constant Reference

<table>
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<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.8.1</td>
<td>Jogging speed reference</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>5.00</td>
<td>124</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.8.2</td>
<td>Preset speed 1</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>10.00</td>
<td>105</td>
<td></td>
<td>Multi-step speed 1</td>
</tr>
<tr>
<td>P2.2.8.3</td>
<td>Preset speed 2</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>15.00</td>
<td>106</td>
<td></td>
<td>Multi-step speed 2</td>
</tr>
<tr>
<td>P2.2.8.4</td>
<td>Preset speed 3</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>20.00</td>
<td>126</td>
<td></td>
<td>Multi-step speed 3</td>
</tr>
<tr>
<td>P2.2.8.5</td>
<td>Preset speed 4</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>25.00</td>
<td>127</td>
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<td>Multi-step speed 4</td>
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<tr>
<td>P2.2.8.6</td>
<td>Preset speed 5</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>30.00</td>
<td>128</td>
<td></td>
<td>Multi-step speed 5</td>
</tr>
<tr>
<td>P2.2.8.7</td>
<td>Preset speed 6</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>40.00</td>
<td>129</td>
<td></td>
<td>Multi-step speed 6</td>
</tr>
<tr>
<td>P2.2.8.8</td>
<td>Preset speed 7</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>50.00</td>
<td>130</td>
<td></td>
<td>Multi-step speed 7</td>
</tr>
<tr>
<td>P2.2.8.9</td>
<td>inching reference 1</td>
<td>-320.00</td>
<td>320.00</td>
<td>Hz</td>
<td>2.00</td>
<td>1239</td>
<td></td>
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<td>P2.2.8.10</td>
<td>inching reference 2</td>
<td>-320.00</td>
<td>320.00</td>
<td>Hz</td>
<td>-2.00</td>
<td>1240</td>
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</tbody>
</table>
### 7.2.3 Torque Reference

<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>P2.2.9.1</td>
<td>Torque reference selection</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>641</td>
<td></td>
<td>0=Not used 1=A1 2=A2 3=A3 4=A4 5=A1 joystick (-10–10 V) 6=A2 joystick (-10–10 V) 7=Torque reference from keypad, R3.5 8=FB Torque Reference 9=Master Torque 10=Power Reference</td>
</tr>
<tr>
<td>P2.2.9.2</td>
<td>Torque reference max.</td>
<td>-300</td>
<td>300</td>
<td>%</td>
<td>100</td>
<td>642</td>
<td></td>
<td></td>
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<tr>
<td>P2.2.9.3</td>
<td>Torque reference min.</td>
<td>-300</td>
<td>300</td>
<td>%</td>
<td>0,0</td>
<td>643</td>
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<td></td>
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<tr>
<td>P2.2.9.4</td>
<td>Torque reference filtering time</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>0</td>
<td>1244</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.5</td>
<td>Torque Reference Dead Zone</td>
<td>0,0</td>
<td>300</td>
<td>%</td>
<td>0,00</td>
<td>1246</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.6</td>
<td>Torque Select</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>1278</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.7</td>
<td>Window negative</td>
<td>0,00</td>
<td>50,00</td>
<td>Hz</td>
<td>2,00</td>
<td>1305</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.8</td>
<td>Window positive</td>
<td>0,00</td>
<td>50,00</td>
<td>Hz</td>
<td>2,00</td>
<td>1304</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.9</td>
<td>Window negative off</td>
<td>0,00</td>
<td>P2.10.11</td>
<td>Hz</td>
<td>0,00</td>
<td>1307</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.10</td>
<td>Window positive off</td>
<td>0,00</td>
<td>P2.10.12</td>
<td>Hz</td>
<td>0,00</td>
<td>1306</td>
<td></td>
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</tr>
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</table>

#### 7.2.3.1 Torque Reference OL Settings

<table>
<thead>
<tr>
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<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.9.11.1</td>
<td>Open loop torque control minimum frequency</td>
<td>0,00</td>
<td>50,00</td>
<td>Hz</td>
<td>3,00</td>
<td>636</td>
<td></td>
<td>0=Max. frequency 1=Selected frequency ref. 2=Preset speed 7</td>
</tr>
<tr>
<td>P2.2.9.11.2</td>
<td>Open loop torque controller P gain</td>
<td>0</td>
<td>32000</td>
<td>150</td>
<td>639</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.11.3</td>
<td>Open loop torque controller I gain</td>
<td>0</td>
<td>32000</td>
<td>10</td>
<td>640</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.2.9.11.4</td>
<td>Torque speed limit for Open Loop</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>644</td>
<td></td>
<td></td>
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</table>
7.2.3.2 Torque Reference CL Settings

<table>
<thead>
<tr>
<th>Code</th>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.2.9.12.1</td>
<td>Torque Step</td>
<td>-300,0</td>
<td>300,0</td>
<td>%</td>
<td>0,0</td>
<td></td>
<td>1253</td>
<td></td>
</tr>
</tbody>
</table>

7.2.4 Prohibit frequency parameters

<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>P2.2.10.1</td>
<td>Prohibit frequency range 1 low limit</td>
<td>-1,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>509</td>
<td></td>
<td>0=Not used</td>
</tr>
<tr>
<td>P2.2.10.2</td>
<td>Prohibit frequency range 1 high limit</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>510</td>
<td></td>
<td>0=Not used</td>
</tr>
<tr>
<td>P2.2.10.3</td>
<td>Ramp time factor</td>
<td>0,1</td>
<td>10,00</td>
<td>x</td>
<td>1,0</td>
<td>518</td>
<td></td>
<td>Multiplier of the currently Selected ramp time between prohibit frequency limits.</td>
</tr>
</tbody>
</table>

Table 7-2. Prohibit frequencies (G2.5)

7.2.5 Motor Potentiometer

<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>P2.2.11.1</td>
<td>Motor potentiometer ramp rate</td>
<td>0,10</td>
<td>2000,00</td>
<td>Hz/s</td>
<td>1,00</td>
<td>331</td>
<td></td>
<td>Ramp rate for motor potentiometer</td>
</tr>
<tr>
<td>P2.2.11.2</td>
<td>Motor potentiometer frequency reference memory reset</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>367</td>
<td></td>
<td></td>
<td>0=No reset 1=Reset in stop state 2=Reset in powered down</td>
</tr>
</tbody>
</table>

Table 7-3. Motor potentiometer (G2.5)

7.2.6 Adjust Reference

<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>P2.2.12.1</td>
<td>Adjust input</td>
<td>0</td>
<td>5</td>
<td>%</td>
<td>0</td>
<td>493</td>
<td></td>
<td>0=Not used 1=AI1 2=AI2 3=AI3 4=AI4 5=Fieldbus</td>
</tr>
<tr>
<td>P2.2.12.2</td>
<td>Adjust minimum</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>494</td>
<td></td>
<td>Adjust limit to decrease ref.</td>
</tr>
<tr>
<td>P2.2.12.3</td>
<td>Adjust maximum</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>495</td>
<td></td>
<td>Adjust limit to increase ref.</td>
</tr>
<tr>
<td>P2.2.12.4</td>
<td>Speed Step</td>
<td>-200,0</td>
<td>200,0</td>
<td>%</td>
<td></td>
<td>1252</td>
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<td></td>
</tr>
</tbody>
</table>
### 7.3 Ramp Control

#### 7.3.1 Basic Settings

<table>
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<tr>
<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.3.1</td>
<td>Start function</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>505</td>
<td>0=Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Flying start</td>
</tr>
<tr>
<td>P2.3.2</td>
<td>Stop function</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>506</td>
<td>0=Coasting</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Ramp</td>
</tr>
<tr>
<td>P2.3.3</td>
<td>Acceleration time 1</td>
<td>0.2</td>
<td>3270.0</td>
<td>s</td>
<td>3.0</td>
<td>3,0</td>
<td>103</td>
<td>0 Hz to Max frequency</td>
</tr>
<tr>
<td>P2.3.4</td>
<td>Deceleration time 1</td>
<td>0.2</td>
<td>3270.0</td>
<td>s</td>
<td>3.0</td>
<td>3,0</td>
<td>104</td>
<td>Max frequency to 0 Hz</td>
</tr>
<tr>
<td>P2.3.5</td>
<td>Ramp 1 shape</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>2</td>
<td></td>
<td>500</td>
<td>0=Linear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt;0=S-curve ramp time</td>
</tr>
<tr>
<td>P2.3.6</td>
<td>Acceleration time 2</td>
<td>0.2</td>
<td>3270.0</td>
<td>s</td>
<td>10.0</td>
<td>10,0</td>
<td>502</td>
<td>0=Linear</td>
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<td>P2.3.7</td>
<td>Deceleration time 2</td>
<td>0.2</td>
<td>3270.0</td>
<td>s</td>
<td>10.0</td>
<td>10,0</td>
<td>503</td>
<td>&gt;0=S-curve ramp time</td>
</tr>
<tr>
<td>P2.3.8</td>
<td>Ramp 2 shape</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>4</td>
<td></td>
<td>501</td>
<td>0=Linear</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>&gt;0=S-curve ramp time</td>
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<tr>
<td>P2.3.9</td>
<td>Inching Ramp</td>
<td>0.01</td>
<td>320.00</td>
<td>s</td>
<td>1.00</td>
<td>1,00</td>
<td>1257</td>
<td>Scales active ramp from 100 % to 10 %.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>0=Not used</td>
</tr>
<tr>
<td>P2.3.10</td>
<td>Reducing of acc./dec. times</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td>401</td>
<td>1=AI1</td>
</tr>
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<td></td>
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<td>2=AI2</td>
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<td>3=AI3</td>
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<td>4=AI4</td>
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<td>5=Fieldbus</td>
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<tr>
<td>P2.3.11</td>
<td>IO Quick Stop Mode</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>1276</td>
<td>0=Coasting</td>
</tr>
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<td></td>
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<td></td>
<td>1=Ramp</td>
</tr>
<tr>
<td>P2.3.12</td>
<td>Quick Stop Ramp time</td>
<td>0.1</td>
<td>3200.0</td>
<td>s</td>
<td>10.0</td>
<td>10,0</td>
<td>1256</td>
<td>0=Coasting</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>1=Ramp</td>
</tr>
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#### 7.3.2 Ramp Control Options

<table>
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<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>P2.3.12.1</td>
<td>Ramp Input Interpolator TC</td>
<td>0</td>
<td>200</td>
<td>ms</td>
<td>10</td>
<td></td>
<td>1184</td>
<td>Scales active ramp from 100 % to 10 %.</td>
</tr>
<tr>
<td>P2.3.12.2</td>
<td>Ramp Time Format</td>
<td>0</td>
<td>3</td>
<td></td>
<td>2</td>
<td></td>
<td>1500</td>
<td>0=#</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=#,#</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=#,#,#</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3=#,#,#,#</td>
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</table>
7.4 Input Signals

7.4.1 Basic Settings

<table>
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<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>P2.4.1.1</td>
<td>Start/Stop logic selection</td>
<td>0</td>
<td>7</td>
<td></td>
<td>0</td>
<td>300</td>
<td></td>
<td>Start signal 1 (Default: DIN1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Start signal 2 (Default: DIN2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 Start fwd</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Start/Stop</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 Start/Stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 Start pulse</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>4 Start</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 Start fwd*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 Start*/Stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7 Start*/Stop</td>
</tr>
</tbody>
</table>

Table 7-4. Input signals: basic settings, G2.2.1

* = Rising edge required to start
### 7.4.2 Digital inputs

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.2.1</td>
<td>Start signal 1</td>
<td>0.1</td>
<td>A.1</td>
<td></td>
<td>403</td>
<td>Forward, See ID300</td>
</tr>
<tr>
<td>P2.4.2.2</td>
<td>Start signal 2</td>
<td>0.1</td>
<td>A.2</td>
<td></td>
<td>404</td>
<td>Reverse, See ID300</td>
</tr>
<tr>
<td>P2.4.2.3</td>
<td>Run enable</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>407</td>
<td>Motor start enabled (cc)</td>
</tr>
<tr>
<td>P2.4.2.4</td>
<td>Reverse</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>412</td>
<td>Direction forward (oc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Direction reverse (cc)</td>
</tr>
<tr>
<td>P2.4.2.5</td>
<td>Preset speed 1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>419</td>
<td>See preset speeds in basing parameter group G2.1</td>
</tr>
<tr>
<td>P2.4.2.6</td>
<td>Preset speed 2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>420</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.7</td>
<td>Preset speed 3</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>421</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.8</td>
<td>Motor potentiometer reference DOWN</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>417</td>
<td>Mot.pot. reference decreases (cc)</td>
</tr>
<tr>
<td>P2.4.2.9</td>
<td>Motor potentiometer reference UP</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>418</td>
<td>Mot.pot. reference increases (cc)</td>
</tr>
<tr>
<td>P2.4.2.10</td>
<td>Fault reset</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>414</td>
<td>All faults reset (cc)</td>
</tr>
<tr>
<td>P2.4.2.11</td>
<td>External fault (close)</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>405</td>
<td>Ext. fault displayed (cc)</td>
</tr>
<tr>
<td>P2.4.2.12</td>
<td>External fault (open)</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>406</td>
<td>Ext. fault displayed (oc)</td>
</tr>
<tr>
<td>P2.4.2.13</td>
<td>Acc/Dec time selection</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>408</td>
<td>Acc/Dec time 1 (oc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Acc/Dec time 2 (cc)</td>
</tr>
<tr>
<td>P2.4.2.14</td>
<td>Acc/Dec prohibit</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>415</td>
<td>Acc/Dec prohibited (cc)</td>
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<tr>
<td>P2.4.2.15</td>
<td>DC braking</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>416</td>
<td>DC braking active (cc)</td>
</tr>
<tr>
<td>P2.4.2.16</td>
<td>Jogging speed</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>413</td>
<td>Jogging speed selected for frequency reference (cc)</td>
</tr>
<tr>
<td>P2.4.2.17</td>
<td>IO reference 1 / 2 selection</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>422</td>
<td>IO reference selection:14 ID117</td>
</tr>
<tr>
<td>P2.4.2.18</td>
<td>Control from I/O terminal</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>409</td>
<td>Force control place to I/O terminal (cc)</td>
</tr>
<tr>
<td>P2.4.2.19</td>
<td>Control from keypad</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>410</td>
<td>Force control place to keypad (cc)</td>
</tr>
<tr>
<td>P2.4.2.20</td>
<td>Control from fieldbus</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>411</td>
<td>Force control place to fieldbus (cc)</td>
</tr>
<tr>
<td>P2.4.2.21</td>
<td>Parameter set 1/set 2 selection</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>496</td>
<td>Closed cont.=Set 2 is used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open cont.=Set 1 is used</td>
</tr>
<tr>
<td>P2.4.2.22</td>
<td>Motor control mode 1/2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>164</td>
<td>Closed cont.=Mode 2 is used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Open cont.=Mode 1 is used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>See par 2.6.1, 2.6.12</td>
</tr>
<tr>
<td>P2.4.2.23</td>
<td>External Brake Acknowledge</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>1210</td>
<td>Monitoring signal from mechanical brake</td>
</tr>
<tr>
<td>P2.4.2.24</td>
<td>Cooling Monitor</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>750</td>
<td>Used when water cooled unit</td>
</tr>
<tr>
<td>P2.4.2.25</td>
<td>Enable Inching</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>532</td>
<td>Enables Inching function</td>
</tr>
<tr>
<td>P2.4.2.26</td>
<td>Inching 1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>531</td>
<td>Inching reference 1 (Default Forward 2 Hz. See P2.4.16). <strong>This will start the drive.</strong></td>
</tr>
<tr>
<td>P2.4.2.27</td>
<td>Inching 2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>532</td>
<td>Inching reference 2 (Default Reverse -2 Hz. See P2.4.17). <strong>This will start the drive.</strong></td>
</tr>
<tr>
<td>P2.4.2.28</td>
<td>Reset Position</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1090</td>
<td></td>
</tr>
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<td>P2.4.2.29</td>
<td>MF Mode 2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1092</td>
<td></td>
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<tr>
<td>P2.4.2.30</td>
<td>Quick Stop</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>1213</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.31</td>
<td>Input Switch Ack</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1209</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.32</td>
<td>PID Activation</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1804</td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-5. Digital input signals, G2.2.4*

**cc** = closing contact  
**oc** = opening contact

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.4.3 Analogue input 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>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.3.1</td>
<td>AI1 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td>A.1</td>
<td>377</td>
<td></td>
<td></td>
<td>Slot: Board input No.</td>
</tr>
<tr>
<td>P2.4.3.2</td>
<td>AI1 filter time</td>
<td>0.000</td>
<td>32,000</td>
<td>s</td>
<td>0.000</td>
<td>324</td>
<td></td>
<td>0-No filtering</td>
</tr>
<tr>
<td>P2.4.3.3</td>
<td>AI1 signal range</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>320</td>
<td></td>
<td>0=6...100%* 1=20...100%* 4 mA Fault 2=-10V...+10V* 3=Custom range*</td>
</tr>
<tr>
<td>P2.4.3.4</td>
<td>AI1 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>321</td>
<td></td>
<td>Custom Range: Minimum input</td>
</tr>
<tr>
<td>P2.4.3.5</td>
<td>AI1 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>322</td>
<td></td>
<td>Custom Range: Maximum input</td>
</tr>
<tr>
<td>P2.4.3.6</td>
<td>AI1 reference scaling, minimum value</td>
<td>0.000</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td>303</td>
<td></td>
<td>Selects the frequency that corresponds to the min. reference signal</td>
</tr>
<tr>
<td>P2.4.3.7</td>
<td>AI1 reference scaling, maximum value</td>
<td>0.000</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td>304</td>
<td></td>
<td>Selects the frequency that corresponds to the max. reference signal</td>
</tr>
<tr>
<td>P2.4.3.8</td>
<td>AI1 joystick Dead Zone</td>
<td>0.000</td>
<td>20.000</td>
<td>%</td>
<td>0.00</td>
<td>384</td>
<td></td>
<td>Dead Zone for joystick input</td>
</tr>
<tr>
<td>P2.4.3.9</td>
<td>AI1 sleep limit</td>
<td>0.000</td>
<td>100.00</td>
<td>%</td>
<td>0.00</td>
<td>385</td>
<td></td>
<td>Drive goes to stop if input is below this limit for this time.</td>
</tr>
<tr>
<td>P2.4.3.10</td>
<td>AI1 sleep delay</td>
<td>0.000</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>386</td>
<td></td>
<td>Drive goes to stop if input is below this limit for this time.</td>
</tr>
<tr>
<td>P2.4.3.11</td>
<td>AI1 joystick offset</td>
<td>-100.00</td>
<td>100.00</td>
<td>%</td>
<td>0.00</td>
<td>165</td>
<td></td>
<td>Press enter for 1s to set offset</td>
</tr>
</tbody>
</table>

*Remember to place jumpers of block X2 accordingly. See NX User’s Manual, chapter 6.2.2.2

### 7.4.4 Analogue input 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>P2.4.4.1</td>
<td>AI2 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td>A.2</td>
<td>388</td>
<td></td>
<td></td>
<td>Slot: Board input No.</td>
</tr>
<tr>
<td>P2.4.4.2</td>
<td>AI2 filter time</td>
<td>0.000</td>
<td>32,000</td>
<td>s</td>
<td>0.000</td>
<td>329</td>
<td></td>
<td>0-No filtering</td>
</tr>
<tr>
<td>P2.4.4.3</td>
<td>AI2 signal range</td>
<td>0</td>
<td>3</td>
<td></td>
<td>1</td>
<td>325</td>
<td></td>
<td>0=6...100%* 1=20...100%* 4 mA Fault 2=-10V...+10V* 3=Custom range*</td>
</tr>
<tr>
<td>P2.4.4.4</td>
<td>AI2 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>326</td>
<td></td>
<td>Custom Range: Minimum input</td>
</tr>
<tr>
<td>P2.4.4.5</td>
<td>AI2 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>327</td>
<td></td>
<td>Custom Range: Maximum input</td>
</tr>
<tr>
<td>P2.4.4.6</td>
<td>AI2 reference scaling, minimum value</td>
<td>0.000</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td>393</td>
<td></td>
<td>Selects the frequency that corresponds to the min. reference signal</td>
</tr>
<tr>
<td>P2.4.4.7</td>
<td>AI2 reference scaling, maximum value</td>
<td>0.000</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td>394</td>
<td></td>
<td>Selects the frequency that corresponds to the max. reference signal</td>
</tr>
<tr>
<td>P2.4.4.8</td>
<td>AI2 joystick Dead Zone</td>
<td>0.000</td>
<td>20.000</td>
<td>%</td>
<td>0.00</td>
<td>395</td>
<td></td>
<td>Dead Zone for joystick input</td>
</tr>
<tr>
<td>P2.4.4.9</td>
<td>AI2 sleep limit</td>
<td>0.000</td>
<td>100.00</td>
<td>%</td>
<td>0.00</td>
<td>396</td>
<td></td>
<td>Drive goes to stop if input is below this limit for this time.</td>
</tr>
<tr>
<td>P2.4.4.10</td>
<td>AI2 sleep delay</td>
<td>0.000</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>397</td>
<td></td>
<td>Drive goes to stop if input is below this limit for this time.</td>
</tr>
<tr>
<td>P2.4.4.11</td>
<td>AI2 joystick offset</td>
<td>-100.00</td>
<td>100.00</td>
<td>%</td>
<td>0.00</td>
<td>166</td>
<td></td>
<td>Press enter for 1s to set offset</td>
</tr>
</tbody>
</table>

*Remember to place jumpers of block X2 accordingly. See NX User’s Manual, chapter 6.2.2.2

---

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.4.5 Analogue input 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>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.5.1</td>
<td>A13 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>141</td>
<td></td>
<td>Slot: Board input No. If 0.1 ID27 can be controlled from FB</td>
</tr>
<tr>
<td>P2.4.5.2</td>
<td>A13 filter time</td>
<td>0.00</td>
<td>32.00</td>
<td>s</td>
<td>0.00</td>
<td>142</td>
<td></td>
<td>0 = No filtering</td>
</tr>
<tr>
<td>P2.4.5.3</td>
<td>A13 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>144</td>
<td></td>
<td>Custom range always active. See ID326</td>
</tr>
<tr>
<td>P2.4.5.4</td>
<td>A13 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>145</td>
<td></td>
<td>Custom range always active. See ID327</td>
</tr>
<tr>
<td>P2.4.5.5</td>
<td>A13 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>151</td>
<td></td>
<td>0 = Not inverted 1 = Inverted</td>
</tr>
<tr>
<td>P2.4.5.6</td>
<td>A13 reference scaling, minimum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1037</td>
<td></td>
<td>Selects the value that corresponds to the min. reference signal</td>
</tr>
<tr>
<td>P2.4.5.7</td>
<td>A13 reference scaling, maximum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1038</td>
<td></td>
<td>Selects the value that corresponds to the max. reference signal</td>
</tr>
<tr>
<td>P2.4.5.8</td>
<td>A13 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1509</td>
<td></td>
<td>Select parameter that you want to control by ID number</td>
</tr>
</tbody>
</table>

Table 7-8. Analogue input 3 parameters, G2.2.4

**Remember to place jumpers of block X2 accordingly. See NX User’s Manual, chapter 6.2.2.2

7.4.6 Analogue input 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>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.6.1</td>
<td>A14 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>152</td>
<td></td>
<td>Slot: Board input No. If 0.1 ID28 can be controlled from FB</td>
</tr>
<tr>
<td>P2.4.6.2</td>
<td>A14 filter time</td>
<td>0.00</td>
<td>32.00</td>
<td>s</td>
<td>0.00</td>
<td>153</td>
<td></td>
<td>0 = No filtering</td>
</tr>
<tr>
<td>P2.4.6.3</td>
<td>A14 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>155</td>
<td></td>
<td>Custom range always active. See ID326</td>
</tr>
<tr>
<td>P2.4.6.4</td>
<td>A14 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>156</td>
<td></td>
<td>Custom range always active. See ID327</td>
</tr>
<tr>
<td>P2.4.6.5</td>
<td>A14 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>162</td>
<td></td>
<td>0 = Not inverted 1 = Inverted</td>
</tr>
<tr>
<td>P2.4.6.6</td>
<td>A14 reference scaling, minimum value</td>
<td>-32000</td>
<td>-32000</td>
<td></td>
<td>0</td>
<td>1039</td>
<td></td>
<td>Selects the value that corresponds to the min. reference signal</td>
</tr>
<tr>
<td>P2.4.6.7</td>
<td>A14 reference scaling, maximum value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1040</td>
<td></td>
<td>Selects the value that corresponds to the max. reference signal</td>
</tr>
<tr>
<td>P2.4.6.8</td>
<td>A14 Controlled ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>1510</td>
<td></td>
<td>Select parameter that you want to control by ID number</td>
</tr>
</tbody>
</table>

Table 7-9. Analogue input 4 parameters, G2.2.5

7.4.7 Options

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.4.7.1</td>
<td>Input signal inversion Control</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1091</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# 7.5 Output Signals

## 7.5.1 Digital output signals

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.1.1</td>
<td>Ready</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>432</td>
<td>Ready to Run</td>
</tr>
<tr>
<td>P2.5.1.2</td>
<td>Run</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>433</td>
<td>Running</td>
</tr>
<tr>
<td>P2.5.1.3</td>
<td>Fault</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>434</td>
<td>Drive in fault state</td>
</tr>
<tr>
<td>P2.5.1.4</td>
<td>Inverted fault</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>435</td>
<td>Drive not in fault state</td>
</tr>
<tr>
<td>P2.5.1.5</td>
<td>Warning</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>436</td>
<td>Warning active</td>
</tr>
<tr>
<td>P2.5.1.6</td>
<td>External fault</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>437</td>
<td>External fault active</td>
</tr>
<tr>
<td>P2.5.1.7</td>
<td>Reference fault/warning</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>438</td>
<td>4 mA fault active</td>
</tr>
<tr>
<td>P2.5.1.8</td>
<td>Over temperature warning</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>439</td>
<td>Drive over temperature active</td>
</tr>
<tr>
<td>P2.5.1.9</td>
<td>Reverse</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>440</td>
<td>Output frequency &lt;0 Hz</td>
</tr>
<tr>
<td>P2.5.1.10</td>
<td>Unrequested direction</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>441</td>
<td>Reference = Output frequency</td>
</tr>
<tr>
<td>P2.5.1.11</td>
<td>At speed</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>442</td>
<td>Reference = Output frequency</td>
</tr>
<tr>
<td>P2.5.1.12</td>
<td>Jogging speed</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>443</td>
<td>Jogging or preset speed command active</td>
</tr>
<tr>
<td>P2.5.1.13</td>
<td>External control place</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>444</td>
<td>IO control active</td>
</tr>
<tr>
<td>P2.5.1.14</td>
<td>External brake control</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>445</td>
<td>See explanations on chapter Brake Control</td>
</tr>
<tr>
<td>P2.5.1.15</td>
<td>External brake control, inverted</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>446</td>
<td></td>
</tr>
<tr>
<td>P2.5.1.16</td>
<td>Output frequency limit 1 supervision</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>447</td>
<td>See ID315</td>
</tr>
<tr>
<td>P2.5.1.17</td>
<td>Output frequency limit 2 supervision</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>448</td>
<td>See ID346</td>
</tr>
<tr>
<td>P2.5.1.18</td>
<td>Reference limit supervision</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>449</td>
<td>See ID350</td>
</tr>
<tr>
<td>P2.5.1.19</td>
<td>Temperature limit supervision</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>450</td>
<td>Drive temperature supervision. See ID354</td>
</tr>
<tr>
<td>P2.5.1.20</td>
<td>Torque limit supervision</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>451</td>
<td>See ID348</td>
</tr>
<tr>
<td>P2.5.1.21</td>
<td>Motor thermal protection</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>452</td>
<td>Thermistor fault or warning</td>
</tr>
<tr>
<td>P2.5.1.22</td>
<td>Analogue input supervision limit</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>463</td>
<td>See ID356</td>
</tr>
<tr>
<td>P2.5.1.23</td>
<td>Motor regulator activation</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>454</td>
<td>One of limit controller is active</td>
</tr>
<tr>
<td>P2.5.1.24</td>
<td>Fieldbus digital input 1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>455</td>
<td>FB CW B11</td>
</tr>
<tr>
<td>P2.5.1.25</td>
<td>FB Dig 1 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td></td>
<td>891</td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.26</td>
<td>Fieldbus digital input 2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>456</td>
<td>FB CW B12</td>
</tr>
<tr>
<td>P2.5.1.27</td>
<td>FB Dig 2 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td></td>
<td>892</td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.28</td>
<td>Fieldbus digital input 3</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>457</td>
<td>FB CW B13</td>
</tr>
<tr>
<td>P2.5.1.29</td>
<td>FB Dig 3 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td></td>
<td>893</td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.30</td>
<td>Fieldbus digital input 4</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>169</td>
<td>FB CW B14</td>
</tr>
<tr>
<td>P2.5.1.31</td>
<td>FB Dig 4 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td></td>
<td>894</td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.32</td>
<td>Fieldbus digital input 5</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>170</td>
<td>FB CW B15</td>
</tr>
<tr>
<td>P2.5.1.33</td>
<td>FB Dig 5 Parameter</td>
<td>ID0</td>
<td>ID0</td>
<td></td>
<td>895</td>
<td>Select parameter to control</td>
</tr>
<tr>
<td>P2.5.1.34</td>
<td>Safe Disable Active</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>756</td>
<td></td>
</tr>
<tr>
<td>P2.5.1.35</td>
<td>MCC Close Continuous</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1218</td>
<td></td>
</tr>
<tr>
<td>P2.5.1.36</td>
<td>MCC Close Pulse</td>
<td>0.1</td>
<td>0.1</td>
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<td>1219</td>
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</tbody>
</table>
### 7.5.2 Analogue output 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>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.2.1</td>
<td>Analogue output 1 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>A.1</td>
<td></td>
<td></td>
<td>TTF programming See chapter 3.1 and 3.2</td>
</tr>
<tr>
<td>P2.5.2.2</td>
<td>Analogue output 1 function</td>
<td>0</td>
<td>20</td>
<td></td>
<td>1</td>
<td>307</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.2.3</td>
<td>Analogue output 1 filter time</td>
<td>0,00</td>
<td>10,00</td>
<td>s</td>
<td>1,00</td>
<td>308</td>
<td></td>
<td>0=No filtering</td>
</tr>
<tr>
<td>P2.5.2.4</td>
<td>Analogue output 1 inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>309</td>
<td></td>
<td>0=Not inverted 1=Inverted</td>
</tr>
<tr>
<td>P2.5.2.5</td>
<td>Analogue output 1 minimum</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>310</td>
<td></td>
<td>0=0 mA (0 %) 1=4 mA (20 %)</td>
</tr>
<tr>
<td>P2.5.2.6</td>
<td>Analogue output 1 scale</td>
<td>10</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>311</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.2.7</td>
<td>Analogue output 1 offset</td>
<td>-100,00</td>
<td>100,00</td>
<td>%</td>
<td>0,00</td>
<td>375</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7-10. Analogue output 1 parameters, G2.3.5**

### 7.5.3 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>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.3.1</td>
<td>Analogue output 2 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>471</td>
<td></td>
<td>TTF programming See chapter 3.1 and 3.2</td>
</tr>
<tr>
<td>P2.5.3.2</td>
<td>Analogue output 2 function</td>
<td>0</td>
<td>20</td>
<td></td>
<td>4</td>
<td>472</td>
<td></td>
<td>See P2.5.2.2</td>
</tr>
<tr>
<td>P2.5.3.3</td>
<td>Analogue output 2 filter time</td>
<td>0,00</td>
<td>10,00</td>
<td>s</td>
<td>1,00</td>
<td>473</td>
<td></td>
<td>0=No filtering</td>
</tr>
<tr>
<td>P2.5.3.4</td>
<td>Analogue output 2 inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>474</td>
<td></td>
<td>0=Not inverted 1=Inverted</td>
</tr>
<tr>
<td>P2.5.3.5</td>
<td>Analogue output 2 minimum</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>475</td>
<td></td>
<td>0=0 mA (0 %) 1=4 mA (20 %)</td>
</tr>
<tr>
<td>P2.5.3.6</td>
<td>Analogue output 2 scale</td>
<td>10</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>476</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.3.7</td>
<td>Analogue output 2 offset</td>
<td>-100,00</td>
<td>100,00</td>
<td>%</td>
<td>0,00</td>
<td>477</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7-11. Analogue output 2 parameters, G2.3.6**

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7.5.4 Analogue output 3

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<th>Note</th>
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<td>E.10</td>
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<td>1=4 mA (20 %)</td>
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Table 7-12: Analogue output 3 parameters, G2.3.7

7.5.5 Delayed digital output 1

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<td>6=Ext. fault or warning</td>
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<td>21=Ext. brake control inverted</td>
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<td>0,00</td>
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<td>488</td>
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<td>1=inverted</td>
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Table 7-13: Delayed digital output 1 parameters, G2.3.1
7.5.6 Delayed digital output 2

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<td>491</td>
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</tr>
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<td>s</td>
<td>0.00</td>
<td>492</td>
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<td>0.00 = Off delay not in use</td>
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Table 7-14. Delayed digital output 2 parameters, G2.3.2

7.5.7 Supervision Limits

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<td>Hz</td>
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<td>Hz</td>
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<td>Reducing of torque supervision limit</td>
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<td>%</td>
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Table 7-15. Supervision Limit settings, G2.3.4
7.6 Limit Settings

7.6.1 Current handling

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<th>ID</th>
<th>Note</th>
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<td>$2 \times I_H$</td>
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<td>$I_L$</td>
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7.6.2 Power Handling

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<td>%</td>
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<td>Scaling from 0 to ID1289</td>
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<td>Scaling from 0 to ID1290</td>
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### 7.6.3 Torque Handling

<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>P2.6.3.1</td>
<td>Motoring Torque Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td></td>
<td>1287</td>
<td>Motoring side torque limit</td>
</tr>
<tr>
<td>P2.6.3.2</td>
<td>Generator Torque Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td></td>
<td>1288</td>
<td>Generator side torque limit</td>
</tr>
</tbody>
</table>
| P2.6.3.3 | Scaling Motoring Torque limit  | 0   | 5     |      | 0       | 485  |     | Scaling from 0 to ID1287  
0=Not used  
1=AI1  
2=AI2  
3=AI3  
4=AI4  
5=FB Limit Scaling ID46 |
| P2.6.3.4 | Scaling Generator Torque limit | 0   | 5     |      | 0       | 1087 |     | Scaling from 0 to ID1288  
As parameter P2.6.3.9 |

#### 7.6.3.1 Torque Handling OL Settings

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.3.5.1</td>
<td>Torque limit control P-gain</td>
<td>0,0</td>
<td>32000</td>
<td></td>
<td>3000</td>
<td></td>
<td>610</td>
<td></td>
</tr>
<tr>
<td>P2.6.3.5.2</td>
<td>Torque limit control I-gain</td>
<td>0,0</td>
<td>32000</td>
<td></td>
<td>200</td>
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#### 7.6.3.2 Torque Handling CL Settings

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<th>ID</th>
<th>Note</th>
</tr>
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<tbody>
<tr>
<td>P2.6.3.6.1</td>
<td>SPC Out Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td></td>
<td>1382</td>
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<tr>
<td>P2.6.3.6.2</td>
<td>SPC Pos Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td></td>
<td>646</td>
<td></td>
</tr>
<tr>
<td>P2.6.3.6.3</td>
<td>SPC Neg Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td></td>
<td>645</td>
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#### 7.6.4 Frequency Handling

<table>
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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.6.4.1</td>
<td>Negative frequency limit</td>
<td>-320,0</td>
<td>320,0</td>
<td>Hz</td>
<td>-320,0</td>
<td></td>
<td>1286</td>
<td>Alternative limit for negative direction</td>
</tr>
<tr>
<td>P2.6.4.2</td>
<td>Positive frequency limit</td>
<td>-320,0</td>
<td>320,0</td>
<td>Hz</td>
<td>320,0</td>
<td></td>
<td>1285</td>
<td>Alternative limit for positive direction</td>
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<tr>
<td>P2.6.4.3</td>
<td>Zero Frequency limit</td>
<td>0,0</td>
<td>320,0</td>
<td>Hz</td>
<td>1,00</td>
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### 7.6.5 DC-Link Handling

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<th>ID</th>
<th>Note</th>
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<tbody>
<tr>
<td>P2.6.5.1</td>
<td>Overvoltage controller</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>607</td>
<td></td>
<td>0 = Not used &lt;br&gt;1 = Used (no ramping) &lt;br&gt;2 = Used (ramping)</td>
</tr>
<tr>
<td>P2.6.5.2</td>
<td>Over Voltage Reference selector</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1262</td>
<td></td>
<td>0 = High Voltage &lt;br&gt;1 = Normal Voltage &lt;br&gt;2 = BrakeChopperLevel</td>
</tr>
<tr>
<td>P2.6.5.3</td>
<td>Brake chopper</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td>504</td>
<td></td>
<td>0 = Disabled &lt;br&gt;1 = Used when running &lt;br&gt;2 = External brake chopper &lt;br&gt;3 = Used when stopped/running &lt;br&gt;4 = Used when running (no testing)</td>
</tr>
<tr>
<td>P2.6.5.4</td>
<td>Brake Chopper Level</td>
<td>0</td>
<td>1267</td>
<td>V</td>
<td>Varies</td>
<td>1267</td>
<td></td>
<td>500 V unit: 567 Vdc &lt;br&gt;6690 V unit: 836 Vdc</td>
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<tr>
<td>P2.6.5.5</td>
<td>Undervoltage controller</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>608</td>
<td></td>
<td>0 = Not used &lt;br&gt;1 = Used (no ramping) &lt;br&gt;2 = Used (ramping to zero)</td>
</tr>
<tr>
<td>P2.6.5.6</td>
<td>Under Voltage Kp</td>
<td></td>
<td></td>
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<td>1415</td>
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<td>P2.6.5.7</td>
<td>Under Voltage Ki</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1416</td>
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<tr>
<td>P2.6.5.8</td>
<td>Under Voltage Kd</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1265</td>
<td></td>
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<tr>
<td>P2.6.5.9</td>
<td>UV Control Threshold</td>
<td>100</td>
<td>1000</td>
<td>V</td>
<td></td>
<td></td>
<td>1711</td>
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### 7.7 Flux and DC Current handling

#### 7.7.1 Flux and DC Current handling OL Settings

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<th>Code</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
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</thead>
<tbody>
<tr>
<td>P2.7.1.1</td>
<td>DC braking current</td>
<td>0,00</td>
<td></td>
<td>A</td>
<td>0,00</td>
<td></td>
<td>507</td>
<td></td>
</tr>
<tr>
<td>P2.7.1.2</td>
<td>DC braking time at start</td>
<td>0,00</td>
<td>600,00</td>
<td>s</td>
<td>0,00</td>
<td></td>
<td>516</td>
<td>0=DC brake is off at start</td>
</tr>
<tr>
<td>P2.7.1.3</td>
<td>DC braking time at stop</td>
<td>0,00</td>
<td>600,00</td>
<td>s</td>
<td>0,00</td>
<td></td>
<td>508</td>
<td>0=DC brake is off at stop</td>
</tr>
<tr>
<td>P2.7.1.4</td>
<td>Frequency to start DC braking during ramp stop</td>
<td>0,10</td>
<td>10,00</td>
<td>Hz</td>
<td>1,50</td>
<td></td>
<td>515</td>
<td></td>
</tr>
<tr>
<td>P2.7.1.5</td>
<td>Scaling of DC-braking current</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td>400</td>
<td>ID46=Scaling from 0 to ID507 0=Not used 1=AI1 2=AI2 3=AI3 4=AI4 5=FB Limit Scaling</td>
</tr>
<tr>
<td>P2.7.1.6</td>
<td>DC-Brake Current in Stop</td>
<td>0,00</td>
<td></td>
<td>A</td>
<td>Varies</td>
<td></td>
<td>1080</td>
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<tr>
<td>P2.7.1.7</td>
<td>Flux brake</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>520</td>
<td>0=Off 1=On</td>
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<tr>
<td>P2.7.1.8</td>
<td>Flux braking current</td>
<td>0,00</td>
<td></td>
<td>A</td>
<td>I_{H}</td>
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#### 7.7.2 Flux and DC Current handling CL Settings

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<th>Cust</th>
<th>ID</th>
<th>Note</th>
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<tbody>
<tr>
<td>P2.7.2.1</td>
<td>Magnetizing current at start</td>
<td>0</td>
<td></td>
<td>A</td>
<td>0,00</td>
<td></td>
<td>627</td>
<td></td>
</tr>
<tr>
<td>P2.7.2.2</td>
<td>Magnetizing time at start</td>
<td>0,0</td>
<td>600,0</td>
<td>s</td>
<td>0,0</td>
<td></td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>P2.7.2.3</td>
<td>Flux Reference</td>
<td>0,0</td>
<td>500,0</td>
<td>%</td>
<td>100,0</td>
<td></td>
<td>1250</td>
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</tr>
<tr>
<td>P2.7.2.4</td>
<td>Flux Off Delay</td>
<td>-1</td>
<td>32000</td>
<td>s</td>
<td>0</td>
<td></td>
<td>1402</td>
<td>-1=forever</td>
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<tr>
<td>P2.7.2.5</td>
<td>Stop State Flux</td>
<td>0,0</td>
<td>150,0</td>
<td>%</td>
<td>100,0</td>
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<td>1401</td>
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</tr>
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</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.8 Motor Control

7.8.1 Motor Control Basic Settings

<table>
<thead>
<tr>
<th>Code</th>
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<th>Max</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.8.1</td>
<td>Motor control mode</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td>600</td>
<td></td>
<td>0=Frequency control 1=Speed control 2=Torque control 3=Closed loop speed ctrl 4=Closed loop Speed/torque ctrl</td>
</tr>
<tr>
<td>P2.8.2</td>
<td>Motor control mode 2</td>
<td>0</td>
<td>4</td>
<td></td>
<td>2</td>
<td>521</td>
<td></td>
<td>See P2.8.1</td>
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7.8.2 U/f Settings

<table>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.8.3.1</td>
<td>U/f optimisation</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>109</td>
<td></td>
<td>0=Not used 1=Automatic torque boost</td>
</tr>
<tr>
<td>P2.8.3.2</td>
<td>U/f ratio selection</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>108</td>
<td></td>
<td>0=Linear 1=Squared 2=Programmable 3=Linear with flux optim.</td>
</tr>
<tr>
<td>P2.8.3.3</td>
<td>Field weakening point</td>
<td>6,00</td>
<td>320,00</td>
<td>Hz</td>
<td>50,00</td>
<td>602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.4</td>
<td>Voltage at field weakening point</td>
<td>10,00</td>
<td>200,00</td>
<td>%</td>
<td>100,00</td>
<td>603</td>
<td></td>
<td>% x U_{imot}</td>
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<tr>
<td>P2.8.3.5</td>
<td>U/f curve midpoint frequency</td>
<td>0,0</td>
<td>P2.8.3.3</td>
<td>Hz</td>
<td>50,00</td>
<td>604</td>
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<td>P2.8.3.6</td>
<td>U/f curve midpoint voltage</td>
<td>0,0</td>
<td>100,00</td>
<td>%</td>
<td>100,00</td>
<td>605</td>
<td></td>
<td>% x U_{imot} Parameter max. value = P2.6.5</td>
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<tr>
<td>P2.8.3.7</td>
<td>Output voltage at zero frequency</td>
<td>0,0</td>
<td>40,00</td>
<td>%</td>
<td>0,0</td>
<td>606</td>
<td></td>
<td>% x U_{imot}</td>
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<tr>
<td>P2.8.3.8</td>
<td>OL Mode</td>
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<td>3</td>
<td></td>
<td>0</td>
<td>1600</td>
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<td>P2.8.3.9</td>
<td>I/f Start</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1809</td>
<td></td>
<td>0=Disable 1=Enable</td>
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<tr>
<td>P2.8.3.10</td>
<td>I/f Current</td>
<td>0,0</td>
<td>150,00</td>
<td>%</td>
<td>50,00</td>
<td>1693</td>
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<tr>
<td>P2.8.3.11</td>
<td>I/f Control Limit</td>
<td>0,0</td>
<td>300,00</td>
<td>%</td>
<td>10,0</td>
<td>1790</td>
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7.8.3 Closed Loop Control Settings

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<th>Unit</th>
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<th>ID</th>
<th>Note</th>
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<tr>
<td>P2.8.4.1</td>
<td>Current control P gain</td>
<td>0,0</td>
<td>100,00</td>
<td>%</td>
<td>15,00</td>
<td>617</td>
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<td>P2.8.4.2</td>
<td>Current control I Time</td>
<td>0,0</td>
<td>3200,0</td>
<td>ms</td>
<td>1,5</td>
<td>657</td>
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<td></td>
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<td>P2.8.4.3</td>
<td>Slip adjust</td>
<td>0</td>
<td>500</td>
<td></td>
<td>75</td>
<td>619</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.4</td>
<td>Acceleration compensation</td>
<td>0,0</td>
<td>300,00</td>
<td>s</td>
<td>0,0</td>
<td>626</td>
<td></td>
<td></td>
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<tr>
<td>P2.8.4.5</td>
<td>Speed Error Filter TC</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>0</td>
<td>1311</td>
<td></td>
<td></td>
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<tr>
<td>P2.8.4.6</td>
<td>Encoder filter time</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>0</td>
<td>618</td>
<td></td>
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<td>P2.8.4.7</td>
<td>SC Torque Chain Select</td>
<td>0</td>
<td>65535</td>
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<td>0</td>
<td>1557</td>
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<td>Default 96 after identification.</td>
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### 7.8.4 PMSM Control settings

<table>
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<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
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<th>Note</th>
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<td>PMSM Shaft Position</td>
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<td>Start Angle Identification mode</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>1691</td>
<td></td>
<td>0=Automatic 1=Forced 2=After Power Up 3=Disabled</td>
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<td>Start Angle Identification ID Current</td>
<td>0,0</td>
<td>150,0</td>
<td>%</td>
<td>0,0</td>
<td>1756</td>
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<tr>
<td>P2.8.5.4</td>
<td>Polarity Pulse Current</td>
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<td>200,0</td>
<td>%</td>
<td>0,0</td>
<td>1566</td>
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<td>Start Angle ID Time</td>
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<td>ms</td>
<td>0</td>
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<td></td>
<td></td>
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<td>P2.8.5.6</td>
<td>I/f Current</td>
<td>0,0</td>
<td>150,0</td>
<td>%</td>
<td>50,0</td>
<td>1693</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.5.7</td>
<td>I/f Control Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>10,0</td>
<td>1790</td>
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<td>P2.8.5.8</td>
<td>Flux Current Kp</td>
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<td>5000</td>
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<td>P2.8.5.9</td>
<td>Flux Current Ti</td>
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<td></td>
<td>25</td>
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Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
# 7.8.7 Identification parameters

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**Table 7-16. Identification parameters, G2.6.4**

## 7.8.8 High Speed parameters

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**Table 7-17. High Speed parameters**
### 7.8.9 Fine tuning parameters

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<td>P 2.8.10.8</td>
<td>CurrLimOptions</td>
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<td>1702</td>
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<td>P 2.8.10.9</td>
<td>AdConvStartShift</td>
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<td></td>
<td>1701</td>
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<td>P 2.8.10.10</td>
<td>VoltageCorr. Kp</td>
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<td>1783</td>
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<td>P 2.8.10.11</td>
<td>VoltageCorr. Ki</td>
<td></td>
<td></td>
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<td>1784</td>
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<td>P 2.8.10.12</td>
<td>GearRatioMultipl</td>
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<td></td>
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<td></td>
<td>1558</td>
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<td>P 2.8.10.13</td>
<td>GearRatioDivider</td>
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<td>P 2.8.10.14</td>
<td>VCA900TrmStep</td>
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<td>VCA9000SSDelay</td>
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<td>P 2.8.10.16</td>
<td>VCA9000MTPCon</td>
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</table>

*Table 7-18. Fine tuning parameters*
7.9  Speed Control

7.9.1  Speed Control Basic settings

<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>P2.9.1</td>
<td>Load drooping</td>
<td>0,00</td>
<td>100,00</td>
<td>%</td>
<td>0,00</td>
<td>Cust</td>
<td>620</td>
<td></td>
</tr>
<tr>
<td>P2.9.2</td>
<td>Load Drooping Time</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>0</td>
<td>Cust</td>
<td>656</td>
<td>For dynamic changes</td>
</tr>
</tbody>
</table>

Table 7-19. Speed control basic settings

7.9.2  Speed Control OL Settings

<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>P2.9.31</td>
<td>Speed controller P gain (open loop)</td>
<td>0</td>
<td>32767</td>
<td>%</td>
<td>3000</td>
<td>Cust</td>
<td>637</td>
<td></td>
</tr>
<tr>
<td>P2.9.31</td>
<td>Speed controller I gain (open loop)</td>
<td>0</td>
<td>32767</td>
<td>%</td>
<td>300</td>
<td>Cust</td>
<td>638</td>
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Table 7-20. Speed control OL settings

7.9.3  Speed Control CL Settings

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
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<tbody>
<tr>
<td>P2.9.41</td>
<td>Speed control P gain</td>
<td>0</td>
<td>1000</td>
<td>%</td>
<td>30</td>
<td>Cust</td>
<td>613</td>
<td></td>
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<tr>
<td>P2.9.42</td>
<td>Speed control I time</td>
<td>-32000</td>
<td>32000</td>
<td>ms</td>
<td>100</td>
<td>Cust</td>
<td>614</td>
<td>Negative value uses 0,1 ms format instead of 1 ms</td>
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<tr>
<td>P2.9.43</td>
<td>0-speed time at start</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>100</td>
<td>Cust</td>
<td>615</td>
<td></td>
</tr>
<tr>
<td>P2.9.44</td>
<td>0-speed time at stop</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>100</td>
<td>Cust</td>
<td>616</td>
<td></td>
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<tr>
<td>P2.9.45</td>
<td>SPC F1 Point</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>Cust</td>
<td>1301</td>
<td></td>
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<tr>
<td>P2.9.46</td>
<td>SPC F0 Point</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>Cust</td>
<td>1300</td>
<td></td>
</tr>
<tr>
<td>P2.9.47</td>
<td>SPC Kp f0</td>
<td>0</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>Cust</td>
<td>1299</td>
<td></td>
</tr>
<tr>
<td>P2.9.48</td>
<td>SPC Kp FWP</td>
<td>0</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>Cust</td>
<td>1298</td>
<td></td>
</tr>
<tr>
<td>P2.9.49</td>
<td>SPC Torque minimum</td>
<td>0</td>
<td>400,0</td>
<td>%</td>
<td>0,0</td>
<td>Cust</td>
<td>1296</td>
<td></td>
</tr>
<tr>
<td>P2.9.50</td>
<td>SPC Torque minimum Kp</td>
<td>0</td>
<td>1000</td>
<td>%</td>
<td>100</td>
<td>Cust</td>
<td>1295</td>
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<tr>
<td>P2.9.51</td>
<td>SPC Kp TC Torque</td>
<td>0</td>
<td>1000</td>
<td>ms</td>
<td>0</td>
<td>Cust</td>
<td>1297</td>
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</tr>
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Table 7-21. Speed control CL settings

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.10 Drive Control

<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>P2.10.1</td>
<td>Switching frequency</td>
<td>1.0</td>
<td>Varies</td>
<td>kHz</td>
<td>Varies</td>
<td>601</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.2</td>
<td>Modulator Type</td>
<td>0</td>
<td>10</td>
<td></td>
<td>1</td>
<td>1516</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.3</td>
<td>Control Options</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>132</td>
<td>1084</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.4</td>
<td>Advanced Options 1</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1560</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.5</td>
<td>Advanced Options 2</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1561</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.6</td>
<td>Advanced Options 4</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>32</td>
<td>1563</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.7</td>
<td>Advanced Options 5</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1564</td>
<td></td>
<td></td>
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<tr>
<td>P2.10.8</td>
<td>Advanced Options 6</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>32</td>
<td>1565</td>
<td></td>
<td></td>
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<td>P2.10.9</td>
<td>Restart Delay</td>
<td>0</td>
<td>65535</td>
<td>s</td>
<td>Varies</td>
<td>1424</td>
<td></td>
<td>CL and Flying Start</td>
</tr>
<tr>
<td>P2.10.10</td>
<td>Restart Delay CL</td>
<td>0</td>
<td>60,000</td>
<td>s</td>
<td>Varies</td>
<td>672</td>
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<td></td>
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<td>P.2.10.11</td>
<td>Sine Filter Capacitor Size</td>
<td>0</td>
<td>32000</td>
<td></td>
<td></td>
<td>1460</td>
<td></td>
<td></td>
</tr>
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<td>P.2.10.12</td>
<td>Sine Filter Inductor Size</td>
<td>0</td>
<td>32000</td>
<td></td>
<td></td>
<td>1461</td>
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<td></td>
</tr>
<tr>
<td>P.2.10.13</td>
<td>Enable SVM/SHE</td>
<td>0</td>
<td>1</td>
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<td></td>
<td>1725</td>
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<tr>
<td>P.2.10.14</td>
<td>SVM/SHE FreqLim1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td>1727</td>
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<td></td>
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<tr>
<td>P.2.10.15</td>
<td>SVM/SHE FreqLim2</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td>1728</td>
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<td>P.2.10.16</td>
<td>SVM/SHE FreqLim3</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td>1729</td>
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Table 7-22 Drive control
### 7.11 Master Follower Control Parameters

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<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
</table>
| P2.11.1 | Master Follower Mode               | 0   | 2   |      | 0       |      | 1324| 0=Not Used  
1=Master  
2=Follower |
|       | Follower Speed Reference Select    | 0   | 18  |      | 17      |      | 1081| 0=AI1  
1=AI2  
2=AI1+AI2  
3=AI1-AI2  
4=AI2-AI1  
5=AI1xAI2  
6=AI1 joystick  
7=AI2 joystick  
8=Keypad  
9=Fieldbus  
10=Motor potentiometer  
11=AI1, AI2 minimum  
12=AI1, AI2 maximum  
13=Max frequency  
14=AI1/AI2 selection  
15=Encoder 1  
16=Encoder 2  
17=Master Reference  
18=Master Ramp Out |
|       | Follower Torque Reference Select   | 0   | 10  |      | 10      |      | 1083| 0=Not used  
1=AI1  
2=AI2  
3=AI3  
4=AI4  
5=AI1 joystick  
6=AI2 joystick  
7=Torque reference from keypad, R3.5  
8=FB Torque Reference  
9=Master Torque OL  
10=Master Torque CL |
|       | Follower Stop Function             | 0   | 2   |      | 2       |      | 1089| 0=Coasting  
1=Ramping  
2=As Master |
| P2.11.5 | MF Mode 2                          | 0   | 4   |      | 0       |      | 1093| P2.11.1 |
| P2.11.6 | System Bus Fault                  | 0   | 3   |      | 1       |      | 1082| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.11.7 | System Bus Fault Delay            | 0,00 | 320,00 | s | 3,00   |      | 1352|                                          |
| P2.11.8.1 | DS Follower Fault                 |      |      |      |         |      | 1531|                                          |

*Table 7-23. Master Follower Control parameters, G2.5*
7.12 Protections

7.12.1 Common settings

<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>P2.12.1.1</td>
<td>Response to external fault</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>701</td>
<td></td>
<td></td>
<td>0=No response 1=Warning 2=Fault,stop acc. to 2.4.7 3=Fault,stop by coasting</td>
</tr>
<tr>
<td>P2.12.1.2</td>
<td>Input phase supervision</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>730</td>
<td></td>
<td></td>
<td>0=No response 1=Warning 2=Fault,stop acc. to 2.3.2 3=Fault,stop by coasting</td>
</tr>
<tr>
<td>P2.12.1.3</td>
<td>Response to undervoltage fault</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>727</td>
<td></td>
<td></td>
<td>0=Fault stored in history 1=Fault not stored</td>
</tr>
<tr>
<td>P2.12.1.4</td>
<td>Output phase supervision</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>702</td>
<td></td>
<td></td>
<td>See P2.12.1.1</td>
</tr>
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<td>P2.12.1.5</td>
<td>Response to slot fault</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>734</td>
<td></td>
<td></td>
<td>See P2.12.1.1</td>
</tr>
<tr>
<td>P2.12.1.6</td>
<td>Safe Disable Response</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>755</td>
<td></td>
<td></td>
<td>See P2.12.1.1</td>
</tr>
<tr>
<td>P2.12.1.7</td>
<td>Cooling fault delay</td>
<td>0.00</td>
<td>7.00</td>
<td>s</td>
<td>2.00</td>
<td>751</td>
<td></td>
<td>0=No response 1=Warning 2=Fault,stop by coasting</td>
</tr>
<tr>
<td>P2.12.1.8</td>
<td>Encoder fault mode</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1353</td>
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Table 7-24. Common settings

7.12.2 Temperature sensor protections

<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>P2.12.2.1</td>
<td>No. of used inputs on board 1</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>739</td>
<td></td>
<td></td>
<td>0=Not used (ID Write) 1=Sensor 1 in use 2=Sensor 1 &amp; 2 in use 3=Sensor 1 &amp; 2 &amp; 3 in use 4=Sensor 2 &amp; 3 in use 5=Sensor 3 in use</td>
</tr>
<tr>
<td>P2.12.2.2</td>
<td>Response to temperature fault</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>740</td>
<td></td>
<td></td>
<td>0=No response 1=Warning 2=Fault,stop acc. to 2.3.2 3=Fault,stop by coasting</td>
</tr>
<tr>
<td>P2.12.2.3</td>
<td>Board 1 warning limit</td>
<td>-30,0</td>
<td>200,0</td>
<td>Cº</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>P2.12.2.4</td>
<td>Board 1 fault limit</td>
<td>-30,0</td>
<td>200,0</td>
<td>Cº</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>P2.12.2.5</td>
<td>No. of uses inputs on board 2</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>743</td>
<td></td>
<td></td>
<td>0=Not used (ID Write) 1=Sensor 1 in use 2=Sensor 1 &amp; 2 in use 3=Sensor 1 &amp; 2 &amp; 3 in use 4=Sensor 2 &amp; 3 in use 5=Sensor 3 in use</td>
</tr>
<tr>
<td>P2.12.2.6</td>
<td>Board 2 warning limit</td>
<td>-30,0</td>
<td>200,0</td>
<td>Cº</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>P2.12.2.7</td>
<td>Board 2 fault limit</td>
<td>-30,0</td>
<td>200,0</td>
<td>Cº</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>
</tbody>
</table>

Table 7-25. PT-100 protections
### 7.12.3 Stall Protection

<table>
<thead>
<tr>
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<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.3.1</td>
<td>Stall protection</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>709</td>
<td>0=No response 1=Warning 2=Fault, stop acc. to 2.3.2 3=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.3.2</td>
<td>Stall current</td>
<td>0.1</td>
<td>2</td>
<td>A</td>
<td>I_a</td>
<td>710</td>
<td></td>
</tr>
<tr>
<td>P2.12.3.3</td>
<td>Stall time limit</td>
<td>1.0</td>
<td>120</td>
<td>s</td>
<td>15.0</td>
<td>711</td>
<td></td>
</tr>
<tr>
<td>P2.12.3.4</td>
<td>Stall frequency limit</td>
<td>1.0</td>
<td>P2.1.2</td>
<td>Hz</td>
<td>25.0</td>
<td>712</td>
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Table 7-26. Stall protection

### 7.12.4 Speed error monitoring

<table>
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<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.4.1</td>
<td>Speed Error Mode</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>752</td>
<td>0=No response 1=Warning 2=Fault, stop acc. to 2.3.2 3=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.4.2</td>
<td>Speed Error Limit</td>
<td>0.0</td>
<td>100</td>
<td>%</td>
<td>5.0</td>
<td>753</td>
<td></td>
</tr>
<tr>
<td>P2.12.4.3</td>
<td>Speed Fault Delay</td>
<td>0.00</td>
<td>100</td>
<td>s</td>
<td>0.1</td>
<td>754</td>
<td></td>
</tr>
</tbody>
</table>

Table 7-27. Speed error monitoring

### 7.12.5 Motor thermal protections

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.5.1</td>
<td>Thermal protection</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>704</td>
<td>0=No response 1=Warning 2=Fault, stop acc. to 2.3.2 3=Fault, stop by coasting</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.2</td>
<td>Motor ambient</td>
<td>~</td>
<td>100</td>
<td>%</td>
<td>0.0</td>
<td>705</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.3</td>
<td>Motor cooling factor</td>
<td>0.0</td>
<td>150</td>
<td>%</td>
<td>40.0</td>
<td>706</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.4</td>
<td>Motor thermal time</td>
<td>1</td>
<td>200</td>
<td>min</td>
<td>45</td>
<td>707</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.5</td>
<td>Motor duty cycle</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>100</td>
<td>708</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.6</td>
<td>Response to</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>732</td>
<td>See P 2.12.5.1</td>
<td></td>
</tr>
<tr>
<td>P2.12.5.7</td>
<td>Software Over</td>
<td>0.0</td>
<td>500</td>
<td>%</td>
<td>300.0</td>
<td>703</td>
<td>0.0 =Disabled</td>
</tr>
</tbody>
</table>

Table 7-28. Motor thermal protections

### 7.12.6 Living Zero monitoring

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.6.1</td>
<td>Response to 4mA</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>700</td>
<td>0=No response 1=Warning 2=Warning+Previous Freq. 3=WarningPresetFreq 2.12.6.2</td>
<td></td>
</tr>
<tr>
<td>P2.12.6.2</td>
<td>4mA reference fault</td>
<td>0.00</td>
<td>P2.1.2</td>
<td>Hz</td>
<td>0.00</td>
<td>728</td>
<td>0=Fault, stop acc. to 2.3.2 5=Fault, stop by coasting</td>
</tr>
</tbody>
</table>

Table 7-29. Living zero monitoring

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.12.7 **Underload protection**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.7.1</td>
<td>Underload protection</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>713</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>P2.12.7.2</td>
<td>Field weakening area load</td>
<td>10.0</td>
<td>150.0</td>
<td>%</td>
<td>50.0</td>
<td>714</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.3</td>
<td>Zero frequency load</td>
<td>5.0</td>
<td>150.0</td>
<td>%</td>
<td>10.0</td>
<td>715</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.4</td>
<td>Underload protection time limit</td>
<td>2.00</td>
<td>600.00</td>
<td>s</td>
<td>20.00</td>
<td>716</td>
<td></td>
<td></td>
</tr>
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</table>

Table 7-30. Underload protection

7.12.8 **Earth Fault protection**

<table>
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<tr>
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<th>Max</th>
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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.8.1</td>
<td>Earth fault protection</td>
<td>0</td>
<td>3</td>
<td></td>
<td>2</td>
<td>703</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>P2.12.8.2</td>
<td>Ear fault current limit</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>50.0</td>
<td>1333</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7-31. Earth fault protection

7.12.9 **Fieldbus protection**

<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>P2.12.10.1</td>
<td>Fieldbus Communication response Slot D</td>
<td>0</td>
<td>3</td>
<td></td>
<td>2</td>
<td>733</td>
<td></td>
<td>0=No Action 1=Warning 2=Fault 3=Fault,stop by coasting 4=Warning; Prev Freq 5=Warning; 4 mA Freq 6=Warning; Change Slot</td>
</tr>
<tr>
<td>P2.12.10.2</td>
<td>Fieldbus Communication response Slot E</td>
<td>0</td>
<td>3</td>
<td></td>
<td>2</td>
<td>761</td>
<td></td>
<td>0=No Action 1=Warning 2=Fault 3=Fault,stop by coasting 4=Warning; Prev Freq 5=Warning; 4 mA Freq 6=Warning; Change Slot</td>
</tr>
<tr>
<td>P2.12.10.3</td>
<td>FB Fault Delay</td>
<td>0,00</td>
<td>60,00</td>
<td>s</td>
<td>0,50</td>
<td>1850</td>
<td></td>
<td>Delay to fault when FB Response is 4</td>
</tr>
<tr>
<td>P2.12.10.4</td>
<td>FB Watchdog Delay</td>
<td>0,00</td>
<td>30,00</td>
<td>s</td>
<td>0,00</td>
<td>1354</td>
<td></td>
<td>Delay when WD pulse is missing, 0.00 s = Disabled</td>
</tr>
</tbody>
</table>

Table 7-32. Fieldbus protection

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.12.10  **PM Synch Fault**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
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<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.12.10.1</td>
<td>Synch Fall Detection</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1712</td>
<td></td>
</tr>
<tr>
<td>2.12.10.2</td>
<td>Sync Fall Angle</td>
<td>0.0</td>
<td>101.0</td>
<td>%</td>
<td>75.0</td>
<td></td>
<td>1736</td>
<td></td>
</tr>
<tr>
<td>2.12.10.3</td>
<td>Sync Fall Voltage</td>
<td>0.0</td>
<td>1000.0</td>
<td>%</td>
<td>60.0</td>
<td></td>
<td>1714</td>
<td></td>
</tr>
</tbody>
</table>

Note: 0=No Action, 1=Warning, 2=Fault

**Table 7-33. PM Synch fault protection**

7.12.11  **Options**

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.11</td>
<td>Disable Stop Lock</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>1086</td>
<td></td>
</tr>
<tr>
<td>P2.12.12</td>
<td>Reset Datalogger</td>
<td>-1</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>1857</td>
<td></td>
</tr>
</tbody>
</table>

Note: -1 =Blocked, 0 =No, 1 =Yes
# 7.13 Fieldbus Parameters

<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>
</table>
| P2.13.1| Fieldbus min scale               | 0.00 | 320.00| Hz   | 0.00    |      | 850 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Output Frequency                                                |
| P2.13.2| Fieldbus max scale               | 0.00 | 320.00| Hz   | 0.00    |      | 851 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Speed                                                      |
| P2.13.3| Fieldbus process data out 1 selection | 0  | 10000 |      | 1       |      | 852 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Output Frequency                                                |
| P2.13.4| Fieldbus process data out 2 selection | 0  | 10000 |      | 2       |      | 853 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Speed                                                      |
| P2.13.5| Fieldbus process data out 3 selection | 0  | 10000 |      | 3       |      | 854 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Current to FB                                              |
| P2.13.6| Fieldbus process data out 4 selection | 0  | 10000 |      | 4       |      | 855 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Torque                                                     |
| P2.13.7| Fieldbus process data out 5 selection | 0  | 10000 |      | 5       |      | 856 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Power                                                      |
| P2.13.8| Fieldbus process data out 6 selection | 0  | 10000 |      | 6       |      | 857 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: Motor Voltage                                                    |
| P2.13.9| Fieldbus process data out 7 selection | 0  | 10000 |      | 7       |      | 858 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: DC-Link Voltage                                                  |
| P2.13.10| Fieldbus process data out 8 selection | 0 | 10000 |      | 37      |      | 859 | Choose monitoring data with parameter ID  
|       |                                  |      |       |      |         |      |     | Def: Last Active Fault                                                |
| P2.13.11| Fieldbus process data out 9 selection | 0  | 10000 |      | 0       |      | 558 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.12| Fieldbus process data out 10 selection | 0 | 10000 |      | 0       |      | 559 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.13| Fieldbus process data out 11 selection | 0 | 10000 |      | 0       |      | 560 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.14| Fieldbus process data out 12 selection | 0 | 10000 |      | 0       |      | 561 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.15| Fieldbus process data out 13 selection | 0 | 10000 |      | 0       |      | 562 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.16| Fieldbus process data out 14 selection | 0 | 10000 |      | 0       |      | 563 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.17| Fieldbus process data out 15 selection | 0 | 10000 |      | 0       |      | 564 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.18| Fieldbus process data out 16 selection | 0 | 10000 |      | 0       |      | 565 | Choose monitoring data with parameter ID  
|        |                                  |      |       |      |         |      |     | Visible with correct hw & sw                                         |
| P2.13.19| Fieldbus process data in 1 selection | 0  | 10000 |      | 1140    |      | 876 | Choose controlled data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: FB Torque Reference                                             |
| P2.13.20| Fieldbus process data in 2 selection | 0  | 10000 |      | 46      |      | 877 | Choose controlled data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: FB Limit Scaling                                                 |
| P2.13.21| Fieldbus process data in 3 selection | 0  | 10000 |      | 47      |      | 878 | Choose controlled data with parameter ID  
|        |                                  |      |       |      |         |      |     | Def: FB Adjust Reference                                             |
### Table 7-34. Fieldbus parameters

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.13.22</td>
<td>Fieldbus process data in 4 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>48</td>
<td>879</td>
<td>Choose controlled data with parameter ID. Def: FB Analogue Output.</td>
</tr>
<tr>
<td>P2.13.23</td>
<td>Fieldbus process data in 5 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>880</td>
<td>Choose controlled data with parameter ID.</td>
</tr>
<tr>
<td>P2.13.24</td>
<td>Fieldbus process data in 6 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>881</td>
<td>Choose controlled data with parameter ID.</td>
</tr>
<tr>
<td>P2.13.25</td>
<td>Fieldbus process data in 7 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>882</td>
<td>Choose controlled data with parameter ID.</td>
</tr>
<tr>
<td>P2.13.26</td>
<td>Fieldbus process data in 8 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>883</td>
<td>Choose controlled data with parameter ID.</td>
</tr>
<tr>
<td>P2.13.27</td>
<td>Fieldbus process data in 9 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>550</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.28</td>
<td>Fieldbus process data in 10 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>551</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.29</td>
<td>Fieldbus process data in 11 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>552</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.30</td>
<td>Fieldbus process data in 12 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>553</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.31</td>
<td>Fieldbus process data in 13 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>553</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.32</td>
<td>Fieldbus process data in 14 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>555</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.33</td>
<td>Fieldbus process data in 15 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>556</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.34</td>
<td>Fieldbus process data in 16 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td>557</td>
<td>Choose controlled data with parameter ID. Visible with correct hw &amp; sw</td>
</tr>
<tr>
<td>P2.13.35</td>
<td>General Status Word ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>65</td>
<td>897</td>
<td>Choose monitoring data in General Status Word</td>
</tr>
<tr>
<td>P2.13.36</td>
<td>Control Slot Selector</td>
<td>0</td>
<td>Varies</td>
<td></td>
<td>0</td>
<td>1440</td>
<td>0=All, 4=Slot D, 5=Slot E, 6=Slot D Fast, 7=Slot E Fast, 8=Slot D 16 PD, 9=Slot E 16 PD. Note: opt. 6-9 are available with correct hw &amp; sw.</td>
</tr>
<tr>
<td>P2.13.37</td>
<td>ProfiBus Mode</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td>896</td>
<td>1=Standard 2=ProfiDrive</td>
</tr>
<tr>
<td>P2.13.38</td>
<td>FB Custom Minimum</td>
<td>-32000</td>
<td>+32000</td>
<td></td>
<td>0</td>
<td>898</td>
<td>FB Speed Reference Minimum scaling</td>
</tr>
<tr>
<td>P2.13.39</td>
<td>FB Custom Maximum</td>
<td>-32000</td>
<td>+32000</td>
<td>+10000</td>
<td>899</td>
<td>FB Speed Reference Maximum Scaling</td>
<td></td>
</tr>
</tbody>
</table>
### 7.13.1 Value Control

<table>
<thead>
<tr>
<th>Code</th>
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<th>Min</th>
<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</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></td>
</tr>
<tr>
<td>P2.14.1.8</td>
<td>Control Output Filtering rate</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>

**Note:**
0=SR ABS
1=Scale ABS
2=Scale INV ABS
3=SR
4=Scale
5=Scale INV

Table 7-35. Power reference input signal selection, G2.2.8

### 7.13.2 DIN ID Control 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>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.14.2.1</td>
<td>ID Control DI B0</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.</td>
</tr>
<tr>
<td>P2.14.2.2</td>
<td>ID Control DI B1</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1277</td>
<td>Slot. Board input No.</td>
</tr>
<tr>
<td>P2.14.2.3</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>P2.14.2.4</td>
<td>B0 value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1572</td>
<td></td>
</tr>
<tr>
<td>P2.14.2.5</td>
<td>B01 value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1573</td>
<td></td>
</tr>
<tr>
<td>P2.14.2.6</td>
<td>B10 value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1193</td>
<td></td>
</tr>
<tr>
<td>P2.14.2.7</td>
<td>B11 value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1182</td>
<td></td>
</tr>
<tr>
<td>P2.14.2.8</td>
<td>Ramp Rate</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1112</td>
<td></td>
</tr>
</tbody>
</table>

Table 7-36. DIN ID Control parameters
### 7.13.3  Brake Control

<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>P2.15.1</td>
<td>Brake Logic</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>1546</td>
<td>0=Multi-Purpose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=Marine</td>
</tr>
<tr>
<td>P2.15.2</td>
<td>BrakeMechDelay</td>
<td>0,00</td>
<td>320,00</td>
<td>s</td>
<td>0,00</td>
<td></td>
<td>1544</td>
<td>Time that is required to open the brake</td>
</tr>
<tr>
<td>P2.15.3</td>
<td>Brake OFF FreqLim Open Loop</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>1,50</td>
<td></td>
<td>1535</td>
<td>Opening limit and maximum reference limit when brake is closed.</td>
</tr>
<tr>
<td>P2.15.4</td>
<td>Brake OFF FreqLim Closed Loop</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td></td>
<td>1555</td>
<td>Opening limit and maximum reference limit when brake is closed.</td>
</tr>
<tr>
<td>P2.15.5</td>
<td>Brake ON FreqLim +</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>1,00</td>
<td></td>
<td>1539</td>
<td>Close frequency from positive direction</td>
</tr>
<tr>
<td>P2.15.6</td>
<td>Brake ON FreqLim -</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>1,50</td>
<td></td>
<td>1540</td>
<td>Close frequency from negative direction</td>
</tr>
<tr>
<td>P2.15.7</td>
<td>Brake On/Off Current Limit</td>
<td>0,00</td>
<td>320,00</td>
<td>A</td>
<td>0,00</td>
<td></td>
<td>1085</td>
<td>Brake is closed immediately if current goes below this value.</td>
</tr>
<tr>
<td>P2.15.8</td>
<td>External brake-off delay</td>
<td>0,00</td>
<td>100,00</td>
<td>s</td>
<td>0,10</td>
<td></td>
<td>352</td>
<td>From brake off limits</td>
</tr>
<tr>
<td>P2.15.9</td>
<td>External brake-on delay</td>
<td>0,00</td>
<td>100,00</td>
<td>s</td>
<td>2,90</td>
<td></td>
<td>353</td>
<td>From Run Request. Use longer time than ID104</td>
</tr>
<tr>
<td>P2.15.10</td>
<td>Brake Fault Action</td>
<td>1</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
<td>1316</td>
<td>1=Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=Fault, stop acc. to 2.3.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.15.11</td>
<td>Brake Fault Delay</td>
<td>0,00</td>
<td>320,00</td>
<td>s</td>
<td>0,20</td>
<td></td>
<td>1317</td>
<td></td>
</tr>
</tbody>
</table>

Table 7-37. Brake control parameters, G2.3.9

### 7.13.3.1  Brake Control Start up torque for CL

<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>P2.15.12</td>
<td>Start-up torque</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td></td>
<td>621</td>
<td>0=Not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Torque memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=Torque reference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3=Start-up torque fwd/rev</td>
</tr>
<tr>
<td>P2.15.12.2</td>
<td>Start-up torque FWD</td>
<td>-300,0</td>
<td>300,0</td>
<td>s</td>
<td>0,0</td>
<td></td>
<td>633</td>
<td></td>
</tr>
<tr>
<td>P2.15.12.3</td>
<td>Start-up torque REV</td>
<td>-300,0</td>
<td>300,0</td>
<td>s</td>
<td>0,0</td>
<td></td>
<td>634</td>
<td></td>
</tr>
<tr>
<td>P2.15.12.4</td>
<td>Start Up Torque Time</td>
<td>-1</td>
<td>10000</td>
<td>ms</td>
<td>-1</td>
<td></td>
<td>1371</td>
<td>-1 =Automatic</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.14 Autorestart parameters

<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>P2.16.1</td>
<td>Wait time</td>
<td>0,10</td>
<td>10,00</td>
<td>s</td>
<td>0,50</td>
<td>0,10</td>
<td>717</td>
<td></td>
</tr>
<tr>
<td>P2.16.2</td>
<td>Trial time</td>
<td>0,00</td>
<td>60,00</td>
<td>s</td>
<td>0,10</td>
<td>0,10</td>
<td>718</td>
<td></td>
</tr>
<tr>
<td>P2.16.3</td>
<td>Start function</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>719</td>
<td>718</td>
<td></td>
</tr>
<tr>
<td>P2.16.4</td>
<td>Number of tries after undervoltage trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>720</td>
<td>720</td>
<td></td>
</tr>
<tr>
<td>P2.16.5</td>
<td>Number of tries after overvoltage trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>721</td>
<td>721</td>
<td></td>
</tr>
<tr>
<td>P2.16.6</td>
<td>Number of tries after overcurrent trip</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>722</td>
<td>722</td>
<td></td>
</tr>
<tr>
<td>P2.16.7</td>
<td>Number of tries after reference trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>723</td>
<td>723</td>
<td></td>
</tr>
<tr>
<td>P2.16.8</td>
<td>Number of tries after motor temperature fault trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>726</td>
<td>726</td>
<td></td>
</tr>
<tr>
<td>P2.16.9</td>
<td>Number of tries after external fault trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>725</td>
<td>725</td>
<td></td>
</tr>
<tr>
<td>P2.16.10</td>
<td>Number of tries after underload fault trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>738</td>
<td>738</td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-38. Autorestart parameters, G2.16*

7.15 PI Control Parameters

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Step</th>
<th>Default</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.17.1</td>
<td>PI controller gain</td>
<td>0,0</td>
<td>1000,0</td>
<td>%</td>
<td></td>
<td>100,0</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>P2.17.2</td>
<td>PI controller I-time</td>
<td>0,00</td>
<td>320,00</td>
<td>s</td>
<td></td>
<td>1,00</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>P2.17.3</td>
<td>PI Reference</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td></td>
<td>0</td>
<td>167</td>
<td>Default P2.17.3</td>
</tr>
<tr>
<td>P2.17.4</td>
<td>PI controller reference signal ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>167</td>
<td>332</td>
<td></td>
</tr>
<tr>
<td>P2.17.5</td>
<td>PI Actual value ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>333</td>
<td></td>
</tr>
<tr>
<td>P2.17.6</td>
<td>PI Controller output ID</td>
<td>0</td>
<td>10000</td>
<td></td>
<td></td>
<td>0</td>
<td>1802</td>
<td></td>
</tr>
<tr>
<td>P2.17.7</td>
<td>PI Controller Scale</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td></td>
<td>1</td>
<td>340</td>
<td>≧1 =No inversion, ≦1 =Inverted, 0 = Illegal value</td>
</tr>
<tr>
<td>P2.17.8</td>
<td>PI Low limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td></td>
<td>0</td>
<td>359</td>
<td></td>
</tr>
<tr>
<td>P2.17.9</td>
<td>PI High limit</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td></td>
<td>10000</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>P2.17.10</td>
<td>PI Controller Output scale</td>
<td>-3200,0</td>
<td>3200,0</td>
<td>%</td>
<td></td>
<td>100,0</td>
<td>1803</td>
<td></td>
</tr>
<tr>
<td>P2.17.11</td>
<td>PI Stop state value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td></td>
<td>0</td>
<td>1806</td>
<td></td>
</tr>
</tbody>
</table>

*Table 39. PI Controller parameters, G2.15*
7.16 Keypad control (Control keypad: Menu M3)

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

<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>P3.1</td>
<td>Control place</td>
<td>1</td>
<td>3</td>
<td></td>
<td>2</td>
<td>125</td>
<td>0</td>
<td>PC Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>I/O terminal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>Keypad</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>Fieldbus</td>
</tr>
<tr>
<td>R3.2</td>
<td>Keypad reference</td>
<td>P2.1.1</td>
<td></td>
<td></td>
<td>0,00</td>
<td></td>
<td>123</td>
<td>0=Forward</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1=Reverse</td>
</tr>
<tr>
<td>P3.3</td>
<td>Direction (on keypad)</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>123</td>
<td>0</td>
<td>0=Forward</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1=Reverse</td>
</tr>
<tr>
<td>P3.4</td>
<td>Stop button</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1</td>
<td>114</td>
<td>114</td>
<td>0=Limited function of Stop button</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1=Stop button always enabled</td>
</tr>
<tr>
<td>R3.5</td>
<td>Torque reference</td>
<td>0,0</td>
<td>100</td>
<td>%</td>
<td>0,0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>P3.6</td>
<td>Licence High Speed</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1502</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.7</td>
<td>Licence 2</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1802</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-40. Keypad control parameters, M3*

7.17 System menu (Control keypad: Menu M6)

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

7.18 Expander boards (Control keypad: Menu M7)

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

8.1 Basic Parameters

**P2.1.1 Frequency Scale**  \text{ID}523

This parameter defines speed area where frequency converter can operate.
Changing this parameter affect to all Hz and rpm monitoring values and parameters.

- **0**: 0,000 - 32,000 Hz for low speed motors, 0,0 - 1 920,0 rpm
- **1**: 0,00 - 320,00 Hz standard, 0 – 19 200 rpm
- **2**: 0,0 - 599,0 Hz for high speed motors, 0 – 35,94 rpm.
- **3**: 0,0 - 1900,0 Hz for high speed motors, 0 – 114,00 krpm.
- **4**: 0,0 - 3200,0 Hz for high speed motors, 0 – 192,00 krpm.
- **5**: 0 – 5200 Hz for high speed motors, 0 – 312,00 krpm.
- **6**: 0 – 7200 Hz for high speed motors, 0 – 432,0 krpm.

**P2.1.2 RPM Format**  \text{ID}1852

- **0** = Default
- **1** = #,# rpm
- **2** = # rpm
- **3** = #,## krpm
- **4** = #,# krpm

**P2.1.3 Minimum frequency**  \text{ID}101 “Min Frequency”

Defines minimum frequency of any adjustable reference input (i.e. reference is not a parameter). Minimum frequency is bypassed when jogging speed, preset speed or inching reference is used.

**P2.1.4 Maximum frequency**  \text{ID}102 “Max Frequency”

Defines maximum frequency limit both negative and positive directions.
Direction dependent frequency limits can be given in ”G: Limit Settings \ Frequency Handling”.

Note: Do not change this parameter to lower value that current output frequency. If changed while running, change will be executed without ramp.

**P2.1.5 Motor Nominal Voltage**  \text{ID}110 “Motor Nom Voltyg”

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

**P2.1.6 Motor Nominal Frequency**  \text{ID}111 “Motor Nom Freq”

Find this value $f_n$ on the rating plate of the motor. This parameter sets the field weakening point to the same value in ”G: Motor Control \ U/f Settings”.

**P2.1.7 Motor nominal speed**  \text{ID}112 “Motor Nom Speed”

Find this value $n_n$ on the rating plate of the motor. Note also nominal frequency.
Some cases motor nominal speed is shown with one decimal. In this case the practice is to give nearest integer number and adjust motor nominal frequency so that drive will calculate correct [FW]PolePairNumber.

**P2.1.8 Motor nominal current ID113 “Motor Nom Current”**
Find this value $I_n$ on the rating plate of the motor. If magnetization current is provided set also Magnetization current P2.1.9 before identification run.

**P2.1.9 Motor cos phi ID120 “Motor Cos Phi”**
Find this value “cos phi” on the rating plate of the motor.

**P2.1.10 Motor Nominal Power ID116 “Motor Nom Power”**
Find this value on the rating plate of the motor.
P2.1.1 Magnetizing current \( iD612 \) "MagnCurrent"

Set here the motor magnetizing current (no-load current). Can be measured by running motor without load at 2/3 of nominal speed.

When value is zero the magnetization current is calculated from motor nominal parameters

\[
\text{Motor Magnetization Current} = \frac{5 \times \sin \varphi - 1}{5 - \sin \varphi} \times \text{Motor Nominal Current}
\]

\[
[FW]\text{Rotor Flux} = \left(\frac{f(MotorNomFreq)}{f(Out)}\right)^2, \text{ when } f(Out) > f(MotorNomFreq)
\]

If given before identification run this is used as reference for U/f tuning when making identification without rotating the motor.

P2.1.2 Identification \( iD631 \) "Identification"

Identification Run is a part of tuning the motor and the drive specific parameters. It is a tool for commissioning and service of the drive with the aim to find as good parameter values as possible for most drives. The automatic motor identification calculates or measures the motor parameters that are needed for optimum motor and speed control.

**NOTE:** Set motor control mode to Frequency Control before identification!

**NOTE:** During identification drive will not open mechanical brake for safety reasons. If motor rotation requires that brake is opened this needs to be achieved externally.

**NOTE:** During identification run torque and power limits should be above 100%. Also current limit should be above motor nominal current.

**NOTE:** During identification run acceleration time should be below 20 second.

**NOTE:** If switching frequency is changed after identification it's recommended to do identification run again.

**NOTE:** Small motor with long motor cabled may require reduction of switching frequency if identification is not successful.

\( 0 = \text{"No Action"} \)  \( \text{No action} \)

No identification requested.
1 = "ID No Run" - Identification without rotating the motor
Current is applied to the motor but shaft will not be rotated. U/f settings are identified. This identification is minimum requirement if motor is only to be used in open loop control. It is however recommended to make always identification with rotating motor if need for closed loop control comes after mechanics are connected to shaft.

Example of behaviour

Parameters updated during this identification

AM:

- P2.1.11 MagnCurrent
- P2.8.3.2 U/f Ratio Select
- P2.8.3.5 U/f Mid Freq
- P2.8.3.6 U/f Mid Voltg
- P2.8.3.7 Zero Freq Voltg
- P2.8.8.16 RsVoltageDrop
- P2.8.8.17 IrAddZeroPVoltag
- P2.8.8.22-24 Ix Offset

PM:

- P2.8.3.2 U/f Ratio Select
- P2.8.3.5 U/f Mid Freq
- P2.8.3.6 U/f Mid Voltg
- P2.8.3.7 Zero Freq Voltg
- P2.8.4.1 CurrentControlKp
- P2.8.5.11 LsdVoltageDrop
- P2.8.5.12 LsqVoltageDrop
- P2.8.5.18 Curr. Contr. Kp d
- P2.8.8.16 RsVoltageDrop
- P2.8.8.17 IrAddZeroPVoltag
- P2.8.8.20 LsVoltageDrop
- P2.8.8.22-24 Ix Offset
- P2.8.8.25 Estimator Kp

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
2 = “ID With Run” - Identification with motor rotating

Shaft is rotated during identification.

This identification must be run without load on motor shaft. U/f settings and magnetization current are identified. This identification should be run regardless of the final operation mode (closed loop or open loop) to get the best performance from the motor. When identification with motor rotation is successfully finished the drive starts to use internal slip estimator to compensate the motor temperature changed.

SCTorqueChainSelect B5 & B6.

Example of behaviour

Parameters updated during this identification

AM: 

- P2.1.11 MagnCurrent
- P2.8.3.2 U/f Ratio Select
- P2.8.3.5 U/f Mid Freq
- P2.8.3.6 U/f Mid Voltg
- P2.8.3.7 Zero Freq Voltg
- P2.8.8.16 RsVoltageDrop
- P2.8.8.17 IrAddZeroPVoltag
- P2.8.8.22-24 Ix Offset
- P2.8.8.1-15 Flux X %

PM: 

- P2.8.3.2 U/f Ratio Select
- P2.8.3.3 Field Weakening Pnt
- P2.8.3.5 U/f Mid Freq
- P2.8.3.6 U/f Mid Voltg
- P2.8.3.7 Zero Freq Voltg
- P2.8.4.1 CurrentControlKp
- P2.8.5.11 LsdVoltageDrop
- P2.8.5.12 LsqVoltageDrop
- P2.8.5.18 Curr. Contr. Kp d
- P2.8.8.16 RsVoltageDrop
- P2.8.8.17 IrAddZeroPVoltag
- P2.8.8.20 LsVoltageDrop
- P2.8.8.21 MotorBEMVoltage
- P2.8.8.22-24 Ix Offset
- P2.8.8.25 Estimator Kp

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
3 = “Enc. ID Run” - Encoder identification run

The motor shaft is rotated during identification.

**IM**: If performed for induction motor encoder pulse number and direction are identified. Can be used if the is no encoder information available, correct result can be achieved only when motor in unloaded.

**PMSM**: This selection is used for PMS motor if automatic angle identification is not suitable for used motor (angle is identified automatically in every start if PMSM Shaft Position parameter is zero).

This identification run will update PMSM Shaft Position parameter based on absolute position of the encoder or Z pulse position of incremental type encoder.

**Note**: Identification needs to be remade if encoder position related to motor is changed e.g. due maintenance.

Parameters updated during this identification

**AM**:

- P2.1.11 MagnCurrent
- P2.8.3.2 U/f Ratio Select
- P2.8.3.5 U/f Mid Freq
- P2.8.3.6 U/f Mid Voltg
- P2.8.3.7 Zero Freq Voltg
- P2.8.8.16 RsVoltageDrop
- P2.8.8.17 IrAddZeroPVoltag
- P2.8.8.22-24 Ix Offset
- P2.8.8.1-15 Flux X%
- P7.3.1.2 Pulse revolution
- P7.3.1.3 Invert direction

**PM**:

- P2.8.5.1 PMSMShaftPositio
- P2.8.8.22-24 Ix Offset
- P2.8.8.25 Estimator Kp
4 = "Ident All" - Identified All

Shaft is rotated during identification.

All the above identification selections are made in sequence.

Parameters updated during this identification

AM:                  PM:
P2.1.11 MagnCurrent   P2.8.3.2 U/f Ratio Select
P2.8.3.2 U/f Ratio Select P2.8.3.3 Field Weakening Pnt
P2.8.3.5 U/f Mid Freq   P2.8.3.5 U/f Mid Freq
P2.8.3.6 U/f Mid Voltg  P2.8.3.6 U/f Mid Voltg
P2.8.3.7 Zero Freq Voltg P2.8.3.7 Zero Freq Voltg
P2.8.8.16 Rs Voltage Drop P2.8.4.1 Current Control Kp
P2.8.8.17 Ir Add Zero P Voltg P2.8.5.11 Lsd Voltage Drop
P2.8.8.22-24 Ix Offset  P2.8.5.12 Lsq Voltage Drop
P2.8.8.1-15 Flux X %     P2.8.8.16 Rs Voltage Drop
P2.8.8.22-24 Ix Offset  P2.8.8.17 Ir Add Zero P Voltg
P2.8.8.20 Ls Voltage Drop P2.8.8.21 Motor BEM Voltage
P2.8.8.22-24 Ix Offset  P2.8.8.25 Estimator Kp
P2.8.8.25 Estimator Kp
P2.8.5.1 PMSM Shaft Position

5 = "Enc.ABS.Lock" - Absolute encoder when locked rotor

Absolute encoder zero position identification when rotor is locked while using permanent magnet motor.

It’s recommended to have shaft locked during this identification mode.

Parameters updated during this identification

PM:

P2.8.5.1 PMSM Shaft Position
P2.8.8.22-24 Ix Offset
P2.8.8.25 Estimator Kp
Identification failed in last attempt.

The basic motor name plate data has to be set correctly before performing the identification run:

- P2.1.3 – P2.1.8. Motor basic data.
- P2.1.9 Magnetization current can also be given if available if given before identification without rotating motor; U/f curve will be tuned according to given magnetization current.
- P2.1.11 Motor Type.

When in closed loop and with an encoder installed, also the parameter for pulses / revolutions (in Menu M7) has to be set. The automatic identification is activated by setting this parameter to the appropriate value followed by a start command in the requested direction. The start command to the drive has to be given within 20 s. If no start command is given within 20 s the identification run is cancelled and the parameter will be reset to its default setting. The identification run can be stopped any time with normal stop command and the parameter is reset to its default setting. In case identification run detects fault or other problems, the identification run is completed if possible. After the identification is finished, warning will be given if not all requested identification types has been completed successfully. During Identification Run, the brake control is disabled.

**Note:** After identification is made drive requires rising edge of start command.
**Note:** Advance application has all identified values stored to parameters, no need to redo identification if previous parameters are loaded back to the drive if e.g. control board is changed.

**P2.1.13 Motor Type ID650**

Select used motor type with this parameter

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Induction motor</td>
</tr>
<tr>
<td>1</td>
<td>Permanent magnet synchronous motor</td>
</tr>
</tbody>
</table>

See related parameter in "G2.8.6: Motor Control \ PMSM Control”.

**P2.1.14 Supply Voltage ID1201**

This parameter can be used when license key P3.7 License 2 has been given. This enables use of 690 Vac unit in voltage range of 500 Vac unit. Contact factory for warranty and license issues.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.2 Reference Handling – “Ref Handling”

Priority order of Advance application speed reference chain.

Speed reference chain before ramp control
8.2.1 Basic Parameters

**P2.2.1 Torque reference scale**  
*ID1247 “Torque Scale”*

With this parameter the default resolution of torque reference 1000 = motor nominal torque can be changed to 10000 = motor nominal torque.

**NOTE!** This function is available for closed loop control only.

- 0 1000: (100,0 %)
- 1 10000: (100,00 %)

All the torque related signals and parameters are changed and displayed automatically in the same scale.

Parameters affected by this are presented below, and values should be checked before starting the drive, values are not automatically changed when torque format is changed:

- **P2.2.12.2 Torque Ref Max**
- **P2.2.12.3 Torque Ref Min**
- **P2.2.12.5 TorqueRefDeadZone**
- **P2.2.12.6 Torque Ref. Hyst**
- **P2.2.12.12 Torque Step**
- **P2.2.12.13 Torque Ref. Add**
- **P2.3.13.4 Quick Stop T Lim**
- **P2.6.3.1 Torque Limit**
- **P2.6.3.2 MotorTorqueLimit**
- **P2.6.3.3 GenerTorqueLimit**
- **P2.6.3.6.1 SPC Out Limit**
- **P2.6.3.6.2 SPC Pos Limit**
- **P2.6.3.6.3 SPC Neg Limit**
- **P2.6.5.12.2 CL OVConMotTLim**
- **P2.9.5.9 SPC Torq Min**
- **P2.12.7.2 UP F0 Torque**
- **P2.12.7.3 UP Fnom Torque**
- **P2.15.9 MaxTorqLim**

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.2.2  I/O frequency reference selection 1  ID117 “I/O Reference”
Defines which frequency reference source is used when control place is I/O terminal
P3.1 Control Place

0=“AI1” - Analogue Input 1.
  Signal scaling in “G2.4.2: Input Signals \ Analogue Input 1”
1=“AI2” - Analogue Input 2.
  Signal scaling in “G2.4.3: Input Signals \ Analogue Input 2”
2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.
  With alternative reference scaling in Analogue Input group 100 % input values can be
  set to correspond 25 Hz thus when both are at 100 % final reference will be 50 Hz.
3=“AI1-AI2”
  Analogue Input 1 - Analogue Input 2.
4=“AI2-AI1”
  Analogue Input 2 - Analogue Input 1.
5=“AI1xAI2”
  Analogue Input 1 x Analogue Input 2
6=“AI1 Joystick”
  Analogue input 1, -10 Vdc... +10 Vdc
7=“AI2 Joystick”
  Analogue input 2, -10 Vdc... +10 Vdc
8=“Keypad Ref”
  Reference from keypad R3.2
9=“Fieldbus”
  Reference is taken from Fieldbus, alternative scaling can be selected in “G: Fieldbus”
10=“Motor Pot” - Motor potentiometer.
  Reference handled with two digital input “G: Input Signals \ Digital Inputs” (increase
  and decrease). Behaviour adjusted in “G: Ref Handling \ Motor Potentiometer”.
11=“AI1, AI2 min”
  The minimum of Analogue Input 1 and Analogue Input 2 is used as reference.
12=“AI1, AI2 max”
  The maximum from Analogue Input 1 and Analogue Input 2 is used as reference.
13=“Max Freq” – Maximum Frequency
  P2.1.2 Max Frequency is used as reference.
14=“AI1/AI2 Sel” – AI1/AI2 Selection
  Digital Input “I/O Ref 1/2” is used to select between Analogue Input 1 and Analogue
  Input 2 reference. “I/O Ref 1/2” is sued to elect between “I/O Reference” and “I/O
  Reference 2” if selection is different than 14 (this one).
15=“Encoder 1”
  Reference is read from encoder input 1.
16=“Encoder 2”
  Reference is read from encoder input 2. This selection is usable with double encoder
  boards. Could be used e.g. for speed synchronization where two motor needs to run
  at same speed but not necessarily same angle.
P2.2.3 Keypad frequency reference selection  ID121  "Keypad Ref Sel"

Defines which frequency reference source is used when control place is keypad P3.1 Control Place

0=“AI1” - Analogue Input 1.
   Signal scaling in "G2.4.3: Input Signals \ Analogue Input 1"
1=“AI2” - Analogue Input 2.
   Signal scaling in "G2.4.4: Input Signals \ Analogue Input 2"
2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.
   With alternative reference scaling in Analogue Input group 100 % input values can be set to correspond 25 Hz. That is, when both are at 100 % final reference will be 50 Hz.
3=“AI1-AI2”
   Analogue Input 1 - Analogue Input 2.
4=“AI2-AI1”
   Analogue Input 2 - Analogue Input 1.
5=“AI1xAI2”
   Analogue Input 1 x Analogue Input 2.
6=“AI1 Joystick”
   Analogue input 1, -10 Vdc... +10 Vdc
7=“AI2 Joystick”
   Analogue input 2, -10 Vdc... +10 Vdc
8=“Keypad Ref”
   Reference from keypad R3.2
9=“Fieldbus”
   Reference is taken from Fieldbus, alternative scaling can select in "G: Fieldbus"

P2.2.4 Fieldbus frequency reference selection  ID122  "Fieldbus Ctr Ref"

Defines which frequency reference source is selected when control place is Fieldbus P3.1. Control Place

0=“AI1” - Analogue Input 1.
   Signal scaling in "G2.4.3: Input Signals \ Analogue Input 1"
1=“AI2” - Analogue Input 2.
   Signal scaling in "G2.4.4: Input Signals \ Analogue Input 2"
2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.
   With alternative reference scaling in Analogue Input group 100 % input values can be set to correspond 25 Hz thus when both are at 100 % final reference will be 50 Hz.
3=“AI1-AI2”
   Analogue Input 1 - Analogue Input 2.
4=“AI2-AI1”
   Analogue Input 2 - Analogue Input 1.
5=“AI1xAI2”
   Analogue Input 1 x Analogue Input 2.
6=“AI1 Joystick”
   Analogue input 1, -10 Vdc... +10 Vdc
7=“AI2 Joystick”
   Analogue input 2, -10 Vdc... +10 Vdc
8=“Keypad Ref”
   Reference from keypad R3.2
9=“Fieldbus”
   Reference is taken from Fieldbus, alternative scaling can select in "G: Fieldbus"
**P2.2.5  I/O frequency reference selection 2  ID131  “I/O Reference 2”**

This parameter is used to select different reference input location with digital input P2.4.2.17 I/O Ref. 2. Selections for this are the same as for the I/O frequency reference selection 1.

Other parameters related to function
- Digital input P2.4.2.17 I/O Ref. 1/2

**P2.2.6  Speed share  ID1241  “Speed Share”**

Defines the speed reference percentage ratio after final reference location but before ramp control. Monitoring value “FreqReference” shows the reference after speed share function. Used to adjust reference ratio e.g. in line drive that PLC can give same reference to all drives while speed share compensate gear ratio affect to the line speed.

**P2.2.7  Load Share  ID1248  “Load Share”**

Defines the percentage for final torque reference after final torque reference location selection but before the torque reference step function, torque reference dead zone and reference filtering.
8.2.2 Constant Reference

**P2.2.7.1 Jogging speed reference**  ID124 "Jog Speed Ref"

Defines the jogging speed reference when activated by a digital input. This reference will follow the reverse command if given. Jogging speed has a higher priority than preset speed references.

Related parameters
- Digital Input P2.4.2.16 Jogging Speed

<table>
<thead>
<tr>
<th>Speed</th>
<th>Digital Input Preset speed 1</th>
<th>Digital Input Preset speed 2</th>
<th>Digital Input Preset speed 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic speed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 4</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 5</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 6</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Table 8-1. Preset speeds 1 to 7*

Parameter values define the Preset speeds references activated by digital inputs. These references will follow reverse command if given.

**8.2.2.1 Inching function**

Inching function will start the drive to reference without additional start command regardless of control place. Inching function requires enabling from digital input before command is accepted. Inching is also disabled if there is start command active from active control place.

**P2.2.7.9 Inching reference 1**  ID1239 "Inching Ref 1"

**P2.2.7.10 Inching reference 2**  ID1240 "Inching Ref 2"

These parameters define the reference for the inching function. The references are bidirectional and the reverse command does not affect the direction of the inching reference.

Other parameters for inching function
- Digital input selection: Enable Inching
- Digital input selection: Inching 1
- Digital input selection: Inching 2
- Parameter: Inching Ramp

8.2.3 Torque Reference

Motor torque is controlled which allows the motor speed to change depending on the actual load on the motor shaft. Speed limit behaviour is controlled by P2.2.9.6 TorqSpeedLimit parameter.

For joystick inputs maximum negative reference is negated “Torq Ref Max”. The minimum is used only for analogue input selections 1 to 4. Also the maximum negative torque reference maximum is negated “Torq Ref Max”.

P2.2.9.1 Torque reference selection

ID641 “Torq Ref Select”

0=“Not Used”
1=“AI1” - Analogue Input 1.
   Signal scaling in “G: Input Signals \ Analogue Input 1”
2=“AI2” - Analogue Input 2.
   Signal scaling in “G: Input Signals \ Analogue Input 2”
3=“AI3”
4=“AI4”
5=“AI1 Joystick”
   Analogue input 1, -10 Vdc... +10 Vdc. For joystick inputs the maximum negative reference is negated “Torq Ref Max”.
6=“AI2 Joystick”
   Analogue input 2, -10 Vdc... +10 Vdc. For joystick inputs the maximum negative reference is negated “Torq Ref Max”.
7=“Keypad Ref”
   Torque reference from keypad R3.5.
8=“Fieldbus”
   Reference is taken from Fieldbus. Alternative scaling can be selected in “G: Fieldbus”

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.2.9.2 **Torque reference scaling, maximum value**  \( ID641 \) **“Torq Ref Max”**
Maximum allowed torque reference for positive and negative values. This is also used for joystick input for negative maximum limit.

P2.2.9.3 **Torque reference scaling, minimum value**  \( ID642 \) **“Torq Ref Min”**
Minimum torque reference for analogue input reference selections 1-4.

P2.2.9.4 **Torque reference filtering time**  \( ID1244 \) **“TorqRefFilterTC”**
Defines the filtering time for torque reference. Filtering is after load share function and before torque step function.

P2.2.9.5 **Torque reference dead zone**  \( ID1246 \) **“TorqRefDeadZone”**
The small values of the torque reference around zero can be ignored by setting this value greater than zero. When reference is between zero to plus/minus this parameter, the reference is forced to zero.

---

P2.2.9.6 Torque Speed Limit for Closed Loop  ID1278 “TorqSpeedLimitCL”

This parameter defines the speed limiting mode in torque control mode. This parameter can be used as single motor control mode selection when no change is made between open loop and closed loop controls.

0 = Speed Control Mode  SpeedControl
1 = Positive - Negative Frequency limits  MaxFreqLimit
2 = RampOut (±)  RampOutPut
3 = Negative frequency limit - RampOut  MIN
4 = RampOut - Positive frequency limit  MAX
5 = RampOut in Window
6 = 0 -- RampOut
7 = RampOut in Window with On Off limits  Window

0 = “SpeedControl” - **Speed control mode**
The drive is forced to operate in speed control mode while the motor control mode parameter is set to torque control mode thus allowing selection of speed control and torque control mode with single parameter e.g. from Fieldbus.

1 = MaxFreqLimit” - **Positive and negative frequency limits**
Speed is not limited by speed reference, only maximum frequency or Positive and Negative frequency limit if set lower than maximum frequency parameter.

![Diagram of speed control and frequency limits](image-url)
2= ”Ramp output” – Ramp output for both directions
Speed is limited by reference after ramp generator, thus speed will increase with set ramp time until actual torque is equal to reference torque. If speed is below reference when load is removed from the shaft the speed will increase without ramp.

This is the default selection. For master follower system it is recommended to use selection that allows a little higher reference for torque follower that load will be balanced equally e.g. window control.

3= ”Min” – Minimum from speed reference and torque reference.
The minimum of the speed controller output and the torque reference is selected as final torque reference.
4=Max – Maximum from speed reference and torque reference
The maximum of the speed controller output and the torque reference is selected as final torque reference.

7=Window – Window control
Speed is limited within window from speed reference. Speed control activation limit is different from the speed limit. Speed needs, therefore, to go first to "Window Pos" or "Window Neg" limit before the speed controller activates, when speed controller is active speed will be restricted to limit defined by "Window Pos Off" and "Windows Neg Off" from the "FinalFreqRef"

P2.2.9.7 Window negative ID1305 "Window Neg"
Defines the size of window to negative direction from the final speed reference. If both windows off limits are zero this parameter is also the speed limit from the "FinalFreqRef". Otherwise this is the speed control activation limit.

P2.2.9.8 Window positive ID1304 "Window Pos"
Defines the size of window to positive direction from the final speed reference. If both windows off limits are zero this parameter is also the speed limit from the "FinalFreqRef". Otherwise this is the speed control activation limit.

P2.2.9.9 Window negative Off limit ID1307 "Window Neg Off"
Defines the speed controller negative off limit when the speed controller brings the speed back to window.

**P2.2.9.10  Window positive Off limit  ID1306  “Window Pos Off”**

Defines speed controller positive off limit when speed controller brings speed back to window.
8.2.3.1  **Torque reference OL settings**

**P2.2.9.11.1 Open loop torque control minimum frequency  ID636  “OL TC Min Freq”**

Defines the frequency limit below which the frequency converter operates in frequency control mode.

**P2.2.9.11.2 Open loop torque controller P gain  ID639  “OL TorqCtrl P”**

Defines the gain for open loop torque control.

**P2.2.9.11.3 Open loop torque controller I gain  ID640  “OL TorqCtrl I”**

Defines the integration gain for open loop torque control.

**NOTE:** This is a gain for integration part.

**P2.2.9.11.4 Torque speed limit in Open Loop Control (2.10.7)**

With this parameter the maximum frequency for the torque control can be selected.

0  Maximum frequency, par. ID102
1  Selected frequency reference
2  Preset speed 7, par. ID130

NXP drives have more selections for this parameter in Closed Loop control.

**2.2.9.12.1 Torque step  ID1253  “Torque Step”**

Step torque reference in percentage of motor nominal torque. Added after the filtering function and ramp function.

This step reference is normally used for the inertia/friction compensation of the drive system through fieldbus in fieldbus control. E.g. the inertia compensation for winder or unwinder roll can be written from fieldbus to this parameter.
8.2.4 Prohibited frequencies

In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems. With these parameters it is possible to set limits for the prohibited frequency region and ramp rate factor to use when frequency is going above this area. When the input reference is increased the internal reference is kept at the low limit until the input reference is above the high limit.

**P2.2.10.1  Prohibit frequency area 1; Low limit**  
**P2.2.10.2  Prohibit frequency area 1; High limit**

ID509 “Range 1 Low Lim”  
ID510 “Range 1 High Lim”

Range definition where a different ramp time defined by “RampTimeFactor” is used.

**P2.2.10.3  Ramp time factor for prohibited range**  
ID518 “RampTimeFactor”

Multiplier of the currently selected ramp time between prohibit frequency limits.

*Figure 8-1. Ramp rate scaling between prohibit frequencies*
8.2.5 Motor potentiometer

Motor potentiometer is used to control the reference with two digital inputs, one increasing the reference and the other decreasing the reference. The reference change rate can be set by parameter [Hz/s]. Motor potentiometer reference is available in I/O control only. It can be changed only when the drive is in running state.

![Diagram of Motor Potentiometer](image)

**P2.2.11.1 Motor potentiometer ramp rate**  **ID331 “MotPot Ramp Rate”**

Defines the rate of change of the motor potentiometer reference value in Hz/s. Normal ramp times are still active and determine how fast the actual output frequency increases.

**P2.2.11.2 Motor potentiometer reference reset ID367 “MotPotRef Reset”**

- **0 “No reset”**
  Reference is kept past the stop state and stored to memory in case of a powerdown.
- **1 “Stop State”**
  Reference is set to zero when the drive is in stop state. This selection includes powerdown situations.
- **2 “Power Down”**
  Reference is reset only in a powerdown situation.

Other parameters related to function
- P2.4.2.8 Motor potentiometer DOWN  ID417 “Mot Pot Ref Down”
- P2.4.2.9 Motor potentiometer UP  ID418 “Mot Pot Ref Up”

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

Adjust reference function is used to fine tune the main reference. Adjust reference is added to main reference after “SpeedShare” function.

P2.2.12.1 Adjust input  ID493 “Adjust Input”

With this parameter you can select the signal according to which the frequency reference to the motor is fine adjusted.

0  Not used
1  Analogue input 1
2  Analogue input 2
3  Analogue input 3
4  Analogue input 4
5  FB Adjust Reference ID47 Monitoring Signal

P2.2.12.2 Adjust minimum  ID494 “Adjust minimum”

Percentage that is subtracted from the main reference when adjust input is at minimum.

P2.2.12.3 Adjust maximum  ID495 “Adjust Maximum”

These parameters define the minimum and maximum of adjusted signals.

If minimum and maximum are not equal to zero adjustment is not at the middlepoint of analogue input or at zero point if -10...+10 Vdc input is used. Below picture minimum is 20 % and maximum 10 %.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.2.12.4  Speed Step  ID1252
8.3 Ramp control

P2.3.1 **Start function**  **ID505 “Start Function”**

Ramp:

0   The frequency converter starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time.

Flying start:

1   The frequency converter is able to start with motor running by applying current to motor and searching for the frequency corresponding to the speed the motor is running at. Searching starts from the maximum frequency towards the zero frequency until the correct value is detected.

Use this mode if the motor is coasting when the start command is given. With the flying start it is possible to start motor form actual speed without forcing the speed to zero before ramping to reference.

Closed loop control will always start like flying start because exact speed of the motor is known from encoder feedback.

P2.3.2 **Stop function**  **ID506 “Stop Function”**

Coasting:

0   Drive stops controlling the motor immediately and lets motor rotate freely.

Ramp:

1   After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters to zero speed. DI ”Run Enable” will make coasting stop regardless of selected stop function.

P2.3.3 **Acceleration time 1**  **ID103 “Accel Time 1”**

This parameter defines the time required for the output frequency to increase from the zero frequency to maximum frequency.

P2.3.4 **Deceleration time 1**  **ID104 “Decel Time 1”**

This parameter defines the time required for the output frequency to decrease from the maximum frequency to zero frequency.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.3.5 Acceleration/Deceleration ramp 1 shape ID500 “Ramp 1 Shape”**

The start and end of acceleration and deceleration ramps can be smoothed with these parameters. Setting value 0 gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal. Setting value 1...100 % for this parameter produces an S-shaped acceleration/deceleration. Used to reduce mechanical erosion and current spikes when reference is changed.

![Graph of 10% S ramp with 3s ramp time compared to without S ramp](image1)

*Figure 8-2. 10% S ramp with 3s ramp time compared to without S ramp*

![Graph of 10% S ramp with 3s ramp time when reference set to zero at 25 Hz](image2)

*Figure 8-3. 10% S ramp with 3s ramp time when reference set to zero at 25 Hz*

**P2.3.6 Acceleration time 2 ID502 “Accel Time 2”**

**P2.3.7 Deceleration time 2 ID503 “Decel”**

**P2.3.8 Acceleration/Deceleration ramp 2 shape ID501 “Ramp 2 Shape”**

These ramp times and ramp shapes are used when the second ramp time is activated by digital input “Acc/Dec Time Sel.”
P2.3.9  **Inching ramp  ID1257  “Inching Ramp”**

This parameter defines acceleration and deceleration times when inching is active. Inching function will start the drive to reference without additional start command regardless of control place. Inching function requires enabling from digital input before command is accepted. Inching is also disabled if there is a start command active on the active control place.

Other parameters for inching:

- Parameter: Inching Reference 1
- Parameter: Inching Reference 2
- Digital input selection: Enable Inching
- Digital input selection: Inching 1
- Digital input selection: Inching 2

P2.3.10  **Reduction of acceleration and deceleration times  ID401**

Acceleration and deceleration times can be reduced with the input signal. Input signal level zero means ramp times set by parameters. Maximum level equals one tenth of the value set by parameter.

![Figure 8-4. Reducing acceleration and deceleration times](image)

P2.3.11  **Quick stop mode ID1276  “Quick Stop Mode”**

Selects the mode of stopping the drive when quick stop is active.

- It is recommended to use same stop function in follower drives.
- It is recommended to use same ramp time in both drives

0  Coast stop.
1  Ramp stop.

P2.3.12  **Quick Stop Ramp time  ID1256**
8.3.1 Ramp Options

**P2.3.1.2.1 Frequency Reference Interpolator TC ID1184 “FreqRefInterp.TC”**

Set here time on what interval speed reference is updated. This function ramps the reference between updated values. Function is used when PLC is updating reference e.g. 100 ms time level but drive own ramp is set much shorter to have fast response. When reference (Green) is used without interpolator also output frequency would behave same way causing torque and current spikes every time reference changes. When interpolator time is set to 100 ms output frequency behaves as blue line.

![Reference](image)

**P2.3.1.2.2 Ramp Time Format ID1500 “RampTimeFormat”**

This parameter selects the format for ramp time. Thus enabling use of very long ramp times or very accurate ramp times.

<table>
<thead>
<tr>
<th>Value</th>
<th>Format</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>#</td>
<td>(3 s)</td>
</tr>
<tr>
<td>1</td>
<td>#,#</td>
<td>(3,0 s)</td>
</tr>
<tr>
<td>2</td>
<td>#,##</td>
<td>(3,00 s)</td>
</tr>
<tr>
<td>3</td>
<td>#,###</td>
<td>(3,000 s)</td>
</tr>
</tbody>
</table>
8.4 Input signals

8.4.1 Basic Settings

P2.4.1.1 Start/Stop logic selection  ID300 "Start/Stop Logic"

This parameter defines start stop logic when using I/O control. Some of these selections do not include the ‘Reverse’ command. Reverse command can be activated by a separate digital input “Reverse”.

0 "Forw – Rev" - Forward Start – Reverse Start
Start 1: closed contact = start forward  DI "Start 1"
Start 2: closed contact = start reverse  DI "Start 2"

Figure 8-5. Start forward/Start reverse

1 "Start – Rev" - Start command – Direction command
Start 1: closed contact = start  open contact = stop
Start 2: closed contact = reverse  open contact = forward

Figure 8-6. Start, Stop, Reverse

2 "Start – Enable" - Start command – Run Enable
DIN1: closed contact = start  open contact = stop
DIN2: closed contact = start enabled  open contact = start disabled and drive stopped if running
3 “StartP-StopP” – Start Pulse – Stop Pulse
3-wire connection (pulse control):
DIN1: closed contact = start pulse
DIN2: open contact = stop pulse, falling edge.

Figure 8-7. Start pulse/ Stop pulse.

The selections including the text ‘Rising edge required to start’ shall 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.

4 “Start-Mot UP” – Start – Motor potentiometer UP
DIN1: closed contact = start forward
DIN2: closed contact = Increases motor potentiometer reference, see Motor potentiometer function for more details.

5 “ForwR – RevR” – Forward start rising edge – Reverse start rising edge
DIN1: closed contact = start forward (Rising edge required to start)
DIN2: closed contact = start reverse (Rising edge required to start)

6 “StartR-Rev” – Start command rising edge – Direction command
DIN1: closed contact = start (Rising edge required to start)
     open contact = stop
DIN2: closed contact = reverse
     open contact = forward

7 “StartR-Enable” – Start command rising edge – Run Enable
DIN1: closed contact = start (Rising edge required to start)
     open contact = stop
DIN2: closed contact = start enabled
     open contact = start disabled and drive stopped if running
8.4.2 Digital inputs

**P2.4.2.1 Start signal 1  ID403 “Start Signal 1”**
Signal selection 1 for the start/stop logic.
Default programming A.1.Default Forward start.

**P2.4.2.2 Start signal 2  ID404 “Start Signal 2”**
Signal selection 2 for the start/stop logic.
Default programming A.2. Default Reverse start.

**P2.4.2.3 Run enable  ID407 “Run Enable”**
When run enable is removed from the drive coasting stop is made always.
Drive will also show warning indication when run is disabled.
- Contact open: Start of motor disabled
- Contact closed: Start of motor enabled

**P2.4.2.4 Reverse  ID412 “Reverse”**
This reverse command is active when Start signal 2 is not used for reverse command
because setting of “Start/Stop logic selection” parameter.
- Contact open: Direction forward
- Contact closed: Direction reverse

**P2.4.2.5 Preset speed 1  ID419 “Preset Speed 1”**
**P2.4.2.6 Preset speed 2  ID419 “Preset Speed 2”**
**P2.4.2.7 Preset speed 3  ID419 “Preset Speed 3”**
Digital input selections for activating preset speeds.
References are set in the “Constant Reference” parameter group.

<table>
<thead>
<tr>
<th>Preset Speed</th>
<th>Digital Input Preset speed 1</th>
<th>Digital Input Preset speed 2</th>
<th>Digital Input Preset speed 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic speed</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Preset Speed 4</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 5</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 6</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Preset Speed 7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Related parameters
- G2.2.7 Constant Ref

**P2.4.2.8 Motor potentiometer DOWN  ID417 “Mot Pot Ref Down”**
Contact closed: Motor potentiometer reference DECREASES until the contact is opened. See details in G2.2.11 Motor Pot.
P2.4.2.9  Motor potentiometer UP  ID418 “Mot Pot Ref Up”  
Contact closed:  Motor potentiometer reference DECREASES until the contact is opened. See details in G2.2.11 Motor Pot.

P2.4.2.10  Fault reset  ID414 “Fault Reset”  
Rising edge required to reset fault.

P2.4.2.11  External fault closing contactor  ID405 “Ext Fault Close”  
External fault input closing contactor, response selected in protection parameter group G2.11.1 Protections / General. Gives fault ”51 Ext Fault”

P2.4.2.12  External fault opening contactor  ID406 “Ext Fault Open”  
External fault input opening contactor, response selected in protection parameter group. Gives fault ”51 Ext Fault”

P2.4.2.13  Acceleration/Deceleration time selection  ID408 “Acc/Dec Time Sel”  
Digital input to select between ramp time 1 and 2, times are set in ”Ramp Control” parameter group.

Contact open:  Acceleration/Deceleration time 1 selected  
Contact closed:  Acceleration/Deceleration time 2 selected

P2.4.2.14  Acceleration/Deceleration prohibited  ID415 “Acc/Dec Prohibit”  
Contact closed:  No acceleration or deceleration possible until the contact is opened.

With P2.9.3 Control Options B13 is possible to select that deceleration direction is allowed thus speed is reduced if reference is smaller that drive speed at the time.

P2.4.2.15  DC-braking command  ID416 “DC Brake Command”  
Contact closed:  In STOP mode, the DC braking operates until the contact is opened. Current level is set with P2.7.1.16 DCBrakeCurInStop parameter.

P2.4.2.16  Jogging speed  ID413 “Jogging Speed”  
Contact closed:  Jogging speed selected for frequency reference  
Reference for jogging speed is set in G2.2.7 Constant Reference group.

P2.4.2.17  I/O Reference 1/2 selection  ID422 “I/O Ref. 1/2”  
With this parameter you can select either AI1 or AI2 signal for frequency reference if I/O reference selection is “14 / AI1/Al2 Sel”.

If selection for P2.2.1 I/O Reference is other than “14 / AI1/Al2 Sel” this digital input will change reference between P2.2.1 I/O Reference and P2.2.4 I/O Reference 2.
8.4.2.1 Forced control place

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.

![Control place selection priority order](image)

**Figure 8-8. Control place selection priority order**

**P2.4.2.18 Control from I/O terminal**  
*ID409 “I/O Term Control”*  
Contact closed: Force control place to I/O terminal

**P2.4.2.19 Control from keypad**  
*ID410 “Keypad Control”*  
Contact closed: Force control place to keypad

**P2.4.2.20 Control from Fieldbus**  
*ID411 “Keypad Control”*  
Contact closed: Force control place to fieldbus

**NOTE:** When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place 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

**P2.4.2.21 Parameter Set 1/Set 2 selection**  
*ID496 “Param Set1/Set2”*  
With this parameter you can select between Parameter Set 1 and Set 2. Remember to put same input for both parameter set. Parameter sets cannot be changed while drive is in run state.

Digital input =FALSE:
- Set 1 is loaded as the active set

Digital input =TRUE:
- The active set is saved to set 1
- When making two parameter sets from the keypad
1. Set all parameters as needed for SET1
2. In “P6.3.1 Parameter Set” select “Store Set1”
3. Set all parameters as needed for SET 1
4. In “P6.3.1 Parameter Set” select “Store Set2”

**Note:** The parameter values are stored only when selecting parameter P6.3.1 Parameter sets Store Set 1 or Store Set 2 or from NCDrive: Drive > Parameter Sets.
P2.4.2.22 Motor control mode 1/2   ID164 “Mot Ctrl Mode 1/2”
This digital input is used to change between to motor control mode selection parameters:
- P2.8.1 Motor Ctrl Mode  ID600
- P2.8.2 Motor Ctrl Mode2  ID521

Contact is open  =  Motor control mode 1 is selected
Contact is closed  =  Motor control mode 2 is selected

When changing between open loop and closed loop control modes, make this change in stop state.

P2.4.2.23 External brake acknowledgment.  ID1210 “Ext. Brake ACK”
Connect this input signal to auxiliary contact of mechanical brake. If contact is not closed within given time when brake is controlled open the drive will generate a brake fault F58, response can be selected in G2.14 Brake Control parameter group.

P2.4.2.24 Cooling monitor  ID750 “Cooling Monitor”
When using a liquid-cooled drive, connect this input to the Cooling OK signal from Vacon flow control application or any input that shows state of used cooling unit. Fault is generated if input is low when drive is in run state, while drive is in stop state only warning is generated. See product user manual of liquid-cooled drive. Delay and response can be selected in G2.11.9 Cooling parameters group.

8.4.2.2 Inching function
Inching function will start the drive to reference without additional start command regardless of control place. Inching requires enabling from digital input before the command is accepted. Inching is also disabled if there is a start command active on the active control place.

P2.4.2.25 Enable inching  ID532 “Enable Inching”
If you are using inching function the given input must be set TRUE by either digital signal or by setting the parameter value to 0.2.

P2.4.2.26 Inching reference 1  ID530 “Inching 1”
P2.4.2.27 Inching reference 2  ID531 “Inching 2”
These inputs activate inching reference if inching is enabled. These inputs also start the drive if activated and if there is no Run Request command from anywhere else.

Other parameter for inching function
- P2.3.9   Inchning Ramp  ID1257 “Inching Ramp”
- P2.2.7.9  Inchning reference 1  ID1239 “Inching Ref 1”
- P2.2.7.10  Inchning reference 2  ID1240 “Inching Ref 2”
P2.4.2.28  Reset encoder counter  ID1090  “Reset Position”
When using encoder, the drive monitors the encoder rotations and angle (V: Shaft Rounds and V:Shaft Angle).
When this input has a rising edge monitoring values V:Shaft Angle (ID1169) and Shaft Rounds (ID1170) are set to zero. Reset command is also included in V: Aux Control Word.

P2.4.2.29  Master Follower mode 2  ID1092  “MF Mode 2”
Master Follower mode can be changed with digital input between P2.10.1 MF Mode and P2.10.5: MF Mode 2 in the Master Follower parameter group. This can be used for redundancy purposes e.g. when using a Drive Synch system.

P2.4.2.30  Quick Stop  ID1213  “Quick Stop”
Digital input for Quick Stop function

P2.4.2.31  Input Switch Acknowledge  ID1209
Selects the digital input to acknowledge the status of input switch. The input switch is normally switch fuse unit or main contactor with which the power is fed to the drive. If the input switch acknowledgement is missing, the drive trips on “F64 Input Switch open” fault.

P2.4.2.32  PIC Function Activation  ID1804  “PI Activation”
Select the digital input that will activate PI controller. Set selection to 0.2 and PI controller is activated without external wiring.
8.4.3 Analogue Input 1 & 2

**P2.4.3.1** Analogue Input 1 signal selection  ID377 “AI1 Signal Sel”
**P2.4.4.1** Analogue Input 2 signal selection  ID388 “AI2 Signal Sel”

Connect the AI1/AI2 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

**P2.4.3.2** Analogue input 1 signal filter time  ID324 “AI1 Filter Time”
**P2.4.4.2** Analogue input 2 signal filter time  ID329 “AI2 Filter Time”

First order filtering is used for analogue signals that are used to control e.g. the power limit. Second order filtering is used for frequency reference filtering.
P2.4.3.3  Analogue input signal 1 signal range  ID320 "AI1 Signal Range"

P2.4.4.3  Analogue input signal 2 signal range  ID325 "AI2 Signal Range"

0  "0-20mA/10V"
Signal input ranges: 0...10 V and 0...20 mA.
Input signal is used from 0% to 100%.

1  "4-20 mA"
Signal input ranges: 4 – 20 mA and 2 – 10 V
Input signal is used from 20 % to 100 %

2  "-10- +10 V"
Signal input range: -10 V - +10 V.
Input signal is used from -100 % to +100 %.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
3 “Custom Range”
With custom range it is possible to freely adjust what input level corresponds to the minimum and maximum frequencies.

![Graph showing custom range adjustment](graph.png)
These parameters set the analogue input signal for any input signal span within -160...160%. E.g. if the signal input scaling is set to 40%...80% the reference can be changed from 8 mA (for Minimum Frequency) to 16 mA (for Maximum Frequency).

Additional reference scaling. Analogue input reference scaling can be set to a different value than the minimum and maximum frequency.

The small values of the reference around zero can be ignored by setting this value greater than zero. When the reference lies between zero and ±this parameter, it is forced to zero.
8.4.3.1 **Sleep function**

The drive can be stopped by sleep function when the analogue input falls below a certain value for a certain time and speed functions become active.

![Graph showing the sleep function](image)

The drive is stopped automatically if the AI signal level falls below the Sleep limit defined with this parameter. In joystick function, when input is between zero and ±this parameter the drive will go to sleep state.

**P2.4.3.9 AI1 sleep limit ID385 “AI1 Sleep Limit”**
**P2.4.4.9 AI2 sleep limit ID396 “AI2 Sleep Limit”**

This parameter defines the time the analogue input signal has to stay under the sleep limit in order to stop the drive.

**P2.4.3.10 AI1 sleep delay ID386 “AI1 Sleep Delay”**
**P2.4.4.10 AI2 sleep delay ID397 “AI2 Sleep Delay”**

Define the frequency zero point as follows:

With this parameter on display, place the potentiometer in the assumed zero point and press *Enter* on keypad.

**Note:** This will not, however, change the reference scaling. Press *Reset* button to change the parameter value back to 0,00%.
8.4.4 Analogue input 3 & 4

Analogue Inputs 3 and 4 can be written from fieldbus. This allows signal scaling and inversion. useful e.g. in case when PLC is not operational (value zero received) signal will be automatically at maximum.

P2.4.5.1 AI3 signal selection \(\text{ID}141\) "AI3 Signal Sel"

P2.4.6.1 AI4 signal selection \(\text{ID}152\) "AI4 Signal Sel"

Connect the AI3/AI4 signal to the analogue input of your choice with this parameter. For more information, see Chapter 5 “Terminal To Function” (TTF) programming principle.

When the parameter for Analogue input signal selection is set to 0.1 you can control the analogue input monitoring variable from Fieldbus by assigning the Process Data Input ID number to the analogue input monitoring signal thus allowing the PLC input signals to be scaled with analogue input scaling functions.

P2.4.5.2 Analogue input 3 signal filtering time \(\text{ID}142\) "AI3 Filter Time"

P2.4.6.2 Analogue input 4 signal filtering time \(\text{ID}153\) "AI3 Filter Time"

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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.4.5.3  AI3 custom setting minimum  ID144 "AI3 Custom Min"
P2.4.5.4  AI3 custom setting maximum  ID145 "AI3 Custom Max"
P2.4.6.3  AI4 custom setting minimum  ID155 "AI4 Custom Min"
P2.4.6.4  AI4 custom setting maximum  ID156 "AI4 Custom Max"

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

P2.4.5.5.  AI3 signal inversion  ID151 "AI3 Signal Inv"
P2.4.6.5  AI4 signal inversion  ID162 "AI4 Signal Inv"

The signal inversion function is useful in a situation when e.g. the PLC is sending power limit to the drive using fieldbus. If the PLC is unable to communicate with the drive the power limit from fieldbus to the drive would be zero. Using an inverted signal logic zero value from PLC would mean maximum power limit. When inversion is needed for the process data signal fieldbus values need to be written to Analogue input monitoring signals. See parameter P2.4.5.1 AI3 Signal selection for details.

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

This function allows control of any parameter by using an analogue input. The parameter selects what the range of control area and the ID number for the parameter that is controlled.

P2.4.5.6 Analogue input 3, minimum value  ID1037 “AI3 Scale Min”
P2.4.5.7 Analogue input 3, maximum value  ID1038 “AI3 Scale Max”
P2.4.6.6 Analogue input 4, minimum value  ID1039 “AI4 Scale Min”
P2.4.6.7 Analogue input 4, maximum value  ID1040 “AI4 Scale Max”

These parameters define the range for the controlled parameters. All the values are considered to be integers i.e. when controlling the Field Weakening Point (as in example) you also need to set numbers for decimals. e.g. FWP 100.00 needs to be set as 10000.

P2.4.5.8 AI3 Controlled ID  ID1509 “AI3 Control. ID”
P2.4.6.8 AI4 Controlled ID  ID1510 “AI4 Control. ID”

These parameters define the controlled parameter.

Example:
You want to control motor field weakening point voltage through 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)

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

**P2.4.7.1 Inversion Control ID1091 “INV Control”**

Inversion control allows you to select which input signal operation will be inverted.

- **B00 = +1 = Reserved**
- **B01 = +2 = Reserved**
- **B02 = +4 = Inverted Run Enable digital input**
- **B03 = +8 = Inverted Brake acknowledge digital input**
8.5 Output signals

8.5.1 Digital output signals

In the Advance application, all output signals are not used by default.

P2.5.1.1 Ready  ID432  "Ready"

The frequency converter is ready to operate.

Common reasons when ready signals are missing:
- Run enable signal is low
- DC Voltage is too low
- DC Voltage is too high

P2.5.1.2 Run  ID433  "Run"

The frequency converter is modulating.

P2.5.1.3 Fault  ID434  "Fault"

A fault trip has occurred.

P2.5.1.4 Inverted fault  ID435  "Fault, Inverted"

No active faults in the drive.

P2.5.1.5 Warning  ID436  "Warning"

General warning signal.

P2.5.1.6 External fault or warning  ID437  "Ext. Fault/Warn."

Fault or warning depending on parameter Response to external fault. P2.4.2.11 Ext Fault Close and P2.4.2.12 Ext Fault Open are used to trigger a fault. P2.12.1 External fault is used to select response.

P2.5.1.7 Reference fault or warning (4mA)  ID438  "Al Ref Fault/Warn"

Fault or warning depending on parameter Response to the 4mA reference fault. Response is selected in G2.11.6.

P2.5.1.8 Drive overtemperature warning  ID439  "OverTemp Warn"

Drive temperature has exceeded normal operation conditions. Temperature limit may vary depending on drive type or size.

P2.5.1.9 Reverse  ID440  "Reverse"

Drive output frequency is negative.

P2.5.1.10 Wrong direction  ID441  "WrongDirection"

Motor rotation direction is different from the requested one. This happens in situation when external force makes the motor rotate in different direction or when the direction change command has been given and the drive is still ramping down to change direction.

P2.5.1.11 At reference speed  ID442  "At Ref. Speed"

**Induction motor**: Speed is within nominal slip of the reference.

**PMS motor**: Output frequency is within 1 Hz of the reference frequency.
P2.5.1.12 Jogging speed ID413 "Jogging Speed"

Jogging speed command has been given.

P2.5.1.13 IO Control Place ID444 "IO Control Place"

Active control place is I/O terminal defined by the parameter for Control place (P3.1) or forced with digital input function.

8.5.1 Brake Control

The mechanical brake control has two parts that need to be synchronically controlled. The first part is the mechanical brake release and the second is the speed reference release. Whole brake control logic is explained in chapter 6.15 Brake Control on page 207.

Conditions to open the brake:

The final brake open command: It is possible that in a Master/Follower system the master drive opens the brake. Also an overriding system may do this without any control from the drive using AuxControlWord.1.B7. During identification run the brake will not open.
Relay state when control unit is not powered

P2.5.1.14 **External brake control**  **ID445** "Ext Brake Ctrl"

See detailed description about brake operation in G2.15 Brake Control.

External brake ON/OFF control

Example: OPTA2 board RO1:
Brake function ON: Terminals 22-23 are connected (Relay is energized).
Brake function OFF: Terminals 22-23 are open (Relay not energized).

<table>
<thead>
<tr>
<th>Brake Open Command</th>
<th>Brake Close Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake function OFF</td>
<td>Brake function ON</td>
</tr>
</tbody>
</table>

Note: When power from control board is removed terminals 22-23 are open.

When using the Master Follower function, the follower drive will open the brake at the same time as the Master even if the Follower’s conditions for brake opening have not been met.

P2.5.1.15 **External brake control, inverted**  **ID446** "ExtBrakeCtrl,Inv"

See detail description about brake operation in G2.15 Brake Control.

Example: OPTA2 board RO1:
Brake function ON: Terminals 22-23 are open. (Relay not energized)
Brake function OFF: Terminals 22-23 are connected. (Relay is energized).

<table>
<thead>
<tr>
<th>Brake Open Command</th>
<th>Brake Close Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake function OFF</td>
<td>Brake function ON</td>
</tr>
</tbody>
</table>

When using the Master Follower function, the follower drive will open the brake at the same time as the Master does even if the Follower’s conditions for brake opening have not been met.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.5.1.16 **Output frequency limit 1 supervision**  ID447 “FreqOut SupvLim1”

The output frequency goes outside the set supervision limits defined in Supervision Lim parameter group. The function can be set to monitor either the high or the low limit. Limit and functions are selected in G2.5.8 Supervision Limits.

P2.5.1.17 **Output frequency limit 2 supervision**  ID448 “FreqOut SupvLim2”

The output frequency goes outside the set supervision limits 2 defined in Supervision Lim parameter group. The function can be set to monitor either the high or the low limit. Limit and functions are selected in G2.5.8 Supervision Limits.

P2.5.1.18 **Reference limit supervision**  ID449 “Ref Lim Superv.”

Active reference goes beyond the set supervision low limit/high limit defined in Supervision Lim parameter group. The function can be set to monitor either the high or the low Limit. The functions are selected in G2.5.8 Supervision Limits.

P2.5.1.19 **Temperature limit supervision**  ID450 “Temp Lim Superv.”

The drive temperature goes beyond the set supervision limits defined in Supervision Lim parameter group. The function can be set to monitor either the high or the low limit. Limit and functions are selected in G2.5.8 Supervision Limits.

P2.5.1.20 **Torque limit supervision**  ID451 “Torq Lim Superv.”

The motor torque goes beyond the set supervision limits defined in Supervision Lim parameter group. The function can be set to monitor either the high or the low limit. Limit and functions are selected in G2.5.8 Supervision Limits.

P2.5.1.21 **Motor thermal protection**  ID452 “MatTherm Flt/Wrn”

Motor thermistor initiates an overtemperature signal which can be led to a digital output. The response is selected with P2.12.5.6 ThermistorF.Resp.

P2.5.1.22 **Analogue input supervision limit**  ID453 “Ain Supv Lim”

The selected analogue input signal goes beyond the set supervision limits defined in G2.5.8 Supervision Lim parameter group. The function can be set to monitor either the high or the low limit.

P2.5.1.23 **Limit Control active**  ID454 “Limit Control ON”

One or more of the drive limit controllers is active.

8.5.1.2 **Fieldbus digital inputs connection**

P2.5.1.24 **Fieldbus input data 1**  ID455 “FB Dig Input 1”
P2.5.1.26 **Fieldbus input data 2**  ID456 “FB Dig Input 2”
P2.5.1.28 **Fieldbus input data 3**  ID457 “FB Dig Input 3”
P2.5.1.30 **Fieldbus input data 4**  ID469 “FB Dig Input 4”
P2.5.1.32 **Fieldbus input data 5**  ID170 “FB Dig Input 5”

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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
With these parameters you can define the parameter to be controlled by using FB Digital input.

**Example:**
All option board inputs are in use and you still want to give 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 controlled on and off using this function (Brake Chopper; 0 = Not Used, 1 = On, Run).

**P2.5.1.34** Safe disable active ID756 "Safe Disable Act"
Select the digital output to show the status of the Safe Disable.

**P2.5.1.35** MCC Close Continues ID1218 "MCC Close Cont.”

**P2.5.1.36** MCC Close Pulse ID1219 "MCC Close Pulse”
Used to close OEVA type of input switch. When the DC link voltage is above the charging level a 2-second pulse train is generated to close the input switch. The pulse train is OFF when the input switch acknowledgement goes high.
8.5.2 Analogue outputs 1 & 2 & 3

P2.5.2.1 Analogue output 1 signal selection ID464 “Iout 1 Signal”
P2.5.3.1 Analogue output 2 signal selection ID471 “Iout 2 Signal”
P2.5.4.1 Analogue output 3, signal selection ID478 “Iout 3 Signal”

Connect the AO1 signal to the analogue output of your choice with this parameter.

P2.5.2.2 Analogue output function ID307 “Iout Content”
P2.5.3.2 Analogue output 2 function ID472 “Iout 2 Content”
P2.5.3.2 Analogue output 3, function ID479 “Iout 3 Content”

This parameter selects the desired function for the analogue output signal.

0 “Not used”
Analogue output is forced to 20 % (=2 V/4 mA)
1 “O/P Freq”
Output frequency from zero to maximum frequency.
2 “Freq Ref”
Freq. reference from zero to maximum frequency
3 “Motor speed”
Motor speed from zero speed to motor synchronous speed
4 “O/P Current”
Drive output current from zero to motor nominal current
5 “Motor Torque”
Motor torque from zero to motor nominal torque (100 %)
6 “Motor Power”
Motor power from zero to motor nominal power (100 %)
7 “Mot Voltage”
Drive output voltage from zero to motor nominal voltage
8 “DC-link volt”
500 V unit: DC voltage from zero to 1000 Vdc
690 V unit: DC voltage from zero to 1317 Vdc
9 “AI1”
Unfiltered Analogue input 1 signal
10 “AI2”
Unfiltered Analogue input 2 signal
11 “Fout,min-max”
Output frequency from minimum frequency to maximum frequency
12 “[−2Tn]−[2Tn]”
Motor torque from negative two times motor nominal to positive two times motor
nominal torque
13 “[−2Pn]−[2Pn]”
Motor power from negative two times motor nominal to positive two times motor
nominal power
14 “PT100 Temp.”
Maximum PT100 temperature value from used input scaling from -30 C to +200 C
15 “FB Data In4”
FB analogue output fieldbus process data value can be connected to analogue output
by using monitoring signal ID48.
First order filtering is used for analogue output signals.

Inverts the analogue output signal:

P2.5.2.3 Analogue output filter time ID308 “Iout Filter Time”
P2.5.3.3 Analogue output 2 filter time ID473 “Iout 2 Filter T”
P2.5.4.3 Analogue output 3, filter time ID480 “Iout 3 Filter T”

P2.5.2.4 Analogue output inversion ID309 “Iout Invert”
P2.5.3.4 Analogue output 2 inversion ID474 “Iout 2 Invert”
P2.5.4.4 Analogue output 3 inversion ID481 “Iout 3 Invert”

P2.5.2.5 Analogue output minimum ID310
**P2.5.3.5** Analogue output 2 minimum ID475
**P2.5.4.5** Analogue output 3 minimum ID482

Defines the signal minimum to either 0 mA or 4 mA (living zero).

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

---

**P2.5.2.6** Analogue output scale ID311 “Iout Scale”
**P2.5.3.6** Analogue output 2 scaling ID476 “Iout 2 Scale”
**P2.5.4.6** Analogue output 3 scaling ID483 “Iout 3 Scale”

---

**P2.5.2.7** Analogue output offset ID375 “Iout Offset”

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
Define the offset for the analogue output signal.

In picture below 50 \% scaling signal has been given 20 \% offset and for 200 \% scaling 50 \% offset.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.5.3 Delayed Digital Output 1 & 2

\textbf{P2.5.6.1} Digital output 1 signal selection \hspace{1cm} \textbf{ID486} “Dig. Out 1 Signal”

\textbf{P2.5.7.1} Digital output 2 signal selection \hspace{1cm} \textbf{ID489} “Dig. Out 2 Signal”

Connect the delayed digital output signal to the digital output of your choice with this parameter. For more information about the TTF programming method, see chapter 5.

\textbf{P2.5.6.2} Digital output function \hspace{1cm} \textbf{ID312} “D01 Content”

\textbf{P2.5.7.2} Digital output 2 function \hspace{1cm} \textbf{ID490} “D02 Content”

\begin{itemize}
  \item 0 = “Not used”
  \item 1 = “Ready”
  \hspace{1cm} The AC drive is ready to operate.
  \hspace{1cm} Common reasons when ‘Ready’ signals are missing:
  \hspace{1cm} \hspace{1cm} \hspace{1cm} \hspace{1cm} o Run enable signal is low
  \hspace{1cm} \hspace{1cm} \hspace{1cm} \hspace{1cm} o DC Voltage is too low
  \hspace{1cm} \hspace{1cm} \hspace{1cm} \hspace{1cm} o DC Voltage is too high
  \item 2 = “Run”
  \hspace{1cm} The frequency converter is modulating.
  \item 3 = “Fault”
  \hspace{1cm} A fault trip has occurred
  \item 4 = “FaultInvert”
  \hspace{1cm} No active faults in the drive.
  \item 5 = “OverheatWarn”
  \hspace{1cm} Drive temperature has exceeded normal operation conditions. Temperature limit may vary depending on drive type and size.
  \item 6 = “ExtFaul/Warn”
  \hspace{1cm} External fault or warning depending on parameter response to external fault
  \item 7 = “RefFaul/Warn”
  \hspace{1cm} Fault or warning depending on parameter Response to the 4mA reference fault
  \hspace{1cm} - occurs if analogue reference is 4–20 mA and signal is <4mA
  \item 8 = “Warning”
  \hspace{1cm} Always if a warning is on
  \item 9 = “Reversed”
  \hspace{1cm} Drive output frequency is negative
  \item 10 = “JogSpeedSel”
  \hspace{1cm} The jogging, preset or inching speed has been activated with digital input.
  \item 11 = “At speed”
  \hspace{1cm} Induction motor: speed is within nominal slip of the reference.
  \hspace{1cm} PMS motor: output frequency is within 1 Hz of the reference.
  \item 12 = “MotorRegAct”
  \hspace{1cm} One of the limit regulators is active.
  \item 13 = “FreqLim1Sup”
  \hspace{1cm} Output frequency limit 1 supervision
  \hspace{1cm} The output frequency goes outside the set supervision low limit/high limit.
  \item 14 = “FreqLim2up”
  \hspace{1cm} Output frequency limit 2 supervision
  \hspace{1cm} The output frequency goes outside the set supervision low limit/high limit.
  \item 15 = “TorqLimSprv”
  \hspace{1cm} Torque limit supervision
  \hspace{1cm} The motor torque goes beyond the set supervision low limit/high .
\end{itemize}
16 = "RefLimSprv"
   Reference limit supervision
   Active reference goes beyond the set supervision low limit/high limit.

17 = "ExtBrakeCont"
   External brake control
   External brake ON/OFF control with programmable delay

18 = "I/O ContAct"
   Control from I/O terminals
   IO control place is active.

19 = "TempLimSprv"
   Drive temperature limit supervision.
   Drive temperature goes beyond the set supervision limits (par. ID354)

20 = "WrongDirecti"
   Motor rotation direction is different from the requested one. This happens in situation
   when an external force makes the motor to rotate into different direction or when a
   command for direction change has been given and the drive is still ramping down to
   change direction.

21 = "ExtBrakeInv"
   External brake control inverted
   External brake ON/OFF control; Output active when brake control is OFF.

22 = "ThermFt/Wrn"
   Thermistor fault or warning
   The thermistor input of option board indicates overtemperature. Fault or warning
   depending on the response parameter.

23 = "AI Supervis"
   Analogue input supervision
   Analogue input supervision function, Set Reset type output function.

24 = "FB DigInput1"
   Fieldbus digital input data 1

25 = "FB DigInput2"
   Fieldbus digital input data 2

26 = "FB DigInput3"
   Fieldbus digital input data 3

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
With these parameters you can set on- and off-delays to digital outputs.

**Figure 8.10. Digital outputs 1 and 2, on- and off-delays**

**P2.5.6.5  Invert digital output 1  ID1587 “INV Delayed DO1”**

**P2.5.7.5  Invert digital output 2  ID1588 “INV Delayed DO2”**
8.5.4 Supervision limits

Supervision function gives you the possibility to monitor certain values with the limit setting. When the actual value exceeds or goes below the set value a message through a digital output can be given. The torque limit supervision is scalable.

- **P2.5.8.1 Output frequency limit supervision function**
  - ID: 315 “Freq Supv Lim 1”
- **P2.5.8.3 Output frequency limit 2 supervision function**
  - ID: 346 “Freq Supv Lim 2”
- **P2.5.8.5 Torque limit supervision function**
  - ID: 348 “Torque Supv Lim”
- **P2.5.8.8 Reference limit supervision function**
  - ID: 350 “Ref Superv Lim”
- **P3.6.8.10 Drive temperature limit supervision function**
  - ID: 354 “Temp Lim Superv.”

<table>
<thead>
<tr>
<th>No supervision</th>
<th>Low limit supervision</th>
<th>High limit supervision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The following five parameters are used to set a limit value to be monitored with the corresponding parameter above.

- **P2.5.8.2 Output frequency limit supervision value**
  - ID: 316 “Freq Dupv Val 1”
- **P2.5.8.4 Output frequency limit 2 supervision value**
  - ID: 347 “Freq Supv Val 2”
- **P2.5.8.6 Torque limit supervision value**
  - ID: 349 “Torque Supv Val”
- **P2.5.8.9 Reference limit supervision value**
  - ID: 351 “Ref Superv Value”
- **P2.5.8.11 Drive temperature limit value**
  - ID: 355 “Temp Supv Value”

![Figure 8-11. Supervision function](image)

- **P2.5.7 Torque Supervision value scaling input**
  - ID: 402 “Torque Superv Scl”
  - This parameter is used to change the torque limit supervision level between zero and P2.5.8.6 Torque Supv Val

<table>
<thead>
<tr>
<th>0 = Not used</th>
<th>1 = AL1</th>
<th>2 = AL2</th>
<th>3 = AL3</th>
<th>4 = AL4</th>
<th>5 = FBLimScaling</th>
</tr>
</thead>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.5.4.1 Analogue input supervision function

The analogue input supervision function will control the selected digital output to close when the analogue input signal has exceeded the high limit and open when the signal goes below the low limit.

**P2.5.8.12 Analogue input supervision signal ID356  “Ain Supv Input”**

With this parameter you can select the analogue input to be monitored.

- 0 = Not used
- 1 = AI1
- 2 = AI2
- 3 = AI3
- 4 = AI4
- 5 = FBLimScaling

**P2.5.8.13 Analogue Low supervision control limit ID357  “Ain Supv Llim”**

**P2.5.8.14 Analogue High supervision control limit ID358  “Ain Supv Hlim”**

*Figure 8-12. An example of On/Off-control*
8.6 Limit settings

8.6.1 Current limit handling

P2.6.1.1 Current limit ID107 “Current Limit”

This parameter determines the maximum motor current from the AC drive. The parameter’s value range differs from size to size.

When the Current limit is changed the Stall current limit is internally calculated to 90% of the current limit (if the Stall current limit is greater than the Current limit). When the current limit is active the drive output frequency is reduced until current is below the set limit.

In closed loop control, the current limit affects the torque producing current limit, not total current. This can be changed in options group with the "LimitTotalCurrent" parameter.

In drive synch operation limiting is for average current of units.

P2.6.1.2 Scaling of current limit ID399 “Currnt Lim Sclng”

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FB Limit Scaling ID46 Monitoring value

This signal will adjust the maximum motor current between 0 and the parameter Motor Current Limit.

P2.6.1.3 Over Current Kp ID1761 “OverCurrrnet Kp”

P2.6.1.4 Over Current Ki ID1762 “OverCurrrnet Ki”
8.6.2 Power limit handling

Power limit function is meant to limit the drive output power to the motor. The general way to do this is to give a limiting signal from a primary system that gives information about how much power is available for drive operations.

NOTE: Power limit is not operational in open loop control in Advanced application. If power limit is needed in open loop control use Marine application (APFIFF09).

**P2.6.2.1 Generator power limit  ID1290  “GenerPower Limit”**
Generator side power limit. This limit value is used for all scaling functions and power limit ramp rate functions.

**P2.6.2.2 Motoring power limit  ID1289  “MotorPowerLimit”**
Motoring side power limit. This limit value is used for all scaling functions and power limit ramp rate functions.

**P2.6.2.3 Scaling of Motoring Power Limit  ID179  “MotPowerLimScLng”**
The motoring power limit is equal to parameter Motoring Power Limit if value 'Not Used' is selected. If any of the inputs is selected the motoring power limit is scaled between zero and parameter P2.6.2.3 Motoring Power Lim.

0 =Parameter  
1 =AI1  
2 =AI2  
3 =AI3  
4 =AI4  
5 =FieldBus Scaling ID46 (Monitoring Value)
P2.6.2.4 Scaling of Generating power limit  ID1088 “GenPowerLimScnng”

The generator power limit is equal to parameter Generator Power Limit if value 'Not Used' is selected. If any of the inputs is selected the generator power limit is scaled between zero and parameter P2.6.2.2 Generator Power Lim.

0 = Parameter
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FieldBus Scaling ID46 (Monitoring Value)
8.6.3 Torque limit handling

8.6.3.1 Motoring torque limit function

P2.6.3.1 Motoring Torque limit ID1287 "MotorTorqueLimit"
Motoring side torque limit. This limit value is used for all scaling functions and torque limit ramp rate functions if activated.

P2.6.3.2 Generator Torque limit ID1288 "GeneratorTorqueLimit"
Generator side torque limit. This limit is used for all scaling functions generator side torque limit is not included in ramp up rate function.
### 8.6.3.3 Motoring Torque limit scaling  ID485 "MotTorqLimScIng"

The motoring torque limit is equal to parameter Motoring Torque Limit if value 'Not Used' is selected. If any of the inputs is selected the motoring torque limit is scaled between zero and parameter Motorin Torque Limit.

- 0 = Not used
- 1 = AI1
- 2 = AI2
- 3 = AI3
- 4 = AI4
- 5 = FB Limit Scaling ID46 Monitoring value

### 8.6.3.4 Generating torque limit scaling  ID1087 "GenTorqLimScIng"

The generator torque limit is equal to parameter Generator Torque Limit if value 'Not Used' is selected. If any of the inputs is selected the generator torque limit is scaled between zero and parameter generator torque limit.

- 0 = Not used
- 1 = AI1
- 2 = AI2
- 3 = AI3
- 4 = AI4
- 5 = FB Limit Scaling ID46 Monitoring value

---

### 8.6.3.5 Open Loop settings only

#### 8.6.3.5.1 Torque limit control P-gain  ID610 "TorqLimCtrl P"

This parameter defines the gain of the torque limit controller. It is used in Open Loop control mode only.

#### 8.6.3.5.2 Torque limit control I-gain  ID611 "TorqLimCtrl I"

This parameter determines the I-gain of the torque limit controller. It is used in Open Loop control mode only.

### 8.6.3.6 Closed Loop settings only

#### 8.6.3.6.1 Speed Control output limit  ID1382 "SPC Out Limit"

Torque limit for the speed controller. It affects both the positive and negative direction torques.

#### 8.6.3.6.2 Speed Control positive limit  ID646 "SPC Pos Limit"

Positive torque limit for speed controller output.

#### 8.6.3.6.3 Speed Control negative limit  ID645 "SPC Neg Limit"

Negative torque limit for speed controller output.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.6.4 Frequency limit handling

P2.6.4.1 Negative frequency limit ID1286 "Neg Freq Limit"
Positive direction frequency limit. When changed in closed loop control mode change is made without ramp.

P2.6.4.2 Positive frequency limit ID1285 "Pos Freq Limit"
Negative direction frequency limit. When changed in closed loop control mode change is made without ramp.

P2.6.4.3 Zero Frequency limit ID1283 "Zero Freq. Limit"
Defines the zero frequency limit.
Used to determine when load drooping is set to zero if load drooping removal function 1 is selected.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.6.5 DC Link handling

**P2.6.5.1 Overvoltage controller  ID607 “Overvolt Contr”**

The parameter selects the behaviour of the overvoltage controller in open loop control. It also activates the closed loop overvoltage controller but the operation is always of type ‘PI’ in closed loop control modes.

0 “Off” - Controller switched off
Both open and closed loop overvoltage controllers are off.

1 “On:NoRamping” – Activated P-Controller type operation
Both open and closed loop controllers are activated.
Open loop controller is a P-type controller.
Closed loop controller is a PI-type controller.

2 “On: Ramping” – Activated PI-Type controller
Both open and closed loop controllers are activated.
Open loop controller is a PI-type controller.
Closed loop controller is PI-type controller (as in selection 1).

**P2.6.5.2 Overvoltage Reference Select  ID1262 “OverVolt.Ref.Set”**

Overvoltage reference level depending on the status of the brake chopper.
In closed loop control, the overvoltage controller level is adjusted by “OverVoltageRef.”
The parameter can be found in the CL setting parameter group.

<table>
<thead>
<tr>
<th>ID1262</th>
<th>Brake chopper in use</th>
<th>Brake chopper not in use</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 / High Voltage</td>
<td>500 V Unit: 844 V 690 V Unit: 1164 V</td>
<td>500 V Unit: 797 V 690 V Unit: 1099 V</td>
</tr>
<tr>
<td>1 / Norm.Voltage</td>
<td>1.25*Estimated DC nominal voltage</td>
<td>1.18*Estimated DC nominal voltage</td>
</tr>
<tr>
<td>2 / BrakeChLevel</td>
<td>1.07*brake chopper level</td>
<td>Brake chopper level</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Over Voltage Reference Select</th>
<th>Brake chopper level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 /High voltage</td>
<td>400 V Unit: 797 V</td>
</tr>
<tr>
<td></td>
<td>690 V Unit: 1099 V</td>
</tr>
<tr>
<td>1 / Norm. Voltage</td>
<td>1.18* Estimated DC nominal voltage</td>
</tr>
<tr>
<td>2 / BrakeChLevel</td>
<td>Brake chopper level</td>
</tr>
</tbody>
</table>

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 = “External” - External brake chopper (no testing)
The system has an item that handles the DC link voltage. This could be a system with AFE or there is an external BCU unit. When this option is selected the drive overvoltage level is set a little higher so that its operation does not conflict with AFE or BCU units.

3 = “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 use e.g. when other drives are generating but energy levels are low enough to be handled with only one drive.

4 = “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  “BrakeChopperLevel”

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

For 400V Supply: 400*1.35*1.18 = 638V
For 500V Supply: 500*1.35*1.18 = 808V
For 690V Supply: 690*1.35*1.18 = 1100V
**P2.6.5.5 Undervoltage controller**  
ID608 “Undervolt Contr”

Undervoltage controller will decrease the output frequency in order to get energy from the motor when the DC voltage has dropped to a limit where the undervoltage controller activates trying to keep DC voltage at the minimum level.

0  “Off” - Controller switched off
Both open and closed loop overvoltage controllers are off.

1  “On: No Ramping” – Activated PI-Controller type operation
Both open and closed loop controllers are activated.
Both open and closed loop controllers are PI-type controllers.
If power comes back while drive is at undervoltage the controller output frequency will regain the reference value.

2  “On: Ramping” – PI controller type and ramping down.
Both open and closed loop controllers are activated.
Both open and closed loop controllers are PI-type controllers.
If power comes back while drive is at undervoltage the controller drive will ramp to zero speed and generate an undervoltage fault.

Note: In closed loop control, also parameter “CLrmpFollEncFreq” needs to be activated to achieve identical operation.

**P2.6.5.6 Undervoltage Kp**

**P2.6.5.7 Undervoltage Ki**

**P2.6.5.8 Undervoltage Kd**

**P2.6.5.9 Under Voltage Control Threshold**  
ID1711  “UVctrl threshold”

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.7 DC current and magnetization handling

The DC brake can be used to hold the motor in place (nominal torque at nominal slip). It can be also used to keep the motor warm in places with high humidity and to speed up the generation of rotor flux. Rotor flux is needed in the induction motor to generate torque. The current that is needed to make the nominal flux is defined by the magnetization current parameter but, depending on motor size, nominal flux takes a different time to produce after start command.

Giving a higher current on start to the motor will decrease the time when the motor is able to generate nominal torque.


![Graph](image1)

8.7.1 Open loop settings

**P2.7.1.1 DC-braking current**  ID627 “DC-Brake Current”

Defines the current injected into the motor during DC-braking. On start this parameter is used together with DC Brake time to decrease the time when motor is able to produce nominal torque. When DC brake current is applied to the motor the output frequency is zero.

**P2.7.1.2 DC-braking time at start**  ID507 “Start DC-Brake Tm”

DC-brake is activated when the start command is given. This parameter defines for how long DC current is given to the motor before acceleration starts. DC brake current at start is used in order to magnetize the motor before running which will improve torque performance at start. Needed time depends on motor size, value varying between 100 ms to 3 second. The bigger the motor the more time is needed. The default setting 0,00 s means that 200 ms is spent to magnetize motor. This 200 ms can be set to zero with parameter “MakeFluxTime”. Activating flying start will disable the DC brake functions at start.
P2.7.1.3  **DC-braking time at stop ID508 "Stop D-Brake Tm"**

Defines the time to use DC brake at stop. The operation is different depending on the selected stop mode (coasting or ramping).

**Stop function = 0 / Coasting:**
After the stop command, the motor coasts to a stop without control of the drive.

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

The braking time is scaled according to the frequency at the moment of stop command. If the frequency is the nominal frequency of the motor or higher, the set value of DC braking time at stop is used as the braking time. When the frequency is below the nominal frequency, the relation between the nominal frequency and the output frequency at the time of stop command will determine the DC braking time. For example, 50-hertz motor is running at 25 Hz when the stop command is given. The DC brake time will be 50 % of the DC braking time at stop. If the frequency is below 5 Hz the minimum DC braking time is 10 % of the DC braking time at stop.

DC braking is started after a short restart delay following the stop command if stop function is coasting.

**Stop function = Ramp:**

After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, to the speed defined with parameter DC braking frequency at stop, where the DC braking starts.

The braking time is defined with parameter DC braking time at stop. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See Figure 8-14.

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Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.7.1.4 **DC braking frequency at stop**  **ID515** “Stop D-BrakeFr”  
The output frequency at which the DC braking is applied when making ramping stop.

P2.7.1.5 **Scaling of DC-braking current**  **ID400** “DC-current Sc1ng”  
The DC braking current can be reduced with the free analogue input signal between zero current and the current set with parameter DC Braking Current.

0 = Not used  
1 = AI1  
2 = AI2  
3 = AI3  
4 = AI4  
5 = FB Limit Scaling ID46 Monitoring value

P2.7.1.6 **DC brake current in stop**  **ID1080** “DCBrakeCurInStop”  
Defines the current injected to the motor in stop state when the digital input signal “DC Brake Command” is used to activate the DC brake when no run request is active. When the DC brake is activated the drive will indicate being in Run state.
8.7.1.1 **Flux braking**

P2.7.1.7 **Flux brake**  
ID520 "Flux Brake"

Instead of DC braking, flux braking is a useful way to raise the braking capacity in cases where additional brake resistors are not needed. When braking is needed, the frequency is reduced and the flux in the motor is increased. This increases losses on motor, which in turn increases the motor's capability to brake. Unlike in DC braking, the motor speed remains controlled during braking.

The flux braking can be set ON or OFF.

0 = Flux braking OFF

1 = Flux braking ON

P2.7.1.8 **Flux braking current**  
ID519 "FluxBrakeCurrent"

Defines the flux braking current value. The value setting range depends on the used unit size.
8.7.2 Closed loop settings

P2.7.2.1 Magnetizing current at start  ID627  “Start Magn Curr”
Defines the current that is applied to the motor when the start command is given in closed loop control. At start this parameter is used together with Magnetizing time at start to decrease the time when the motor is able to produce nominal torque. In closed loop control output frequency is not forced to zero while magnetization current is applied to motor.

P2.7.2.2 Magnetizing time at start  ID628  “Start Magn Time”
Defines the time for how long magnetization current is applied to motor at start. Magnetizing current at start is used to shorten the time when flux is at nominal level. This will improve the torque performance at start. The time needed depends on the motor size, value varying between 100 ms to 3 second. The bigger the motor the more time it needs. Set this time so that the rotor flux is more than 90 % before speed is released (Start Zero Speed Time ID615) or mechanical brake is released.

P2.7.2.3 Flux reference  ID1250  “FluxReference”
Reference value for rotor flux. Rotor flux can be reduced by changing the magnetization current. This, however, also affects the motor model making the torque calculations a little less accurate. When using this parameter the motor model can compensate the effect of the different magnetization current in torque calculations.

\[
[FW]_{\text{Rotor Flux}} = \left( \frac{f(Motor\text{NomFREQ})}{f(Out)} \right)^2 \quad \text{when } f(Out) > f(Motor\text{NomFREQ})
\]

P2.7.2.4 Flux Off Delay  ID1402  “Flux Off Delay”
The Flux off delay function will keep the motor magnetized after a stop command thus making the next start faster because flux is already available in the motor. The function is used e.g. in a system where several repeated starts are made in short cycles. The flux level can be adjusted by parameter Stop State Flux.

\(0\)  = Flux is not maintained in the motor
\(>0\)  = Flux off delay in seconds.
\(-1\) = Flux is maintained indefinitely in the motor

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.7.2.5 Stop State Flux  ID1401**  “Stop State Flux”

The amount of flux in percentage of the motor nominal flux maintained in the motor after the drive is stopped. The flux is maintained for the time set by parameter ID1402 *Flux Off Delay*. This parameter can only be used in closed loop motor control.
8.8 Motor Control

Open Loop control

Open loop control controls the motor without encoder feedback from the motor shaft. Control mode selections 0, 1 and 2 are open loop control modes.

Slip

Induction motor torque is based on slip. When load increases also slip will increase. Slip is the speed that rotor is behind of stator electrical frequency.

Below picture presents torque that is produced by induction motor when connected directly on line.

1. Motor Synchronous speed. Motor is taking only magnetization current.
2. Motor nominal operation point. Motor is producing 100% of rated torque and power. Actual shaft speed is motor nominal speed and motor takes nominal current.
3. Pullout torque. This is point where motor produced torque start to decrease when slip increases. After this point motor will stop if load is not reduced.

In frequency control, the load will determine the actual shaft speed

Slip compensation in open loop control
The drive uses motor torque and motor nominal rpm to compensate slip. If the motor nominal rpm is 1440 -> the nominal slip is 60 rpm. And when the motor torque is 50 % the slip is 30 rpm. To keep the reference speed the drive must increase the output frequency by 1 Hz.

**Closed Loop control**
Closed loop control controls the motor using the exact information of the motor speed from the encoder. Control mode selections 3 and 4 are closed loop control modes. Using these modes without encoder board (and encoder) will result in encoder fault.
P2.8.1 Motor control mode

ID600 “Motor Ctrl Mode” (2.6.1)

0 “Freq Control”
Open loop frequency control:
Drive frequency reference is set to output frequency without slip compensation. Motor speed is defined by motor load.

1 “OL SpeedCont”
Open loop speed control:
Drive frequency reference is set to motor speed reference. Motor speed stays the same regardless of motor load.

2 “OL Torq”
Open loop Speed or Torque control
In this control mode the drive can be selected to run in torque control mode. The operation is selected by parameter TorqueSpeedLimit in the Torque Reference parameter group. The default selection is torque control mode speed limited by ramp generator output.

3 “CL SpeedCtrl”
Close loop speed control
Drive frequency reference is set to motor speed reference. Motor speed stays the same regardless of motor load.

4 “CL Torq”
Closed loop speed or torque control
In this control mode the drive can be selected to run in torque control mode. The operation is selected by parameter TorqueSpeedLimit in the Torque Reference parameter group. The default selection is torque control mode speed limited by ramp generator output.

When the drive is follower and drive synch is enabled the motor control mode is internally set to Frequency control.

P2.8.2 Motor control mode 2

ID521 “Motor Ctrl Mode2”
With this parameter you can set another motor control mode which is activated with parameter Mot Ctrl Mode1/2.

Note: The Motor control mode cannot be changed between open loop and closed loop while the drive is in Run state.
8.8.1 U/f Settings

U/f settings are mainly used in open loop control modes with the exception of the *Field weakening point voltage* that is also used in closed loop control mode as a limit for voltage. U/f settings are used to control the voltage level that are applied to the motor at different frequencies and different load situations.

What changes are required to start with load from 0 Hz?

- First set the motor nominal values (Parameter group 2.1).

**Option 1: Automatic functions**

**Step 1:** Make identification with rotating motor

**Step 2 (If needed):** Activate speed control or U/f optimization (Torque boost).

**Step 3 (If needed):** Activate both speed control and U/f optimization.

**Option 2: Manual tuning**

**Step 1:**
Run the motor using 2/3 of motor nominal frequency as the frequency reference. Read the motor current in the monitoring menu or use NCDrive for monitoring. This current shall be set as the motor magnetization current.

Change the U/f curve ratio selection to programmable (=2).

Run the motor with zero frequency reference and increase the motor zero point voltage until the motor current is approximately same as the motor magnetising current. (If the motor is in a low frequency area for only short periods, it is possible to use up to 65 % of the motor nominal current).
Set then the midpoint voltage to $\sqrt{2} \times \text{Zero Point Voltage}$ and the midpoint frequency to $(\text{Zero Point Voltage} / 100\%) \times \text{Nominal frequency of motor}$.

**Step 2 (if needed):** Activate speed control or U/f optimization (Torque boost).

**Step 3 (if needed):** Activate both speed control and U/f optimization.

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

**P2.8.3.1 U/f optimisation ID109 “U/f Optimization”**

- **Automatic torque boost**: The voltage to the motor changes proportionally to required torque which makes the motor produce more torque at start and when running at low frequencies. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors. Even with linear U/f curve, the torque boost has an affect but the best result will be achieved after the identification run when programmable U/f curve is activated.

**P2.8.3.2 U/f ratio selection ID108 “U/f Ratio Select”**

- **Linear**: 0
  The voltage of the motor changes linearly from zero point voltage to the field weakening point where the voltage at FWP is supplied to the motor.

- **Squared**: 1
  The voltage of the motor changes from zero point voltage following the squared curve form zero frequency to the field weakening point. The motor runs undermagnetised below the field weakening point and produces less torque. Squared U/f ratio can be used in applications where torque demand is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

- **Programmable U/f curve**: 2
  The U/f curve can be programmed with three different points.
  1. Zero point voltage
  2. Midpoint frequency and Midpoint voltage.
  3. Field weakening point and field weakening point voltage.

  Programmable U/f curve can be used if more torque is needed at low frequencies. Make the Identification run for optimal setting (ID631).

- **Linear with flux optimisation**: 3
  The frequency converter starts to search for the minimum motor current in order to save energy. This function can be used in applications with constant motor load, such as fans, pumps etc.
**P2.8.3.3**  **Field weakening point**  **ID602** “Field WeakngPnt”

The field weakening point is the output frequency at which the output voltage reaches the field weakening point voltage.

**P2.8.3.4**  **Voltage at field weakening point**  **ID603** “Voltage at FWP”

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

When the parameter *Motor nominal frequency* is set, the parameter *Field weakening point* is automatically given the corresponding value. If you need different values for the field weakening point and the maximum output voltage, change these parameters after setting the *Nominal frequency*.

In closed loop control this defines maximum voltage to the motor, can be increases if sufficient DC voltage is available.

**P2.8.3.5**  **U/f curve, middle point frequency**  **ID604** “U/f Mid Freq”

If the programmable U/f curve has been selected with parameter U/f ratio this parameter defines the middle point frequency of the curve. See also parameter *Middle point voltage*.

When the programmable U/f curve is selected this value is set to 10% of motor nominal frequency.

**P2.8.3.6**  **U/f curve, middle point voltage**  **ID605** “U/f mid Voltg”

If the programmable U/f curve has been selected with the parameter U/f ratio this parameter defines the middle point voltage of the curve. See also parameter *Middle point frequency*.

When the programmable U/f curve is selected this value is set to 10% (of motor nominal voltage).

**P2.8.3.7**  **Output voltage at zero frequency**  **ID606** “Zero Freq Voltg”

This parameter defines the zero frequency voltage of the U/f curve. The default value is unit size dependent.

**NOTE**: If the value of parameter *U/f Ratio Select* is changed this parameter is set to zero.

**P2.8.3.8**  **Open Loop mode**  **ID1600**

0 = Normal
1 = Mode 2
2 = CL Speed Limits
3 = Mode 2 + CL Speed Limits
8.8.1.1  \textit{/f Control}

I/f-control can be used to start the motor using a constant current control. This is useful especially, if the motor stator resistance is low, which makes the motor current sensitive for u/f-curve tuning at low speed area.

**P2.8.4.8  I/f Start  ID534**

Activates I/f control

![Diagram](image)

**P2.8.4.9  I/f Current  ID1693** "I/f Current"

\textbf{NOTE}: I/f Current parameter is used for several different purposes.

\textbf{I/f Control}

This parameter defines the current level during I/f control, in percent of the motor nominal current

\textbf{Zero position with incremental encoder and Z-Pulse}

In closed loop control utilizing the encoder z-pulse, defines also the current level used in starting before the z-pulse is received to synchronize with.

\textbf{DC Start Angle identification}

This parameter defined DC Current level when Start Angle Identification Time is set greater than zero. See P2.8.5.5 Start Angle Identification Time.

**P2.8.4.10  I/f Control Limit  ID1790** "I/f Control Lim"

This parameter sets the frequency limit for I/f-control in per cent of the motor nominal frequency. I/f-control is used if the frequency is below this limit. The operation changes back to normal when the frequency is above this limit with 1 Hz hysteresis.
8.8.2 Close Loop Settings

**P2.8.4.1 Current control P gain  ID617 “CurrentControlKp”**

Sets the gain for the current controller. The controller generates the voltage vector reference to the modulator. The gain is also used in open loop flying start. When the Sine filter parameter (parameter P6.7.5 in the System menu) has been set to Connected the value of this parameter is changed to 20.00 %.

The value is also identified when using a PMS motor and making identification run with rotating motor. At low speed the motor values may increase up to 300 %. At high speed motor gain and motor with sine filter may have gain values of 10...40 %.

**P2.8.4.3 Current control Ti  ID657 “CurrentControlTi”**

Current controller integrator time constant.

**P2.8.4.3 Slip adjust  ID619 “Slip Adjust”**

The motor name plate speed is used to calculate the nominal slip. This value is used to adjust the voltage of motor when loaded. The name plate speed is sometimes inaccurate and this parameter can therefore be used to trim the slip. Reducing the slip adjust value increases the motor voltage when the motor is loaded.

**P2.8.4.4 Acceleration compensation  ID626 “Accel.Compens.”**

Sets the inertia compensation to improve the speed response during acceleration and deceleration. The time is defined as acceleration time to nominal speed with nominal torque. This function is used when the inertia of the system is known to achieve the best speed accuracy when reference is changed.

Acceleration compensation is added to TorqueReferenceActual i.e. torque is added after speed controller. The speed controller can, therefore, be tuned only for speed error and the acceleration compensation makes sure that the system inertia does not affect the speed controller.
Acceleration compensation in use

\[
\text{AccelCompensationTC} = J \cdot \frac{2\pi \cdot f_{\text{nom}}}{T_{\text{nom}}} = J \cdot \left(\frac{2\pi \cdot f_{\text{nom}}}{P_{\text{nom}}}\right)^2,
\]

\[J = \text{System inertia (kg}\cdot\text{m}^2),\]
\[f_{\text{nom}} = \text{Motor nominal frequency (Hz)},\]
\[T_{\text{nom}} = \text{Motor nominal torque},\]
\[P_{\text{nom}} = \text{Motor nominal power (kW)}.
\]

**P2.8.4.5 Speed Error filtering time constant ID1311 "SpeedErrorFiltTC"**
Filter time constant for speed reference and actual speed error. May be used to remove small disturbances from encoder signal.

**P2.8.4.6 Encoder filter time ID618 "Encoder1FiltTime"**
Sets the filter time constant for speed measurement. The parameter can be used to eliminate encoder signal noise. Too high a filter time reduces speed control stability. Values over 10 ms are not recommended in normal cases.

**P2.8.4.7 Speed Control Torque Chain Select ID1557 "SCTorqueChainSel"**
Values are bit coded. For example, after identification run with rotating motor the value will be 96. If you want to activate an external acceleration compensation you need to add +2 to the existing value.

**B0 +1 = Additional torque limit**
The torque reference chain can be used as an additional torque limit. This option is available in closed loop control mode only.

**B1 +2 = External acceleration compensation**
The torque reference is added to the speed control output, allowing the external controller to give inertia compensation for the drive in speed control mode. This option is available in closed loop control mode only.
**B5&B6, +96** = Internal motor temperature compensation

When the motor cools down or warms up the slip of the motor will change. When this function is activated in closed loop control mode the drive will estimate changes in motor resistance and correct the changes of motor slip automatically to achieve the best torque estimation.

This function is automatically activated when identification run with rotating motor is successfully finished. This option is available in closed loop control mode only.
Permanent magnet synchronous motor settings

There are three ways to know the magnet positions when using the closed loop control. The first one will identify the motor magnet position during every start when using incremental encoder without Z-pulse. Second one uses incremental encoder Z-pulse and the third one uses absolute encoder information. See details of selecting correct mode from chapter “Identification function for permanent magnet synchronous motor”.

**P2.8.5.1 PMSM Shaft Position ID649 “PMSMShaftPositio”**

Absolute encoder position value corresponding to the shaft position where rotor magnet axis is aligned with the stator U-phase magnet axis will be stored here as a result of the encoder identification run. If incremental encoder with a z-pulse is used, z-pulse position will be stored instead. Depending on the motor shaft mechanical position, this parameter can have different values, as there is one right value for each pole-pair of the motor. If incremental encoder and the z-pulse is utilized, the first start after power up is less optimal and i/f-control (see 6.8.3.2) will be used until the drive finds the z-pulse and is able to synchronize in that.

**P2.8.5.2 Start Angle Identification Mode ID1691 “StartAngleIdMode”**

Start angle, i.e. rotor magnet axis position in respect to the stator U-phase magnet axis, identification is needed if there are no absolute encoder or incremental encoder with z-pulse used. This function defines how the start angle identification is made in those cases. Identification time depends on the motor electrical characteristics but takes typically 50ms...200ms.

In case of absolute encoders, start angle will read directly from the encoder absolute angle value. On the other hand, incremental encoder z-pulse will be used automatically for synchronization if its position is defined different from zero in P2.8.5.1. Also for absolute encoders, P2.8.5.1 must be different from zero, otherwise it is interpreted that the encoder identification run has not been done and the running will be prohibited except if the absolute channel is bypassed by the start angle identification.

**NOTE!**
ModulatorType (P2.10.2) need to be >0 to be able to use this function.

0 = Automatic
Decision to use start angle identification is made automatically based on the encoder type connected to the drive. This will serve common cases.

1 = Forced
Bypasses the drive automatic logic and forces the start angle identification to be active. Can be used, for example, with absolute encoders to bypass absolute channel information and to use start angle identification instead.

2 = On Power UP
As a default, start angle identification will be repeated in every start if the identification is active. This setting will enable identification only in a first start after drive is powered up. In consecutive starts, angle will be updated based on the encoder pulse count.

10 = Disabled
Used when Z-pulse from encoder is used for start angle identification.
P2.8.5.3  Start Angle Identification Current  ID1759  “StartAngleIdCurr”
This parameter defines the current level that is used in start angle identification. The correct level depends on the motor type used. In general, 50% of motor nominal current seems sufficient, but depending for example on the motor saturation level, higher current might be needed.

P2.8.5.4  Polarity Pulse Current  ID1566  “PolarityPulseCur”
This parameter defines the current level for the magnet axis polarity direction check during the start angle identification (P2.8.5.2). Value 0 means that the internal current level is used, which is typically slightly higher than the normal identification current defined by P2.8.5.3. Polarity direction check is seldom needed because the identification itself gives already the right direction. Hence in most cases, this function can be disabled by setting any negative parameter value, which is recommended especially if there occurs F1 faults during the identification.

P2.8.5.5  Start Angle Identification Time  ID1755  “StartAngleIdTime”
Start angle can be determined also by feeding dc-current into the motor. Then dc-current will align the rotor magnet axis with the stator magnet axis. This function is activated by determining the time duration dc-current is injected to the motor. Motor must be free to move during the alignment and the time need to be long enough for shaft oscillations to damp out. Hence, this method is not so practical and is intended to be used mainly for testing purposes or to improve starting in together with i/f-control. Dc-current level is determined by P2.8.5.6. Also P2.8.5.2 need to be disabled otherwise overriding this function.
8.8.3.1 I/f Control

I/f-control can be used to start the motor using a constant current control. This is useful especially, if the motor stator resistance is low, which makes the motor current sensitive for u/f-curve tuning at low speed area. I/f-control is activated by setting AdvancedOptions2.B9 = 1 (P2.10.6) for PM-motors. Also software modulator is required for operation.

![Graph showing I/f Control](image)

P2.8.5.6 I/f Current ID1693 “I/f Current”

NOTE: I/f Current parameter is used for several different purposes.

- **I/f Control**
  This parameter defines the current level during I/f control, in percent of the motor nominal current

- **Zero position with incremental encoder and Z-Pulse**
  In closed loop control utilizing the encoder z-pulse, defines also the current level used in starting before the z-pulse is received to synchronize with.

- **DC Start Angle identification**
  This parameter defined DC Current level when Start Angle Identification Time is set greater than zero. See P2.8.5.5 Start Angle Identification Time.

P2.8.5.7 I/f Control Limit ID1790 “I/f Control Lim”

This parameter sets the speed limit for I/f-control in percent of the motor nominal speed (1000 = 100.0%). I/f-control is used if the speed is below this limit. The operation changes back to normal when the speed is above this limit with 60 rpm hysteresis.
8.8.3.2 *Flux current controller*

The flux current controller is used with a PMS motor when running in closed loop control in the field weakening area. This function controls negative $I_d$ current to PM motor in the field weakening area that motor terminal voltage do not increase above maximum level (set by field weakening point voltage, maximum drive output voltage). Field weakening area operation depends on motor construction and motor construction may prohibit operation above field weakening area.

If there is instability in the field weakening area, gain can be decreased and/or time constant increased.

**P2.8.5.8 Flux Current Kp ID551 “FluxCurrent Kp”**

Defines gain for the flux current controller when using a PMS motor. Depending on motor construction and the ramp rate that is used to go to field weakening area high may be needed that output voltage do not reach maximum limit and prevent proper motor control. Too high gain may also lead to unstable control. Integration time is more significant in this case for control.

**P2.8.5.9 Flux Current Ti ID652 “FluxCurrent Ti”**

Defines the integration time for the flux current controller when using a PMS motor. Depending on motor construction and the ramp rate that is used to go to field weakening area, short integration times may be needed that output voltage do not reach maximum limit and prevent proper motor control. Too fast integration time may also lead to unstable control.

**P2.8.5.10 EnableRsIdentifi ID654 “EnableRsIdentifi”**

This parameter enables the Rs identification during DC brake current operations and in closed loop control for every start. If the identification run was made successfully it is recommended to keep this parameter disabled.
8.8.3.3 **D and Q axis voltage drops**

If d-axis and q-axis reactances (voltage drops) are defined, drive calculates the optimal d-axis current reference based on the reactance values and the motor torque in order to account motor reluctance torque part. In this way, motor Torque/Current ratio can be increased.

\[
X_d[\text{Drive scale}] = \frac{X_d[\Omega] \cdot I_n[A] \cdot \sqrt{3}}{U_n[V] \cdot 2560}
\]

\[
X_q[\text{Drive scale}] = \frac{X_q[\Omega] \cdot I_n[A] \cdot \sqrt{3}}{U_n[V] \cdot 2560}
\]

**P2.8.5.11 Lsd Voltage Drop ID1757 “Lsd Voltage Drop”**

D-axis reactance voltage drop 2560 = 100%.
Gives the % voltage drop across the stator inductance at nominal current and frequency.

**P2.8.5.12 Lsq Voltage Drop ID1758 “Lsq Voltage Drop”**

Q-axis reactance voltage drop 2560 = 100%.
Gives the % voltage drop across the stator inductance at nominal current and frequency.
2.8.5.13 \textit{Cos Phi 1 Control} ID1759
This option will control $\cos(\phi)$ to unity if possible.

0 = No  
1 = Yes

P2.8.5.14 \textit{Optimize Current} ID1800
Current (Voltage) optimization for PMSM U/f control

0 = No  
1 = Yes

P2.8.5.15 \textit{Enable Start Positioning Damping} ID1788

0 = No  
1 = Yes

P2.8.5.16 \textit{Encoder Speed Adjust} ID1779
Bad encoder speed correction function

0 = No  
1 = Yes

P2.8.5.17 \textit{Enable Flux Stabilizer} ID1801
This option will enable flux stabilizer for PMSM.

0 = No  
1 = Yes

P2.8.5.18 \textit{Current Control Kp d} ID1766

P2.8.5.19 \textit{Voltage Margin} \% ID1767

P2.8.5.20 \textit{ExtIdRef} ID1730 "ExtIdRef"
This reference value can be used for the external control of the motor id-current i.e. reactive current. Normally there is no need for that as the control uses already the optimal value. This reference value is additive to drive internal values but, for example, field-weakening controller can override the given reference in field-weakening operation.
8.8.4 Stabilator settings

8.8.4.1 Torque stabilator

Torque stabilator is used if there are oscillations in motor speed and torque (current).

**P2.8.6.1 Torque Stabilator Gain ID1412 “TorqStabGain”**
Gain for the torque stabilator in open loop motor control operation.

**P2.8.6.2 Torque Stabilator Damping ID1413 “TorqStabDamp”**
If a PMS motor is used in open loop control mode it is recommended to use value 980 in this parameter instead of 800. The value ‘980’ is set automatically when PMS motor is selected.

**P2.8.6.3 Torque Stabilator Gain in FWP area ID1414 “TorqStabGainFWP”**
Gain of the torque stabilator at field weakening point in open loop motor control operation.

**P2.8.6.4 Torque Stabilator Limit ID1720 “TorqStabLimit”**
This defines how much torque stabilator can affect output frequency.

**P2.8.6.5 Flux Circle Stabilator Gain ID1550 “FluxCircleStabG”**
Gain for flux circle stabilizer.

**P2.8.6.6 Flux Stabilators TC ID1551 “FluxStab TC”**
Filter coefficient of id-current stabilizer.

**P2.8.6.7 Flux Stabilator Gain ID1797 “Flux Stab G”**
Gain of flux stabilizer.

**P2.8.6.8 Flux Stabilator coefficient ID1796 “Flux Stab Coeff”**

**P2.8.6.9 Voltage Stabilator Gain ID1738 “VoltStabGain”**
Gain of voltage stabilizer.

**P2.8.6.10 Voltage Stabilator TC ID1552 “VoltageStab TC”**
Damping rate of voltage stabilizer

**P2.8.6.11 Voltage Stabilator Limit ID1553 “VoltStabLimit”**
Limit of voltage stabilator output as Hz.
8.8.5 Tuning settings

P2.8.7.1 Flying Start Options ID1610

- b0 =+1=Disable movement to reverse direction
- b1 =+2=Disable AC Scanning
- b2 =+4=Disable Fly Brake phase
- b3 =+8=Use encoder information for frequency estimate
- b4 =+16=Use frequency reference for initial guess
- b5 =+32=Disable DC scanning for step-up application

P2.8.7.2 Resonance Damping Select ID1760

This feature can be used to dampen the constant frequency torque oscillations in the drive system.

- 0 Not in use
- 1 Band pass. Oscillation damping with band pass filter.

P2.8.7.3 Resonance Damping Frequency ID1763

Frequency of torque oscillations to be damped in Hz.

P2.8.7.4 Resonance Damping Gain ID1764

The gain for the oscillation damping. This changes amplitude of the compensating signal used for oscillation damping.

P2.8.7.5 Resonance Damping Phase ID1765

The compensating signal used for oscillation damping can be phase shifted 0 to 360 degrees using this parameter.

P2.8.7.6 Resonance Damping Activation frequency ID1770

Defines the frequency limit when resonance damping is started.

P2.8.7.7 Resonance Damping Filtering TC ID1771

Filter TC for external feedback (Iq) signal.

P2.8.7.8 Over modulation limit ID1515

Output Voltage Limit for partial modulation in 1%. 100% means maximum sinusoidal modulation. 113% is full six step.

If you have sini filter in use set this to 96 %.

P2.8.7.9 Modulation Index Limit ID655

Modulation index in % for closed loop operation. Higher value of motor terminal voltage can be achieved by increasing this value.

P2.8.7.10 Enable DC Compensation ID1732

P2.8.7.11 DC-Compensation Gain ID1735
8.8.6 Identification settings

**P2.8.8.1 to P2.8.8.15** Flux 10...150%  ID1355 – ID1369

Motor voltage corresponding to 10%...150% of flux as a percentage of Nominal Flux voltage. Measured during identification.

**P2.8.8.16** Measured Rs voltage drop  ID662 “RsVoltageDrop”

The measured voltage drop at stator resistance between two phases with the nominal current of the motor. This parameter is identified during identification run.

This parameter defines the motor stator resistance as a voltage drop at nominal current. The parameter value is defined according to motor nominal voltage and the current and the actual stator resistance as

\[
RsVoltageDrop = 2560 \times \frac{I_n}{U_n} \times R_s.
\]

**P2.8.8.17** Ir: Add zero point voltage  ID664 “IrAddZeroPVoltag”

Defines how much voltage is applied to motor in zero speed when torque boost is used.

**P2.8.8.18** Ir: Add generator scale ID665 “IrAddGeneScale”

Defines the scaling factor for generator side IR-compensation when torque boost is used.

**P2.8.8.19** Ir: Add motoring scale ID667 “IrAddMotorScale”

Defines the scaling factor for motoring side IR-compensation when torque boost is used.

**P2.8.8.20** Measured Ls voltage drop  ID673 “LsVoltageDrop”

Leakage inductance voltage drop with nominal current and frequency of the motor. This parameter defines the Ls voltage drop between two phases. Use identification run to determine the optimum setting.

**P2.8.8.21** Motor BEM Voltage  ID674 “Motor BEM Voltage”

Motor-induced back voltage.

**P2.8.8.22** IU Offset ID668 “IU Offset”

**P2.8.8.23** IV Offset ID669 “IV Offset”

**P2.8.9.24** IW Offset ID670 “IW Offset”

Offsets the value for phase current measurement. Identified during identification run.

**P2.8.8.25** Estimator Kp  ID1782 “Estimator Kp”

Estimator gain for PMS motor. Identified during identification run.
P2.8.8.26  No Load Torque  ID676

P2.8.8.27  ID Run Current Kp  ID1611

P2.8.8.28  Voltage Drop  ID671  "Voltage Drop"

  Measured residual voltage error.

8.8.7 High Speed settings

P2.8.9.1  Sync/Asynch Modulation  ID1709

  0 / Synchronous modulation
  1 / Asynchronous modulation

P2.8.9.2  Symmetrical Modulation  ID1710

  0 / Asymmetrical modulation
  1 / Symmetrical modulation

P2.8.9.3  Switching Frequency HF Mode  ID1726

  Function to reduce system load in high switching frequency situations. Use only when needed.

  0 / Normal sampling
  1 / Double sampling period
8.9 Speed Control settings

**P2.9.1 Load drooping ID620 “LoadDrooping”**

The drooping function enables speed drop as a function of load. This parameter sets the value corresponding to the nominal torque of the motor.

![Graph showing speed vs. torque with load drooping](image)

**Example:** If load drooping is set to 10 % for a motor that has a nominal frequency of 50 Hz and is nominally loaded (100 % of torque) the output frequency is allowed to decrease 5 Hz from the frequency reference. The function is used for e.g. when balanced load is needed for mechanically connected motors.

**P2.9.2 Load Drooping Time ID656 “LoadDroopingTime”**

This function is used in order to achieve a dynamic speed drooping because of changing load. The parameter defines the time during which the speed is restored to the level it was before the load increase.

![Graph showing load change and speed response](image)
8.9.1.1 Open Loop Settings

P2.9.3.1 Speed controller P gain, Open Loop  ID637 “OL Speed Reg P”
Defines the P gain for the speed controlled in Open Loop control mode.

P2.9.3.2 Speed controller I gain, Open Loop  ID638 “OL Speed Reg I”
Defines the I gain for the speed controlled in Open Loop control mode.

8.9.1.2 Closed Loop Speed Control Settings

P2.9.4.1 Speed control P gain  ID613 “Speed Control Kp”
Gain for the speed controller in closed loop motor control operation. Gain value 100 means that the nominal torque reference is produced at the speed controller output for the frequency error of 1Hz.

P2.9.4.2 Speed control I time  ID614 “Speed Control Ti”
Sets the integral time constant for the speed controller. Increasing the I-time increases stability but lengthens the speed response time.

Kp 30, Ti 100

Kp 30, Ti 300
P2.9.4.3 Zero speed time at start **ID615 “Start 0SpeedTime”**

After giving the start command the drive will remain at zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time has elapsed counted from the instant when the command was given.

P2.9.4.4 Zero speed time at stop **ID616 “Stop 0 SpeedTime”**

The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed when a stop command is given. This parameter has no effect if the selected stop function is *Coasting*. Note that the zero speed time starts when the ramp time is expected to reach the zero speed, not when the actual speed reaches zero. Such situation can happen when the generator power limit is small or the overvoltage controller is active while decelerating.
8.9.1.3 **Speed controller tuning for different speed areas**

The speed controller can be tuned for different gains in different speed areas, for slow speed and above the parameter *Field weakening point*. Gains for different speed areas are percentages of the original Speed Controller Gain value.

![Graph showing speed controller gain tuning for different speed areas.]

**P2.9.4.5 Speed Controller f0 point**  **ID1300**  "SPC f0 Point"

The speed level in Hz below which the speed controller gain is *Speed Controller gain f0*. 

**P2.9.4.6 Speed Controller f1 point**  **ID1301**  "SPC f1 Point"

The speed level in Hz above which the speed controller gain is *Speed Controller P gain*. Gain changes linearly between f0 and f1 points.

**P2.9.4.7 Speed Controller gain f0**  **ID1299**  "SPC Kp f0"

The relative gain of the speed controller as a percentage of the *Speed Controller P Gain* when the speed is below the level defined by *Speed Controller f0 point*.

**P2.9.4.8 Speed controller gain in field weakening area**  **ID1298**  "SPC Kp FWP"

Relative gain of the speed controller in field weakening area as a percentage of *Speed Controller P Gain* values. The set value is reached at two times the *Field weakening point*. 

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.9.1.4  **Speed controller gain with different loads**

The speed controller can also be tuned for different loads. Speed controller gain is first manipulated by the speed area gain function and this result is then further adjusted by torque related relative gain.

![Diagram showing speed controller gain and torque minimum](image)

**P2.9.4.9  Speed Controller torque minimum  ID1296  "SPC Torq Min"**

The level of speed controller output which the speed controller gain is changed to with using a filter set by parameter P2.8.5.4.10 “Speed Controller torque minimum gain” using a filter set by parameter P2.8.5.4.11 “Speed Controller torque minimum filtering time”. This is in percent of the motor nominal torque.

**P2.9.4.10  Speed Controller torque minimum gain  ID1295  "SPC Kp Torq Min"**

Relative gain as a percentage of the speed controller gain after speed area adjustment when the speed control output is less than the “Speed Controller torque minimum”. This parameter is normally used to stabilise the speed controller for a drive system with gear backlash.

**P2.9.4.11  Speed Controller torque minimum filtering time  ID1297  "SPC Kp TC Torq"**

Filtering time for torque. When the speed controller gain is changed below the Speed Controller torque minimum.
8.10 Drive Control

P2.10.1 Switching frequency ID601 “Switching Freq”

Motor noise can be minimised using a high switching frequency. Note, however, that increasing the switching frequency increases losses of the frequency converter. Lower frequencies are used when the motor cable is long and the motor is small. The range of this parameter depends on the size of the frequency converter:

<table>
<thead>
<tr>
<th>Type</th>
<th>Min. [kHz]</th>
<th>Max. [kHz]</th>
<th>Default [kHz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0003—0061 NX_5</td>
<td>1.0</td>
<td>16.0</td>
<td>10.0</td>
</tr>
<tr>
<td>0003—0061 NX_2</td>
<td>1.0</td>
<td>10.0</td>
<td>3.6</td>
</tr>
<tr>
<td>0041—0062 NX_6</td>
<td>1.0</td>
<td>6.0</td>
<td>1.5</td>
</tr>
<tr>
<td>0144—0208 NX_6</td>
<td>1.0</td>
<td>6.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Table 8-2. Size-dependent switching frequencies

Note!
The actual switching frequency might be reduced down to 1.5kHz by thermal management functions. This has to be considered when using sine wave filters or other output filters with a low resonance frequency.

Note!
If the switching frequency is changed it is necessary to redo the identification run.

Note!
Using higher switching frequencies requires approval from factory and licence code.

P2.10.2 Modulator Type ID1516 “Modulator type”

Select modulator type. Some operations require use of a software modulator.

0 =ASIC modulator
A classical third harmonic injection. The spectrum is slightly better compared to the Software 1 modulator.

NOTE: An ASIC modulator cannot be used when using DriveSynch or PMS motor with an incremental type encoder.

1 =Software Modulator 1
Symmetric vector modulator with symmetrical zero vectors. Current distortion is less than with software modulator 2 if boosting is used.

NOTE: Recommended for DriveSynch (Set by default when DS activated) and needed when using PMS motor with an incremental encoder and when using I/f control with PM motors.

2 =Software modulator 2
One phase at a time in IGBT switches is not modulated during a 60-degree period of the frequency cycle. The unmodulated phase is connected to either positive or negative DC-bus.
This modulator type reduces switching losses up to two-thirds and all switches become evenly loaded.
BusClamp modulation is useful if the voltage is >80% of the maximum voltage, in other words, when the drive is operating near full speed. Then again, the motor ripple at low speeds is the double compared to selection 1.

3 = Software modulator 3
Unsymmetrical BusClamp in which one switch always conducts 120 degrees to negative DC-rail to reduce switching losses. However, upper and lower switches are unevenly loaded and the spectrum is wide.

4 = Software modulator 4:
Pure sinewave, sinusoidal modulator without harmonic injection. Dedicated to be used in back to back test benches etc. to avoid circulating third harmonic current. Drawback is that required DC voltage is 15% higher compared to other modulator types.

5 = Software modulator 5:

6 = Software modulator 6:

7 = Software modulator 7:

8 = Software modulator 8:

9 = Software modulator 9:

10 = Software modulator 10:
Same as P2.10.13 Enable SVM/SHE

P2.10.3 Control Options ID1084
"Control Options"
These parameter functions are dependent of Vacon Advance application version.

B02 = Reserved
B07 = Disables switching frequency decrease due to drive temperature rise
B08 = Disable Encoder fault when brake is closed
B11 = Force LoadDrooping to Zero when reference is below Zero freq. Limit

P2.10.4 Advanced Options 1 ID1560 "AdvancedOptions1"
B00 = Disable Synchronous modulation
B01 = Use encoder information to slip compensation in Open Loop Speed control
B02 = Disable encoder fault
B03 = Disable slip compensation for reverse direction
B06 = Enable synchronous symmetrical modulation
B15 = Cosphil =1 control. This controls the motor reactive power to zero. Possible to use only with PMS motors in closed loop control.
P2.10.5  **Advanced Options 2  ID1561**  “AdvancedOptions1”

- **B00** = Sensorless control for PMS motors. This is an open loop control but uses the same control system than the normal closed loop control. Calculations try to estimate the encoder speed instead of using the encoder signal. This mode has speed and torque range limitations and therefore application limitations. A lower speed controller gain may be required to gain stability. Useful for generator applications.
- **B04** = Enable Start Positioning damping active if PMSM
- **B08** = Current optimization for PMS motor. This function activates the current optimization for PMSM motor based on torque calculation and motor parameters. When activated, the optimization starts after 13% of the motor nominal speed and below this a normal U/f curve is used. The activation of this selection requires a performed identification with run.
- **B09** = I/f control for PMS motors. PMS motor can be started with I/f control. Used with high power motor when there is low resistance in motor and U/f is difficult to tune to be stable.

P2.10.6  **Advanced Options 4  ID1563**  “AdvancedOptions4”

Reserved for future use. Some bits are controlled by application software so value may not be always zero.

P2.10.7  **Advanced Options 5  ID1564**  “AdvancedOptions5”

Reserved for future use. Some bits are controlled by application software so value may not be always zero.

P2.10.8  **Advanced Options 6  ID1565**  “AdvancedOptions5”

Reserved for future use. Some bits are controlled by application software so value may not be always zero.

P2.10.9  **Restart Delay  ID1424**  “Restart Delay 0L”

The time delay within which the drive cannot be restarted after a coast stop and flying start is not in use. Closed Loop control mode and the flying start use a different delay see P2.9.11.

P2.10.10  **Restart Delay Closed Loop & Flying Start  ID672**  “Restart Delay CL”

The time delay within which the drive cannot be restarted if flying start is used or the control mode is closed loop.

P2.10.11  **Sine Filter Capacitor Size  ID1460**

Scaling, 2560 = 100%

P2.10.12  **Sine Filter Inductor Size  ID1461**

Scaling, 2560 = 100%
8.11 Master Follower

8.11.1 Master Follower: Standard system

The Master/Follower function is designed for applications in which the system is run by several NXP drives and the motor shafts are coupled to each other via gearing, chain, belt etc. The NXP drives are in closed loop control mode.

The external control signals are connected to the Master NXP only. The Master controls the Follower(s) via a System bus. The Master station is typically speed-controlled and the other drives follow its torque or speed reference.

Torque control of the Follower should be used when the motor shafts of the Master and Follower drives are coupled solidly to each other by gearing, a chain etc., so that no speed difference between the drives is possible.

Speed control of the Follower should be used when the motor shafts of the Master and the Follower drives are coupled flexibly to each other so that a slight speed difference between the drives is possible. When both the Master and Followers are speed-controlled, drooping is typically also used.
8.11.2 Master follower configuration

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

![Diagram of OPTD2 jumper settings](image)

**OPT-D2 Jumper X5 : TX1**
- Master
  - SBInUse = Yes
  - SBID = 1
  - SBNextID = 2
  - SBLastID = 4

**OPT-D2 Jumper X5 : TX2**
- Follower
  - SBInUse = Yes
  - SBID = 2
  - SBNextID = 3
  - SBLastID = 4

**OPT-D2 Jumper X5 : TX2**
- Follower
  - SBInUse = Yes
  - SBID = 3
  - SBNextID = 4
  - SBLastID = 4

**OPT-D2 Jumper X5 : TX2**
- Follower
  - SBInUse = Yes
  - SBID = 4
  - SBNextID = 1
  - SBLastID = 4

Figure 8.15. System bus physical connections with the OPT-D2 board

P2.11.1 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 = Single drive
   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.

P2.11.2 Follower reference selection  ID1081 “Follower Ref Sel”

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
Select where the follower drive receives its speed reference from.

0=“AI1” - Analogue Input 1.
   Signal scaling in “G: Input Signals \ Analogue Input 1”
1=“AI2” - Analogue Input 2.
   Signal scaling in “G: Input Signals \ Analogue Input 2”
2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.
   With alternative reference scaling in Analogue Input group, 100% input values can be set to correspond 25 Hz. In other words, when both are 100% the final reference will be 50 Hz.
3=“AI1-AI2”
   Analogue Input 1 minus Analogue Input 2.
4=“AI2-AI1”
   Analogue Input 2 minus Analogue Input 1.
5=“AI1 x AI2”
   Analogue Input 1 x Analogue Input 2
6=“AI1 Joystick”
   Analogue input 1, -10 Vdc... +10 Vdc
7=“AI2 Joystick”
   Analogue input 2, -10 Vdc... +10 Vdc
8=“Keypad Ref”
   Reference from keypad R3.2
9=“Fieldbus”
   Reference is taken from fieldbus. Alternative scaling can be selected in “G: Fieldbus”
10=“Motor Pot” - Motor potentiometer
   Reference handled with two digital inputs “G: Input Signals \ Digital Inputs” (increase and decrease). Behaviour adjusted in “G: Ref Handling \ Motor Potentiometer”.
11=“AI1, AI2 min”
   The smaller of Analogue Input 1 and Analogue Input 2 is used as reference.
12=“AI1, AI2 max”
   The greater of Analogue Input 1 and Analogue Input 2 is used as reference.
13=“Max Freq” – Maximum Frequency
   P2.1.2 Max Frequency is used as reference.
14=“AI1/AI2 Sel” – AI1/AI2 Selection
   The digital input “I/O Ref 1/2” is used to select between Analogue Input 1 and Analogue Input 2 reference. “I/O Ref 1/2” is used to select between “I/O Reference” and “I/O Reference 2” if selection of this parameter is different from 14 (this one).
15=“Encoder 1”
   Reference is read from encoder input 1.
16=“Encoder 2”
   Reference is read from encoder input 2. This selection is usable with double encoder boards. Could be utilized e.g. for speed synchronization.
17 Master Reference
   Master reference before ramp generator. When this is selected the follower drive’s own ramp times are active and used.
18 Master Ramp Out
   Master reference after ramp generator, before speed controller. When this is selected the follower drive will use the ramp times defined by the Master drive.

P2.11.3 Follower torque reference selection ID1083”FollowerTorq Sel”
Select the source of torque reference for the follower drive.

0="Not Used"
1="AI1" - Analogue Input 1.
   Signal scaling in "G: Input Signals\Analogue Input 1"
2="AI2" - Analogue Input 2.
   Signal scaling in "G: Input Signals\Analogue Input 2"
3="AI3"
4="AI4"
5="AI1 Joystick"
   Analogue input 1, -10 Vdc... +10 Vdc. For joystick inputs, the maximum negative reference is the negative of "Torq Ref Max".
6="AI2 Joystick"
   Analogue input 2, -10 Vdc... +10 Vdc For joystick inputs maximum negative reference is the negative of "Torq Ref Max".
7="Keypad Ref"
   Torque reference from keypad R3.5
8="Fieldbus"
   Reference is taken from fieldbus. Alternative scaling can be selected in "G: Fieldbus"
9="Master Torque"
   Reference is taken from Master drive when using the Master Follower function.

**P2.11.4 Follower stop function ID1089 "FollowerStopFunction"**

When the follower drive does not use the Master Drive Ramp Output as reference this parameter defines how the follower drive will stop as Run request is removed from the Master drive.

0=Coasting; the follower remains in control even if master has stopped to fault.
1=Ramping; the follower remains in control even if master has stopped to fault.
2=As master; the follower behaves as master.

**P2.11.5 Master Follower mode 2 selection ID1093 "MF Mode 2"**

Selects the Master Follower mode 2 that is used when the DI is activated. When Follower is selected the Run Request command is monitored from Master and all other references are selectable by parameters. This parameter can be used for redundancy purposes. If drive number one is unable to be operated through a digital input drive number 2 can be selected as master.

0 =Single Drive
   System bus is deactivated.
1 =Master
   Drive sends control word to follower drive.
2 =Follower
   Drive received control word from Master and sends some diagnostic information to the Master drive.

**P2.11.6 SystemBus communication fault response ID1082 "SB Comm Fault"**

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
Defines the action when the System Bus heartbeat is missing. The master drive sends a heartbeat signal to all follower drives and this heartbeat is sent back to the master drive.

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

**P2.11.7 Systembus fault delay ID1352 “SB fault Delay”**  
Defines the delay before fault generation when heartbeat is missing.
8.12 Protections

8.12.1 General settings

**P2.12.1.1 Response to external fault**  *ID701* "External Fault"

Defines the response to a digital input signal informing about an external condition where the drive needs to react to. The external warning/fault indication can be connected to a digital output.

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

**P2.12.1.2 Input phase supervision**  *ID730* "Input Ph. Superv"

Defines the response when the drive notices that one of the input phases is missing.

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

**P2.12.1.3 Response to undervoltage fault**  *ID727* "UVolt Fault Resp"

In some applications it is normal that the drive will be powered down when in run state. With this parameter it is possible to choose whether undervoltage faults are stored to the fault history of the drive.

0 = Fault stored in fault history  
1 = Fault not stored in fault history

Undervoltage fault limits:

500 V units: 333 Vdc  
690 V units: 460 Vdc

**P2.12.1.4 Output phase supervision**  *ID702* "Output Ph. Superv"

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

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

**P2.12.1.5 Response to slot fault**  *ID734* "SlotComFaultResp"

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

0 = No response  
1 = Warning  
2 = Fault, stop mode after fault according to Stop Function  
3 = Fault, stop mode after fault always by coasting
P2.12.6  Safe Torque Off (STO) mode  ID755  “SafeDisableResp.”

With this parameter it is possible to choose whether the STO signal is handled as fault or warning. The STO input will stop the drive from modulating regardless of this parameter value.

P2.12.7  Cooling fault delay  ID751

This parameter defines delay after the drive goes to fault state when cooling OK signal is missing. If drive is in Stop state this is only warning, In Run state drive will make fault with coast stop.

P2.12.8  Encoder fault mode  ID1353

 Defines function when encoder signal is missing in closed loop control mode.

0 =No response
1 =Warning
2 =Fault, stop mode after fault always by coasting
8.12.2 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 Advance application supports two OPT-BH and OPT-B8 board simultaneously. One can be used for the motor winding and one for the motor bearings.

P2.12.2.1 Number of used inputs in board 1 ID739 "Board1 Channels"

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

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

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

P2.12.2.2 Response to temperature fault ID740 "Fault Response"

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

P2.12.2.3 Board 1 warning limit ID741 "Board1 Warn.Limit"

Set here the limit at which the PT100 warning will be activated.

P2.12.2.5 Board fault limit ID742 "Board1 Fault Lim."

Set here the limit at which the PT100 fault (F56) will be activated.

P2.12.2.5 Number of used inputs in board 2 ID743 "Board2 Channels"

If you have two temperature sensor boards installed in your frequency converter you can choose here the combination inputs in use in the second board. See also the Vacon I/O boards manual.

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

P2.12.2.6 Board 2 warning limit ID745 "Board2 Warn. Lim"

Set here the limit at which the second temperature sensor board warning will be activated.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.12.7 Board2 fault limit ID746 “Board2 FaultLim”

Set here the limit at which the second temperature sensor board fault (F61) will be activated.

8.12.3 Stall protection

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

P2.12.3.1 Stall protection ID709 “Stall Protection”

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

P2.12.3.2 Stall current limit ID710 “Stall Current”

The current can be set to 0...2*I_{n}. For a stall stage to occur, the current must have exceeded this limit. The software does not allow entering a greater value than 2*I_{n}. If the motor current limit is changed this parameter is automatically recalculated to the value 90% of motor current limit.

Note: This limit must be set below the current limit in order for this function to operate.

P2.12.3.3 Stall frequency limit ID712 “Stall Freq Lim”

The frequency can be set between 1-f_{max} (Max Frequency).

For a stall state to occur, the output frequency must have remained below this limit for a certain time. This function requires that the output frequency is 1 Hz below the frequency reference before the stall time count is started.
P2.12.3.4  Stall time  \textit{ID711 “Stall Time Lim”}

This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter. If the stall time counter value goes above this limit the protection will cause a trip.
8.12.4 *Speed Error*

The Speed error monitoring function compares the encoder frequency and the ramp generator output. The function is used with a PMS motor to detect if the motor is off synchronization or to disable the open loop function using the encoder speed for slip compensation. The slip compensation is disabled regardless of the response and needs to be re-activated once a speed error is detected (set parameter again or power down the drive).

**P2.12.4.1 Speed error fault function**  
*ID752 “Speed Error Mode”*

Defines the fault function when the speed reference and the encoder speed are above the set limits.

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

**P2.12.4.2 Speed error maximum difference**  
*ID753 “Speed Error Limit”*

Defines the limit when fault situation is noted. The difference between the speed reference and the encoder speed. Percentage value is in relation to motor nominal frequency.

![Diagram showing speed error maximum difference](image)

**P2.12.4.3 Speed error delay**  
*ID754 “Speed Fault Delay”*

Defines the delay after which a speed error is considered as a fault.

When used to disable open loop slip compensation based on encoder frequency it is recommended to set this time to zero to avoid a speed jump at the time of encoder malfunction.
8.12.5 Motor Protection

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

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

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

The motor thermal protection can be adjusted with parameters. The thermal current $I_T$ specifies the load current above which the motor is overloaded. This current limit is a function of the output frequency.

**P2.12.5.1 Motor thermal protection response ID704 “Motor Therm Prot”**

Defines the response when the calculated temperature of the motor has reached 105% (monitoring signal).

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

**P2.12.5.2 Motor ambient temp. factor ID705 “MotAmbTempFactor”**

Defines the temperature factor for conditions where the motor is located. The factor can be set between -100.0%—100.0%.

- -100.0% = 0°C,
- 0.0% = 40°C,
- 100.0% = 80°C

**P2.12.5.3 Motor cooling factor at zero speed ID706 “MTP f0 Current”**

Defines the cooling factor at zero speed in relation to the point where the motor is running at nominal speed without external cooling.

The default value is set assuming that there is no external fan cooling the motor. If an external fan is used this parameter can be set to 90% (or even higher).

**Note:** The value is set as a percentage of the motor name plate data, (Nominal current of motor), not the drive’s nominal output current. The motor’s nominal current is the current that the motor can withstand in direct on-line use without being overheated.

Setting this parameter does not affect the maximum output current of the drive which is determined by parameter Motor Current Limit alone.
P2.12.5.5 Motor thermal protection: Time constant  ID707 “MTP Motor T”

This time can be set between 1 and 200 minutes.

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

The motor thermal time is specific to motor design and it varies between different motor manufacturers. The default value changes between unit sizes.

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

P2.12.5.5 Motor thermal protection: Motor duty cycle  ID708 “Motor Duty Cycle”

The value can be set to 0%...150%.

Setting value to 130 % motor calculated temperature will reach nominal temperature with 130 % of motor nominal current.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.12.5.6 **Response to thermistor fault**  ID732 "ThermistF.Resp"

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.

P2.12.5.7 **Software over current trip limit**  ID1094

Fast software over current limit function, Set current limit related to motor nominal current in % value. Value 0 will disable function.
8.12.6 4mA Protection

The 4 mA protection monitors the analogue input signal level from Analogue input 1 and Analogue input 2.

The monitoring function is active when signal range 4 mA – 20 mA is selected. A fault or warning is generated when the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds.

P2.12.6.1 Response to the 4mA reference fault ID700 “4mA Input Fault”

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset Frequency is set as reference
4 = Fault, stop mode after fault according to Stop Function
5 = Fault, stop mode after fault always by coasting

P2.12.6.2 4mA reference fault: preset frequency reference ID728 “4mA Fault Freq.”

If value 3 in parameter P2.12.6.1 is selected and a fault occurs the frequency reference to the motor is the value of this parameter.
8.12.7 Underload protection

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.

The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5Hz (the underload time counter is stopped).

The torque values for setting the underload curve are set in percent which refers to the nominal torque of the motor. The motor's name plate data, parameter motor nominal current and the drive's nominal current $I_H$ are used to find the scaling ratio for the internal torque value.

P2.12.7.1 Underload protection ID713 "Underload Protec"

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

If tripping is set active the drive will stop and activate the fault stage. Deactivating the protection by setting the parameter to 0 will reset the underload time counter to zero.

P2.12.7.2 Underload protection, zero frequency load ID715 "UP F0 Torque"

The torque limit can be set between $5.0 - 150.0 \% \times T_{nMotor}$. This parameter gives the value for the minimum torque allowed with zero frequency.

P2.12.7.3 Underload protection, field weakening area load ID714 "UP from Torque"

The torque limit can be set between $10.0 - 150.0 \% \times T_{nMotor}$. This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point.

![Torque graph showing underload area between 5 Hz and $f_n$ frequency output.](image-url)
P2.12.7.4 Underload time ID716 "UP Time Limit"

This time can be set between 2.0 and 600.0 s. This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to parameter Underload Protection.
8.12.8  Earth Fault

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

**P2.12.8.1 Earth fault protection  ID703 “Earth fault”**

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

**P2.12.8.2 Earth fault current limit  ID1333 “EarthFaultCurLim”**

Maximum level for Earth current in % of the unit nominal current.
8.12.9  Fieldbus communication

8.12.9.1  Redundant profibus

Redundant PB is based on ControlSlot Selector (P2.9.21) that is used for selecting option board slot where the fieldbus control commands are coming. Figure above describes selection possibilities.

Working of FB-communication is monitored by supervising the state of FBFixedControlWord bit 15 that signals is the communication working or not. Bit 15 is controlled by Profibus board.

Function can be used only in Profibus ByPass mode, thus profibus state machine needs to be inside application level. Bypass function is activated by selecting ByPass in profibus board parameters and application parameter P2.9.19 PB Profile.
P2.12.10.1 Response to fieldbus fault Slot D  ID733 “FBFaultSlotEResp”
Set here the response mode for the fieldbus fault if active control place is fieldbus. For more information, see the respective Fieldbus Board Manual.
This response is only for Slot D.

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function
3 = Fault, stop mode after fault always by coasting
4 = Warning, Previous frequency. Forced fault after delay. Only for profibus communication.
5 = Warning; 4 mA Freq
6 = Warning; Change Slot

P2.12.10.2 Response to fieldbus fault Slot E  ID761 “FBFaultSlotEResp”
Set here the response mode for the fieldbus fault if active control place is fieldbus. For more information, see the respective Fieldbus Board Manual.
This response is only for Slot E.

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to Stop Function
3 = Fault, stop mode after fault always by coasting
4 = Warning, Previous frequency. Forced fault after delay. Only for profibus communication.
5 = Warning; 4 mA Freq
6 = Warning; Change Slot

P2.12.10.3 Fieldbus fault delay  ID1850 “FB Fault Delay”
This how long drive will stay in run state after the communication has been lost if fault response is set to 4 / Warning, previous frequency. If time is set to zero drive will remain running until communication is established and stop command is given.

P2.12.10.4 Fieldbus Watch Dog delay  ID1354 “FB WD Delay”
Defines delay when fault is generated when watch dog pulse is missing from fieldbus. Set the time to zero to disable watchdog monitoring.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.12.10  Synch Fall Fault

2.12.10.1  Synch Fall Detection  ID1712

2.12.10.2  Sync Fall Angle  ID1736
Sync fall fault activation level 1000 = 100.0% (100.0% corresponds to power angle 90deg)

2.12.10.3  Sync Fall Voltage  ID1714
Sync fall voltage limit from linear U/F-curve voltage. If voltage goes below this limit during I/F-control, fault will be activated.
8.13 Fieldbus settings

8.13.1 General settings

P2.13.1 Fieldbus reference minimum scaling ID850 “FB Min Scale”
P2.13.2 Fieldbus reference maximum scaling ID851 “FB Max Scale”

Use these two parameters to scale the fieldbus reference signal. If both parameters have the same value the minimum and maximum frequency limits are used for scaling.

Using this custom scaling function also affects the scaling of the actual value.
**P2.13.3 to**

**P2.13.10 Fieldbus data out selections 1 to 8**  
**ID852-ID859 “FB Data OutX Sel”**

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

Default settings:

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Word</td>
<td>Main Status Word</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FB General Status Word</td>
<td>MCStatus</td>
<td></td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>FB Actual Speed</td>
<td>Actual Speed</td>
<td>%</td>
<td>0.01%</td>
<td></td>
</tr>
<tr>
<td>Process data OUT 1</td>
<td>Output Frequency</td>
<td>Hz</td>
<td>0.01 Hz</td>
<td>1</td>
</tr>
<tr>
<td>Process data OUT 2</td>
<td>Motor Speed</td>
<td>rpm</td>
<td>1 rpm</td>
<td>2</td>
</tr>
<tr>
<td>Process data OUT 3</td>
<td>Motor Current</td>
<td>A</td>
<td>0.1 A</td>
<td>45</td>
</tr>
<tr>
<td>Process data OUT 4</td>
<td>Motor Torque</td>
<td>%</td>
<td>0.1%</td>
<td>4</td>
</tr>
<tr>
<td>Process data OUT 5</td>
<td>Motor Power</td>
<td>%</td>
<td>0.1%</td>
<td>5</td>
</tr>
<tr>
<td>Process data OUT 6</td>
<td>Motor Voltage</td>
<td>V</td>
<td>0.1 V</td>
<td>6</td>
</tr>
<tr>
<td>Process data OUT 7</td>
<td>DC link voltage</td>
<td>V</td>
<td>1 V</td>
<td>7</td>
</tr>
<tr>
<td>Process data OUT 8</td>
<td>Active Fault Code</td>
<td>-</td>
<td>-</td>
<td>37</td>
</tr>
</tbody>
</table>

**P2.13.11 to**

**P2.13.18 Fieldbus data out selections 9 to 16**  
**ID558-ID565 “FB Data outXSel”**

These parameters work the same as **P2.13.10**. However, these parameters are only visible if a fieldbus board with support for 16 process data variables is inserted in option board slot D or E.

**P2.13.19 to**

**P2.13.26 Fieldbus data in selections 1 to 8**  
**ID876-833 “FB Data IN X Sel”**

Using these parameters, you can control any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters. Monitoring signals that can be controlled from fieldbus are shadowed.

Default settings:

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>Speed Reference</td>
<td>%</td>
<td>0.01%</td>
<td></td>
</tr>
<tr>
<td>Control Word</td>
<td>Main Control Word</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Control Word 2</td>
<td>General Control Word</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Process Data IN1</td>
<td>Torque Reference</td>
<td>%</td>
<td>0.1%</td>
<td>1140</td>
</tr>
<tr>
<td>Process Data IN2</td>
<td>Free Analogue INPUT</td>
<td>%</td>
<td>0.01%</td>
<td>46</td>
</tr>
<tr>
<td>Process Data IN3</td>
<td>Adjust Input</td>
<td>%</td>
<td>0.01%</td>
<td>47</td>
</tr>
<tr>
<td>Process Data IN4</td>
<td>FB Analogue Output</td>
<td>%</td>
<td>0.01%</td>
<td>48</td>
</tr>
<tr>
<td>PD4 – PD8</td>
<td>Not Used</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
P2.13.34 Fieldbus data in selections 9 to 16  ID550-557 "FB Data INX Sel"
These parameters work the same as P2.13.19-26. However, these parameters are only visible if a fieldbus board with support for 16 process data variables is inserted in option board slot D or E.

P2.13.35 Fieldbus General Status Word ID  ID897 "GSW ID"
With this parameter it is possible to select which data are sent in FBGeneralStatusWord (see for details and availability in used fieldbus manual).

P2.13.36 Control Slot selector  ID1440 "ControlSlotSel."
This parameter defines which slot is used as the main control place when two fieldbus boards have been installed in the drive. When values 6 or 7 are selected, the drive uses the Fast Profibus profile. When the Fast Profibus profile is used type ‘B’ boards or other C type boards cannot be used. When values 8 or 9 are selected, the drive uses the Extended Fieldbus mode, which enables the use of 16 process data variables. This mode is only available when a fieldbus board with 16 PD support is inserted in slot D or E. For more information refer to the fieldbus board manual.

Note: Set first the Slave Address and the PPO type before selecting the Fast Profibus mode.

0 =All slots  
4 =Slot D  
5 =Slot E  
6 =Slot D, Fast Profibus support  
7 =Slot E, Fast Profibus support  
8 =Slot D, 16 process data support  
9 =Slot E, 16 process data support
**P2.13.37  ProfiBus Mode**

Defines if standard profile (Explained in fieldbus manual that is used) or if application level profibus profile is used.

1 = Standard  
Profile that is explained in used fieldbus manual.

2 = ProfiDrive  
Drive uses application level ProfiDrive profile, used fieldbus board needs to be in "ByPass" type or communication needs to be set to ByPass mode to be able to use this.

<table>
<thead>
<tr>
<th>FB Control Word</th>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>ON</td>
<td>0&gt;1 will reset the Switch On Inhibit state and bring the drive to Ready Run. Should be reset after fault, Coast Stop (b1) and Emergency Stop (b2).</td>
</tr>
</tbody>
</table>
| b1 | EM Stop Coasting | 0=Coast stop Active  
1=Coast stop NOT active |
| b2 | EM Stop | 0=Emergency stop Active  
1=Emergency stop NOT active |
| b3 | Start | Normal start command  
0=Stop the drive  
1=Start the drive |
| b4 | Ramp Output to Zero | 0=Force speed ramp output to zero  
1=Release speed ramp output |
| b5 | Ramp Hold | 0=Hold speed ramp output  
1=Release speed ramp |
| b6 | Ramp Input to Zero | 0=Force speed ramp input to zero  
1=Release speed ramp input |
| b7 | Fault Reset | 0=No Action  
1=Reset active faults |
| b8 | Inching 1 | Run the drive with defined constant speed  
0=No Action  
1=Run with constant speed |
| b9 | Inching 2 | Run the drive with defined constant speed  
0=No Action  
1=Run with constant speed |
| b10 | Fieldbus Control Enable | Activate Fieldbus control when P3.1 =3  
0=Fieldbus Control NOT active  
1=Activate Fieldbus Control |
| b11 | Watch Dog | 0>1=0>1...1 sec square wave clock. This is used to check data communication between Profibus master and the drive. Used to generate FB Communication - Fault. |
| b12 | | |
| b13 | | |
| b14 | | |
| b15 | | |
### FB Status Word

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Ready to switch On</td>
<td>0=The drive NOT ready to switch ON</td>
</tr>
<tr>
<td></td>
<td>1=The drive is ready to switch ON</td>
</tr>
<tr>
<td>b1 Ready to Operate</td>
<td>0=The drive is NOT ready to run</td>
</tr>
<tr>
<td></td>
<td>1=The drive is ready to run</td>
</tr>
<tr>
<td>b2 Running</td>
<td>0=The drive is NOT running</td>
</tr>
<tr>
<td></td>
<td>1=The drive is running and ready to release the reference</td>
</tr>
<tr>
<td>b3 Fault Active</td>
<td>0=No fault active</td>
</tr>
<tr>
<td></td>
<td>1=Fault IS active</td>
</tr>
<tr>
<td>b4 Cost Stop NOT active</td>
<td>0=Coast stop active</td>
</tr>
<tr>
<td></td>
<td>1=Coast stop NOT active</td>
</tr>
<tr>
<td>b5 EM Stop not Active</td>
<td>0=Emergency stop active</td>
</tr>
<tr>
<td></td>
<td>1=Emergency stop NOT active</td>
</tr>
<tr>
<td>b6 Switch On Inhibit</td>
<td>0=No Inhibit</td>
</tr>
<tr>
<td></td>
<td>1=The drive is out of fault and coast / emergency stop state.</td>
</tr>
<tr>
<td>b7 Warning</td>
<td>0=NO alarm</td>
</tr>
<tr>
<td></td>
<td>1=Alarm IS active</td>
</tr>
<tr>
<td>b8 Speed At Ref</td>
<td>0=Speed actual is NOT equal to speed reference</td>
</tr>
<tr>
<td></td>
<td>1=Speed actual is equal to speed reference</td>
</tr>
<tr>
<td>b9 FB Control Active</td>
<td>0=Fieldbus Control NOT active</td>
</tr>
<tr>
<td></td>
<td>1=Fieldbus Control active</td>
</tr>
<tr>
<td>b10 Above Limit</td>
<td>Indicate if speed actual is below the limit</td>
</tr>
<tr>
<td></td>
<td>0=Speed actual is below the speed limit</td>
</tr>
<tr>
<td></td>
<td>1=Speed actual is above the speed limit</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 Watch Dog Feedback</td>
<td></td>
</tr>
</tbody>
</table>

**P2.13.38 Fieldbus Custom Minimum ID898 “FB Custom Min”**

**P2.13.39 Fieldbus Custom Maximum ID899 “FB Custom Max”**

With these parameters it’s possible to define fieldbus reference input values scaling. default is 0...10000 (0...100%)
8.14 ID Functions
Listed here are the functions that use the parameter ID number to control and monitor the signal.

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

P2.14.1.1 Control Input Signal ID ID1580 “CtrlInSignal ID”
With this parameter you can select what signal is used to control selected parameter.

P2.14.1.2 Control Off Limit ID1581 “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 ID1582 “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 ID1583 “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 ID1584 “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 ID1585 “CtrlOutSignalID”
This parameter defines which parameter is forced to On and Off values when selected input signal exceeds the set limits.

P2.14.1.7 Control Mode ID1586 “Control Mode”
This parameter defines how the value control output behaves.

0 = SR ABS
Absolute input value is used to make a step change in the output between On and Off values.
1 = Scale ABS
Absolute input value is scaled linearly between On and Off values.

2 = Scale ABS Inverted
Inverted absolute value is scaled linearly between On and Off values.

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

4 = Scale ABS
Input value 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   ID1586   “Control Filt TC”
This parameter is used to filter the scaling function output. Used e.g. when unfiltered torque is used to control a parameter that needs stabilization.
8.14.2 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]

**P2.14.2.1 ID Control Digital Input B0 ID1570 “ID Control DI B0”**
Select digital input to be used for controlling the parameter selected by ID1571.

**P2.14.2.2 ID Control Digital Input B1 ID1277 “ID Control DI B1”**
Select digital input to be used for controlling the parameter selected by ID1571.

**P2.14.2.3 DIN Controlled ID ID1571 “Controlled ID”**
Select parameter ID controlled by ID1570.

**P2.14.2.4 B00 Value ID1572 “B00 Value”**
**P2.14.2.5 B01 Value ID1573 “B01 Value”**
**P2.14.2.6 B10 Value ID1193 “B10 Value”**
**P2.14.2.7 B11 Value ID1182 “B11 Value”**

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

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

**P2.14.2.8 Ramp Rate ID1112 “Ramp Rate”**
8.15 Brake Control

The mechanical brake control has two parts that need to be synchronically controlled. The first part is the mechanical brake release and the second is the speed reference release.

**P2.15.1 Brake Logic ID1546**

Use this parameter to select brake control logic

0 = Multi-Purpose brake control logic

---

**Diagram Description:**

- **Reverse Command:**
  - **FreqRampOut:**
  - **GE IN 1 IN 2**
  - **OR IN 1 IN 2**

- **Run Request NOT IN:**
  - **OR IN 1 IN 2 IN 3**

- **Freq supv Lim 0 GE IN 1 IN 2**
  - **FreqRampOut**

- **P2.15.7.2 Freq supv Val P2.15.7.4 Freq supv Val**
  - **EQ IN 1 IN 2**

- **Torque supv Lim 0 GE IN 1 IN 2**
  - **FreqRampOut**
  - **ABS IN**
  - **LE IN 1 IN 2**

- **BrakeCloseReversing ON 1 IN 2**

---

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
1 = Smooth brake control logic

Conditions to open the brake:

The final brake open command: It is possible that in a Master/Follower system the master drive opens the brake. Also an overriding system may do this without any control from the drive using AucControlWord1.B7. During identification run the brake will not open.
1. Start command
2. Start magnetization is used to build rotor flux fast. The drive *Zero speed time* is used during this.
3. When the rotor flux is >90% and the start zero time has expired the speed reference is released to BrakeOpenFreq limit.
4. Speed is kept at this speed until feedback is received from the brake acknowledge or when brake mechanical delay time has passed.
5. Speed follows normal reference signal.

**Speed reference release function:**

**P2.15.2 Mechanical brake reaction time**  
ID1544 “Brake Mech Delay”

After the brake open command has been given, speed is kept at the Brake Open limit until the reaction time has passed. This hold time should be set corresponding to the mechanical brake reaction time. This function is used to avoid current and/or torque spikes eliminating a situation where the motor is run at full speed against the brake. If this parameter is used when simultaneously with the brake acknowledge input both time and brake acknowledgements are needed before the speed reference is released.
P2.15.3  Brake Frequency limit Open Loop  ID1535  "BrakeOFFFrqLimOL"
This parameter defines the frequency limit to release the brake. This value also applies as the maximum frequency reference limit while the brake is closed. In open loop control it is recommended to use a value that is equal to the motor’s nominal slip.

P2.15.4  Brake Frequency limit Closed Loop  ID1555  "BrakeOFFFrqLimCL"
This parameter defines the frequency limit to release the brake. This value also applies as the maximum frequency reference limit while the brake is closed. In closed loop control it is recommended to use zero value so that the brake is released while the drive has zero speed at start. If torque is needed to avoid position change at the moment the brake mechanically opens use the start-up torque function.

P2.15.5  Closing frequency from forward direction  ID1539  "BrakeOnFreqLim +"
Output frequency limit to close the brake when the speed approaches zero speed from positive direction. Lifting direction must be given as positive frequency.

P2.15.6  Closing frequency from reverse direction  ID1540  "BrakeInFreqLim -"
Output frequency limit to close the brake when the speed approaches zero speed from positive direction. Lowering direction must be given as negative frequency.

P2.15.7  Brake On/Off Current limit  ID1085  "BrakeOnOffCurLim"
If motor current is below this value the brake is closed immediately. It is recommended to set this value to approximately 25 % of the magnetization current from the maximum used frequency.
External brake-off delay (P2.15.8) (2.3.4.9)
External brake-on delay (P2.15.9) (2.3.4.10)

The function of the external brake can be timed to the start and stop control signals with these parameters.
The brake control signal can be programmed via the digital outputs. See parameters External brake control (ID445), inverted (ID446) and Delayed outputs (G2.3.1 and G2.3.2)

![Diagram of brake control](image)

**Figure 8-17. External brake control:**
a) Start/Stop logic selection, ID300 = 0, 1 or 2
   b) Start/Stop logic selection, ID300 = 3

8.15.1 Brake monitoring function

The brake monitoring function is activated when the function Brake acknowledge is used. The brake monitoring function compares the brake feedback to the control signal. In other words, a fault will be issued if the feedback is missing when drive is in Run state and the output frequency is above the opening limit and the fault delay has expired. A fault is also triggered if the brake feedback indicates that the brake is open while the drive is in stop state.

In some cases it is possible that an encoder fault appears when the drive is run against closed brake. The encoder fault can be disabled with Control Options B8 when the drive is controlling the brake to be closed.

P2.15.10 Brake fault response

ID1316 "Brake Fault"

Defines the action after detection of a brake fault.

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

P2.15.11 Brake fault delay

ID1317 "Brake Fault Delay"

The delay before the brake fault (F58) is activated. Used when there is a mechanical delay in the brake. See digital input signal External brake acknowledge.
8.15.2 Closed Loop settings

8.15.2.1 Start Up torque

The start-up torque is used to generate torque against the brake so that when the brake is mechanically opened there will be no position change because the drive is already generating the torque needed to keep the load in place.

Settings the start-up torque time is set to -1 means that the start-up torque is removed when the drive notices encoder movement. Setting the time greater than 0 will denote the actual time for how long the start-up torque is applied to the motor even if the motor shaft is already rotating thus making the motor accelerate without control until time has expired.

P2.15.121 CL: Startup torque ID621 "StartUp Torque!"

0 = Not Used

1 = Torque Memory
Torque memory uses the torque that was used by the speed controller last time the drive was in running state. Normally, this is the torque generated when the zero speed time at stop has expired and the drive has stopped modulation or started the flux off delay function.

2 = Torque Reference
The normal torque reference chain is used (expect TorqueStep) for the start-up torque level. This can be used when the external system knows the load on the shaft when brake is released.

3 = Torque Forward/Reverse
Drive uses torque values defined by the start-up torque forward and reverse.

P2.15.122 Start-up torque, forward ID633 "Startup Torq FWD"
Sets the start-up torque for forward direction if selected with parameter Startup Torque.

P2.15.123 Start-up torque, reverse ID634 "Startup Torq REV"
Sets the start-up torque for reverse direction if selected with parameter Startup Torque.

P2.15.124 Start-Up Torque Time ID1371 "Startup Torq Time"
This parameter defines for how long the start-up torque will be used instead of the speed controller output. If the time is set to -1 the drive will automatically start to use the speed controller when speed change is read from encoder. When the setting is >0 the drive will use this defined torque even if speed changes are read from encoder.
8.16 Auto Fault Reset

The Auto reset function tries to reset the fault automatically during the trial time. An individual fault can be defined to be reset certain number of times before the actual fault indication is given. The function will operate as Automatic Restart function if the start command is received as a static signal. In I/O control of the Advance application, the default start function requires a rising edge command after fault trigger.

**P2.16.1 Automatic reset: Wait time ID717 “Wait Time”**

Defines the time for the attempted fault reset after the fault trigger has passed. Note: In case of external fault, remove the cause of fault on the external device. The wait time count starts only when the cause of fault has been removed.

**P2.16.2 Automatic reset: Trial time ID718 “Trial Time”**

The Automatic reset function keeps trying to reset the faults appearing during the time set with this parameter. If the number of faults during the trial time exceed the value of the respective parameter set with ID720 to ID725 a permanent fault is generated.

![Diagram](image)

*Figure 8-18. Example of Automatic restarts with three restarts*

**P2.16.3 Automatic restart: Start function ID719 “Start Function”**

The Start function for restart is selected with this parameter; restart will take place if there is a static Start command active when an automatic fault reset is made.

- 0 = Start with ramp
- 1 = Flying start
- 2 = Start according to Start Function parameter (Default)

The following ‘Number of tries’ parameters determine the maximum number of automatic restarts during the trial time. The time count starts from the first autoreset. If the number of faults occurring during the trial time exceeds the values set by number of tries the fault state becomes active.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.16.4  **Number of tries after undervoltage fault trip**  ID720  “Undervolt. Tries”
This parameter determines how many automatic fault resets can be made during the trial time after undervoltage trip.

0   = No automatic reset  
>0  = Number of automatic fault resets after undervoltage fault.

P2.16.5  **Number of tries after overvoltage trip**  ID721  “Overvolt. Tries”
This parameter determines how many automatic fault resets can be made during the trial time after overvoltage trip.

0   = No automatic fault reset after overvoltage fault trip  
>0  = Number of automatic fault resets after overvoltage fault trip.

P2.16.6  **Number of tries after overcurrent trip**  ID722  “Overcurr. Tries”
(NOTE! IGBT temp faults also included)
This parameter determines how many automatic fault resets can be made during the trial time after overcurrent trip.

0   = No automatic fault reset after overcurrent fault trip  
>0  = Number of automatic fault resets after overcurrent trip, saturation trip and IGBT temperature faults.

P2.16.7  **Number of tries after reference trip**  ID723  “4mA Fault Tries”
This parameter determines how many automatic fault resets can be made during the trial time after 4 mA reference fault.

0   = No automatic fault reset after reference fault trip  
>0  = Number of automatic fault resets after the analogue current signal (4...20mA) has returned to the normal level (≥4mA)

P2.16.8  **Number of tries after motor temperature fault trip**  ID726  “MotTempF Tries”
This parameter determines how many automatic fault resets can be made during the trial time after calculated motor temperature fault trip.

0   = No automatic fault reset after Motor temperature fault trip  
>0  = Number of automatic fault resets after the motor temperature has returned to its normal level

P2.16.9  **Number of tries after external fault trip**  ID725  “Ext. Fault Tries”
This parameter determines how many automatic fault resets can be made during the trial time after external fault trip.

0   = No automatic fault reset after External fault trip  
>0  = Number of automatic fault resets after External fault trip

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.16.10  Number of tries after underload fault trip  ID738 “Underload tries”

This parameter determines how many automatic fault resets can be made during the trial time after underload trip.

0 = No automatic fault reset after Underload fault trip

>0 = Number of automatic fault resets after Underload fault trip
8.17 Keypad control parameters

Unlike the parameters listed above, these parameters are located in the M3 menu of the control keypad. The reference parameters do not have an ID number.

**P3.1 Control Place ID125 “Control Place”**

The active control place can be changed with this parameter.

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

0 = PC Control, Activated by NCDrive
1 = I/O terminal
2 = Keypad
3 = Fieldbus

**R3.2 Keypad Reference No ID “Keypad Reference”**

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

The output frequency can be copied as the keypad reference by pushing the Stop button for 3 seconds when you are on any of the pages of menu M3.

**P3.3 Keypad Direction ID123 “Keypad Direction”**

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

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

**P3.4 Stop button activated ID114 “StopButtonActive”**

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

**R3.5 Torque reference No ID “Torque Reference”**

Define here the torque reference within 0.0...100.0%.

**R3.5 Power reference No ID “Power Reference”**

Define here the power reference within 0.0...100.0%.

**P3.6 License High Speed**

Enter here license key to activate high speed features of this application.

**P3.7 License 2**

Enter here license key to activate 690 Vac unit use in voltage range of 500 Vac unit.
9. IDENTIFICATION FUNCTION FOR PERMANENT MAGNET SYNCHRONOUS MOTOR

PM Motor has several zero positioning identification modes. This chapter explains what kind of identification mode is needed to select when using different kind of hardware configuration.

This chapter is addition to P2.1.9 Identification parameter description and P2.8.5.2 Start Angle Identification mode description.

9.1 Identification with absolute encoder.

When using absolute encoder identification is made only once. Remade is needed if encoder and rotor position changes related to each other.
Motor needs to be able to rotate freely that magnet positions can be identified.
Identification mode in this case is selected by “P2.1.9 Identification” selection “3 / Enc.ID Run”.
During identification drive feeds DC current to motor (~90 % of motor nominal), this causes motor to move zero position, there may be oscillatory movement on the shaft. When identification is successful “P2.8.5.1 PMSM Shaft Position” is updated, if not successful value is set to zero and identification warning is displayed for 10 seconds (W57). If identification is made several times, result may be different; there are as many positions as there are pole pairs in the motor.
Benefit to use absolute encoder is that magnet position is always known thus motor can be fully loaded from the start.

Related parameters:
P2.1.9 Identification ID631
P2.8.5.1 PMSM Shaft Position ID649

9.2 Identification with incremental encoder without Z-pulse input.

When using incremental encoder without Z-pulse, identification is made in every start. Identification mode can be selected by “P2.8.5.2 Start Angle Identification Mode” In this case encoder identification cannot be done because zero position cannot be identified without Z-pulse. But identification P2.1.9 Identification selection “2 / ID With Run” is needed to make. Identification at every start will be automatically active if “P2.8.5.1 PMSM Shaft Position” parameter value is zero.
Best result is get when motor has a mechanical brake that prevents shaft movements. Acceptable result can be achieved also when motor has high load and/or inertia that prevent shaft movements during identification.
Angle identification is done in every start by feeding motor with a DC pulses that identifies magnet position. DC pulses are in two different groups. First one identifies zero position and second one makes polarity check. These DC current levels are adjusted by “P2.8.5.3 Start Angle Identification Current” and “P2.8.5.4 Polarity Pulse current”, respectively.

NOTE: Not all motors are suitable for this identification mode.

Benefit of this mode is that motor can be fully loaded from the start.

Related parameters:
P2.8.5.2 Start Angle Identification Mode ID1691
P2.8.5.1 PMSM Shaft Position ID649
P2.8.5.3 Start Angle Identification Current ID1759
P2.8.5.4 Polarity Pulse current ID1566
9.3 Identification with incremental encoder with Z-pulse input.

When using incremental encoder with Z-pulse, identification is made only once. Remade is needed if encoder and rotor position changes related to each other. Motor needs to be able to rotate freely that magnet positions can be identified. Identification mode in this case is selected by “P2.1.9 Identification” selection “3 / Enc.ID Run”.

During identification drive feeds DC current to motor (~90 % of motor nominal), this causes motor to move to zero position, there may be oscillatory movement on the shaft. When motor oscillatory movement has stopped motor is rotated until Z-pulse is received from the encoder. When identification is successful “P2.8.5.1 PMSM Shaft Position” is updated, if not successful value is set to zero and identification warning is displayed for 10 seconds (W57). If identification is made several times result may be different, there are as many positions as there are pole pairs in the motor.

When motor is started and zero position is not “remembered”: Drive will start to feed DC current to motor (Defined by “P2.8.5.6 I/f Current”) till Z-pulse is received from the encoder. During this DC injection motor may not be able to produce 100 % torque. When running without load Z-pulse position can be seen in the motor current when current goes nearly to zero.

Related parameters:
P2.1.9 Identification
P2.8.5.1 PMSM Shaft Position
P2.8.5.6 I/f Current
### 10. STATUS AND CONTROL WORDS IN DETAIL

#### 10.1 Fieldbus

<table>
<thead>
<tr>
<th>Combination</th>
<th>P7.x.1.4 Operate Mode</th>
<th>P2.13.22 State machine</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 / ProfiDrive</td>
<td>1 / Basic</td>
<td>FB Control and FB Status Word are explained in fieldbus option board manual.</td>
</tr>
<tr>
<td>2</td>
<td>2 / ByPass</td>
<td>2 / ProfiDrive</td>
<td>Control word is ProfiDrive type and explained in this manual. Status Word is can be selected by ID number, default is ProfiDrive type ID65 V1.26.2 FB Status Word. Some fieldbus board operate by default in “ByPass” mode.</td>
</tr>
<tr>
<td>3</td>
<td>2 / ByPass</td>
<td>1 / Basic</td>
<td>Control word is “Three Bit” control. Status Word is can be selected by ID number, default is ProfiDrive type ID65 V1.26.2 FB Status Word.</td>
</tr>
<tr>
<td>4</td>
<td>1 / ProfiDrive</td>
<td>2 / ProfiDrive</td>
<td>Drive cannot be operated in this combination from fieldbus.</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 10.1.1 Combination 1, ProfiDrive – Standard with Profibus option board

#### 10.1.1.1 FB Control Word Combination 1, ProfiDrive – Basic with profibus option board

<table>
<thead>
<tr>
<th>FB Control Word for Profibus in Combination 1</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 STOP 1 (by ramp)</td>
<td>ON 1</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b1 STOP 2 (by cost)</td>
<td>ON 2</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b2 STOP 3 (by ramp)</td>
<td>ON 3</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b3 RUN DISABLE</td>
<td>ENABLE</td>
<td>Use this for start and stop command</td>
<td></td>
</tr>
<tr>
<td>b4 No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b5 No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b6 No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
<td></td>
</tr>
<tr>
<td>b7 No Action</td>
<td>Fault Reset 0 &gt; 1 Use this for fault reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b8 No Action</td>
<td>No Action</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b9 No Action</td>
<td>No Action</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b10 Disable Profibus control</td>
<td>Enable fieldbus control</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b11 Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON</td>
<td>See P2.5.1.17-18</td>
<td></td>
</tr>
<tr>
<td>b12 Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.1.19-20</td>
<td></td>
</tr>
<tr>
<td>b13 Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.1.21-22</td>
<td></td>
</tr>
<tr>
<td>b14 Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.1.23-24</td>
<td></td>
</tr>
<tr>
<td>b15 Fieldbus DIN5=OFF</td>
<td>Fieldbus DIN5=ON</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

#### 10.1.1.2 FB Status Word Combination 1, ProfiDrive – Basic with profibus option board

<table>
<thead>
<tr>
<th>FB Status Word for Profibus in Combination 1</th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Not Ready (initial)</td>
<td>READY 1 (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b1 Not Ready</td>
<td>READY 2 (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b2 DISABLE</td>
<td>ENABLE (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b3 NO FAULT</td>
<td>FAULT ACTIVE</td>
<td>Directly from the drive</td>
<td></td>
</tr>
<tr>
<td>b4 STOP 2</td>
<td>NO STOP 2 (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b5 STOP 3</td>
<td>NO STOP 3 (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b6 START ENABLE</td>
<td>START DISABLE (SM)</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b7 No Warning</td>
<td>Warning</td>
<td>Directly from the drive</td>
<td></td>
</tr>
<tr>
<td>b8 Reference ≠ Actual value</td>
<td>Reference = Actual value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b9 Fieldbus control OFF</td>
<td>Fieldbus control ON</td>
<td>See profibus manual</td>
<td></td>
</tr>
<tr>
<td>b10 Not used</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b11 Not used</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b12 FC Stopped</td>
<td>Running</td>
<td>Directly from the drive</td>
<td></td>
</tr>
<tr>
<td>b13 FC not ready</td>
<td>Ready</td>
<td>Directly from the drive</td>
<td></td>
</tr>
<tr>
<td>b14 Not used</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b15 Not used</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SM = Profibus board State Machine

10.1.2 Combination 2, ByPass – ProfiDrive; State Diagram

Power supply on

S1: Switching On Disabled
SW.B6 = TRUE | B0, B1, B2 = FALSE

S2: Ready For Switching On
SW.B6 = TRUE | B1, B2, B6 = FALSE

S3: Switched On
SW.B0, B1 = TRUE | B2, B6 = FALSE

S4: Operation
SW.B0, B1, B2 = TRUE | B6 = FALSE

S5: Switching Off
SW.B0, B1 = TRUE | B2, B6 = FALSE

Modulation Stopped

CW.B0 = FALSE (OFF)
CW.B1 = TRUE (No Coast Stop)
CW.B2 = TRUE (No Quick Stop)

CW.B0 = FALSE (OFF)
CW.B1 = FALSE (Coast Stop)
CW.B2 = FALSE (Quick Stop)

CW.B3 = TRUE (Enable Operation)
CW.B3 = FALSE (Disable Operation)

CW.B0 = TRUE (ON)
CW.B1 = TRUE (Quick Stop)
CW.B2 = TRUE (Quick Stop)

CW.B0 = FALSE (OFF)
CW.B1 = FALSE (Coast Stop)
CW.B2 = FALSE (Quick Stop)

CW.B0 = TRUE (ON)
CW.B2 = FALSE (Quick Stop)

Quick Stop

Ramp Stop

Modulation Stopped
10.1.2.1 State Machine

Costing Stop

Quick stop

Ready to Switch-On, Operate and Running
## FB Control Word

<table>
<thead>
<tr>
<th>Signal</th>
<th>FB Control Word ID1160</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 ON</td>
<td>0=ON will reset the Switch On Inhibit state and bring the drive to Ready Run. Should be reset after fault, Coast Stop (b1) and Emergency Stop (b2).</td>
</tr>
<tr>
<td>b1 Coasting Stop</td>
<td>0=Coast stop Active 1=Coast stop NOT active</td>
</tr>
<tr>
<td>b2 Quick Stop</td>
<td>0=Quick stop Active 1=Quick stop NOT active</td>
</tr>
<tr>
<td>b3 Start</td>
<td>Normal start command 0=Stop the drive 1=Start the drive</td>
</tr>
<tr>
<td>b4 Ramp Output to Zero</td>
<td>0=Force speed ramp output to zero 1=Release speed ramp output</td>
</tr>
<tr>
<td>b5 Ramp Hold</td>
<td>0=Hold speed ramp output 1=Release speed ramp</td>
</tr>
<tr>
<td>b6 Ramp Input to Zero</td>
<td>0=Force speed ramp input to zero 1=Release speed ramp input</td>
</tr>
<tr>
<td>b7 Fault Reset</td>
<td>0=No Action 1=Reset active faults</td>
</tr>
<tr>
<td>b8 Inching 1</td>
<td>Run the drive with defined constant speed 0=No Action 1=Run with constant speed</td>
</tr>
<tr>
<td>b9 Inching 2</td>
<td>Run the drive with defined constant speed 0=No Action 1=Run with constant speed</td>
</tr>
<tr>
<td>b10 Fieldbus Control Enable</td>
<td>Activate Fieldbus control when P3.1 = Fieldbus 0=Fieldbus Control NOT active 1=Activate Fieldbus Control</td>
</tr>
<tr>
<td>b11 Watch Dog</td>
<td>0=1=0&gt;1...1 sec square wave clock. This is used to check data communication between Profibus master and the drive. Used to generate FB Communication - Fault.</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>

**B00**: FALSE = OFF 1, TRUE = ON 1  
**OFF 1**: Drive will make ramping stop and goes to “Ready to switch-on”. If drive is in “Switch on Inhibit” state this bit is used to reset this status.  
**ON**: Voltage connected to drive and/or DC link charged if drive has the control.

**B01**: FALSE = Coast stop (OFF 2), TRUE = ON 2  
**Coast Stop**: Drive will make coasting stop and goes to “Switch-on Inhibit” state  
**ON 2**: No Coast Stop command

**B02**: FALSE = Quick Stop (OFF 3), TRUE = ON 3  
**Quick Stop**: Drive will make stop function defined by Quick Stop function parameter.  
**ON 3**: No Quick stop command.

**B03**: FALSE = Stop Request, TRUE = Start Request  
**Stop Request**: Drive will make stop defined by stop function.  
**Start Request**: Start Command to the drive.
B04: FALSE = Reset Ramp Generator, TRUE = Enable Ramp Generator
This bit has priority over B05 and B06 in Control Word.
Reset Ramp Generator: Closed Loop: Ramp generator is forced to zero, drive will make stop as fast as possible running against set torque limits or e.g. over voltage controller.
Enable Ramp Generator: Ramp Generator function is enabled.

To activate Jogging function from fieldbus B04, B05 and B06 needs to be zero.

B05: FALSE = Freeze Ramp Generator, TRUE = Unfreeze Ramp Generator
This bit has priority over B06 but not over B05.
Freeze Ramp Generator: Drive will not accept new reference from Fieldbus, drive remain in same speed.
Unfreeze Ramp Generator: Drive will follower reference from Fieldbus.

To activate Jogging function from fieldbus B04, B05 and B06 needs to be zero.

B06: FALSE = Disable Set point, TRUE = Enable Set point
This bit has lowers priority compared to B04 and B05.
Disable Set point: Reference (FW:FreqRef1) is forced to zero, drive will ramp to zero speed
Enable Set point: Drive will follow reference.

To activate Jogging function from fieldbus B04, B05 and B06 needs to be zero.

B07: FALSE = No significance, TRUE = Fault Acknowledge
Fault Acknowledge: The group signal is acknowledged with a positive edge; the drive reaction to a fault depends on the type of fault (refer to *alarm handling in Appendix A.8). If the fault reaction has isolated the voltage, the drive then goes into the "Switching On Inhibited" condition.

10.1.2.3 Jogging function

I/O Jogging Command: Jogging function will start the drive to reference without additional start command regardless of control place when given from IO. Jogging function requires enabling from digital input before command is accepted. Inching is also disabled if there is start command active from active control place. If both inching references are active at the same time drive will stop.
Fieldbus Jogging Command: Jogging command is activated by giving normal start command but the ramp control bits CW.B4, B5 & B6 needs to be zero. Drive needs to be at zero speed before command is accepted and CW.B4, B5 & B6 are active after drive is at zero speed when jogging function is stopped.
**B08**: FALSE = No Function, TRUE = Jogging 1

**Inching 1**: Drive follows reference set by Jogging Ref 1. Function needs to separately activated by Aux Control Word or by digital input Enable Jogging when IO control used for Jogging.

**B09**: FALSE = No Function, TRUE = Inching 2

**Inching 2**: Drive follows reference set by Jogging Ref 2. Function needs to separately activated by Aux Control Word or by digital input Enable Jogging when IO control used for Jogging.

**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 P2.12.10.3 FB WD Delay. When value is zero pulse is not monitored.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### FB Status Word ID65

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Ready to switch On</td>
<td>0=The drive NOT ready to switch ON</td>
</tr>
<tr>
<td></td>
<td>1=The drive is ready to switch ON</td>
</tr>
<tr>
<td>b1 Ready to Operate</td>
<td>0=The drive is NOT ready to run</td>
</tr>
<tr>
<td></td>
<td>1=The drive is ready to run</td>
</tr>
<tr>
<td>b2 Running</td>
<td>0=The drive is NOT running</td>
</tr>
<tr>
<td></td>
<td>1=The drive is running and ready to release the reference</td>
</tr>
<tr>
<td>b3 Fault Active</td>
<td>0=No fault active</td>
</tr>
<tr>
<td></td>
<td>1=Fault IS active</td>
</tr>
<tr>
<td>b4 Cost Stop NOT active</td>
<td>0=Coast stop active</td>
</tr>
<tr>
<td></td>
<td>1=Coast stop NOT active</td>
</tr>
<tr>
<td>b5 EM Stop not Active</td>
<td>0=Emergency stop active</td>
</tr>
<tr>
<td></td>
<td>1=Emergency stop NOT active</td>
</tr>
<tr>
<td>b6 Switch On Inhibit</td>
<td>0=No Inhibit</td>
</tr>
<tr>
<td></td>
<td>1=The drive is out of fault and coast / emergency stop state.</td>
</tr>
<tr>
<td>b7 Warning</td>
<td>0=NO alarm</td>
</tr>
<tr>
<td></td>
<td>1=Alarm IS active</td>
</tr>
<tr>
<td>b8 Speed At Ref</td>
<td>0=Speed actual is NOT equal to speed reference</td>
</tr>
<tr>
<td></td>
<td>1=Speed actual is equal to speed reference</td>
</tr>
<tr>
<td>b9 FB Control Active</td>
<td>0=Fieldbus Control NOT active</td>
</tr>
<tr>
<td></td>
<td>1=Fieldbus Control active</td>
</tr>
<tr>
<td>b10 Above Limit</td>
<td>Indicate if speed actual is below the limit P2.4.16</td>
</tr>
<tr>
<td></td>
<td>0=Speed actual is below the speed limit</td>
</tr>
<tr>
<td></td>
<td>1=Speed actual is above the speed limit</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 Watch Dog Feedback</td>
<td></td>
</tr>
</tbody>
</table>

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

**Not Ready to Switch On:**
- Power supply is switched on, electronics initialized, main contactor, if available, has dropped out, pulses are inhibited.

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

**Not Ready To Operate:**
- **Ready To Operate:**

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

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

**Drive is operational:** Drive is in run state and modulating. Also rotor fulx is ready and brake is opened if feedback signal is sued.

**B03: FALSE = No Fault, TRUE = Fault Present**

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

**Fault Present:** Drive is in fault state.
B04: FALSE = Coast Stop Activated, TRUE = Coast Stop Not Activated
Coast Stop Activated: "Coast Stop (OFF 2)" command is present.
Coast Stop Not Activated: Coast stop command is not active.

B05: FALSE = Quick Stop Activated, TRUE = Quick Stop Not Activated
Quick Stop Activated: "Quick Stop (OFF 3)" command is present.
Quick Stop Not Activated: Quick stop command is not active.

B06: FALSE = Switching On Not Inhibit, TRUE = Switching On Inhibited
Switching On Not Inhibit: The drive goes only again in the "Switched On" condition with "No Coast Stop AND No Quick Stop" followed by "ON". This means that the "Switching On Inhibited" bit is only set back to zero if the OFF command is set after "No Coast Stop AND No Quick Stop".

B07: FALSE = No Warning, TRUE = Warning Present
No Warning: There is no warning or the warning has disappeared again.
Warning Present: Drive still works; warning in the service/maintenance parameter; no acknowledgement.

B08: FALSE = Speed Error Out Of Tolerance Range, TRUE = Speed Error Within Tolerance Range
Speed Error Out Of Tolerance Range:
Speed 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 = f Or n Not Reached, TRUE = f Or n Reached Or Exceeded
f Or n Not Reached: Speed is below P2.6.4.5 Above Speed Limit.
f Or n Reached Or Exceeded: Speed is above P2.6.4.5 Above Speed Limit.

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 use to monitor communication status from the drive.
### 10.1.3 Combination 3, ByPass – Basic

#### 10.1.3.1 FB Control Word Combination 3, ByPass – Basic

<table>
<thead>
<tr>
<th></th>
<th>Main Control Word for Profibus in Combination 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>STOP START</td>
</tr>
<tr>
<td>b1</td>
<td>Clockwise Counter clockwise</td>
</tr>
<tr>
<td>b2</td>
<td>No action FAULT RESET (0 -&gt; 1)</td>
</tr>
<tr>
<td>b3</td>
<td>FB DIN1 FB DIN1</td>
</tr>
<tr>
<td>b4</td>
<td>FB DIN2 FB DIN2</td>
</tr>
<tr>
<td>b5</td>
<td>FB DIN3 FB DIN3</td>
</tr>
<tr>
<td>b6</td>
<td>FB DIN4 FB DIN4</td>
</tr>
<tr>
<td>b7</td>
<td>FB DIN5 FB DIN5</td>
</tr>
<tr>
<td>b8</td>
<td>Not used</td>
</tr>
<tr>
<td>b9</td>
<td>Not used</td>
</tr>
<tr>
<td>b10</td>
<td>Not used</td>
</tr>
<tr>
<td>b11</td>
<td>Not used</td>
</tr>
<tr>
<td>b12</td>
<td>Not used</td>
</tr>
<tr>
<td>b13</td>
<td>Not used</td>
</tr>
<tr>
<td>b14</td>
<td>Not used</td>
</tr>
<tr>
<td>b15</td>
<td>Not used</td>
</tr>
</tbody>
</table>

#### 10.1.3.2 FB Status Word Combination 3, ByPass – Basic

Most of the field busses use “MCStatus” as Status word that is shown below. For profibus it can be selected what is the status word, default is Combination 2 Status Word, ProfiDrive type ID68 V1.3.2 MainStatusWord. Below Status Word can be selected with P2.10.17 GSW Data by setting it to ID64

<table>
<thead>
<tr>
<th></th>
<th>FB Status Word for Profibus in Combination 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Not Ready READY</td>
</tr>
<tr>
<td>b1</td>
<td>STOP RUN</td>
</tr>
<tr>
<td>b2</td>
<td>Clockwise Counter clockwise</td>
</tr>
<tr>
<td>b3</td>
<td>NO FAULT FAULT ACTIVE</td>
</tr>
<tr>
<td>b4</td>
<td>No Warning Warning</td>
</tr>
<tr>
<td>b5</td>
<td>Reference ≠ Actual value Reference = Actual value</td>
</tr>
<tr>
<td>b6</td>
<td>Speed &gt; Zero At Zero Speed</td>
</tr>
<tr>
<td>b7</td>
<td>Flux Not Ready Flux Ready</td>
</tr>
<tr>
<td>b8</td>
<td>TC Speed Limit Active TC Speed Limit Not Active</td>
</tr>
<tr>
<td>b9</td>
<td>Detected Encoder Direction Clockwise Encoder Direction Counter clockwise</td>
</tr>
<tr>
<td>b10</td>
<td>UV Fast Stop Active UV Fast Stop Not Active</td>
</tr>
<tr>
<td>b11</td>
<td>Not used Not used</td>
</tr>
<tr>
<td>b12</td>
<td>Not used Not used</td>
</tr>
<tr>
<td>b13</td>
<td>Not used Not used</td>
</tr>
<tr>
<td>b14</td>
<td>Not used Not used</td>
</tr>
<tr>
<td>b15</td>
<td>Not used Not used</td>
</tr>
</tbody>
</table>

SM = Profibus board State Machine
11. PROBLEM SOLVING

While proper information is needed for the problem, it’s also recommended to try with latest application- and system software versions available. Software is continuously developed and default settings are improved.

<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 1</td>
<td>20683</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Torque</td>
<td>3.5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Value</td>
<td>Current</td>
<td>4.5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Value</td>
<td>FieldReference</td>
<td>37.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>DC Voltage</td>
<td>550</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td>Value</td>
<td>Output Frequency</td>
<td>37.35</td>
<td>Hz</td>
<td>86.00</td>
</tr>
<tr>
<td>Value</td>
<td>Shaft Frequency</td>
<td>37.27</td>
<td>Hz</td>
<td>86.00</td>
</tr>
<tr>
<td>Value</td>
<td>Motor Voltage</td>
<td>293.4</td>
<td>V</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*Figure 1. Recommended signals for NCDrive.*

Use the fastest communication speed (Baudrate: 57600) and a 50 ms update interval for signals for the RS232 communication.

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

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

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

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

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

*Figure 2. Datalogger window opening and Service Info upload.*
12. FAULT CODES

F1 Overcurrent fault
Drive has detected a high current in the output phase.

S1 = Hardware trip: Current above 4*Ih
S2 = Only in NXS unit
S3 = Current controller supervision. Current limit too low or current peak value too high.

Possible cause and solutions
1. Sudden increase in load
   • Check motor load.
2. Short circuit in motor cables
   • Check motor and cables.
3. Motor is undermagnetized at start.
   • Make identification run
4. Unsuitable motor
5. Sine filter is used but drive settings are not correct
   • Activate Sine filter parameter (P6.7.5) in system menu

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
1. Too short a deceleration time
   • Increase deceleration time.
   • Use brake chopper and brake resistor.
   • Use Brake chopper unit.
   • Use active front end unit (AFE ARFIFF02).
   • Activate overvoltage controller.
2. High overvoltage spikes in supply
   • Activate overvoltage controller.
3. 690 V unit operating too long above 1100 Vdc
   • Check input voltage.

F3 Earth fault
Earth fault protection ensures that the sum of the motor phase currents is zero. The overcurrent protection is always working and protects the frequency converter from earth faults with high currents.

S1 = Sum of motor current is not zero

Possible cause and solutions
1. Insulation failure in cables or motor
   • Check motor cables and motor.
F5  Charge switch
Charge switch status is not correct when start command is given.

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

Possible cause and solutions
1. Charge switch was open when the START command was given.
   - Check connection of the feedback from charging relay
   - Reset the fault and restart.

Should the fault re-occur, 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
1. If there is a brake chopper in use
   - Check the isolation resistance and the resistance on the brake resistor.
2. FR4-FR8: Power module
   - Measure the power module directly from its terminals.
3. Hardware
   - Check the capacitors.

F8  System Fault
A system fault indicates several different fault situations in drive operation.

S1  = Reserved
   - Disturbance. Reset the unit and try again.
   - If there is star coupler in the unit, check the fibre connections and phase order.
   - Driver board or IGBT broken.
   - FR9 and the bigger size drives, which includes not star coupler, ASIC board (VB00451) is broken.
   - FR8 and smaller size drives: control board broken.
   - FR8 and smaller size drives: if there is boards VB00449 / VB00450 in use, failure might be in there.

S2  = Reserved
S3  = Reserved
S4  = Reserved
S5  = Reserved
S6  = Reserved
S7  = Charge switch
S8  = No power to driver card
S9  = Power unit communication (TX)
S10 = Power unit communication (Trip)
S11 = Power unit comm. (Measurement)
S12 = SystemBus synchronization has failed in DriveSynch operation
S30 = Safe disable inputs are in different state (OPT-AF)
S31 = Thermistor short circuit detected (OPT-AF)
S32 = OPT-AF board has been removed
S33 = OPT-AF board EEPROM error

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
F9  Undervoltage fault
DC-link voltage is below the fault voltage limit of the drive.

S1 = DC-link too low during run
S2 = No data from power unit
S3 = Undervoltage control supervision

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

Correcting measures
- In case of temporary supply voltage break, reset the fault and restart the frequency converter.
- Check supply voltage.
- Check function of DC charge.
- Contact your local distributor.

F10  Input line supervision
S1 = Phase supervision diode supply
S2 = Phase supervision active front end

Possible cause:
1. Input line phase is missing.

Correcting measures
- Check supply voltage, fuses and cable.

F11  Output phase supervision
Current measurement has detected that there is no current in one phase or one phase current is considerably different from other phases.

Correcting measures
- Check motor cable and motor.

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:
1. No brake resistor installed.
2. Brake resistor is broken.

Correcting measures:
- Check brake resistor and cabling.
- If these are ok the chopper is faulty. Contact your local distributor.
**F13 Drive undertemperature fault**

Possible cause:
1. Heatsink temperature is under -10°C

**F14 Drive overtemperature fault**

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

Correcting measures
- 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.

**F15 Motor Stalled**

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

- Check motor and load.

**F16 Motor over temperature**

Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.

Possible cause:
1. Motor load is too high.
2. Motor values are set incorrectly.

Correcting measures:
- Decrease motor load.
- If no motor overload exists, check the temperature model parameters.

**F17 Motor underload fault**

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.

The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5Hz (the underload time counter is stopped).

The torque values for setting the underload curve are set in percentage which refers to the nominal torque of the motor. The motor’s name plate data, parameter motor nominal current and the drive’s nominal current $I_H$ are used to find the scaling ratio for the internal torque value.

Correcting measures:
- Check load.
F22  **EEPROM checksum fault**
Possible cause:
1. Parameter save fault
2. Faulty operation
3. Component failure

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

F24  **Counter fault**
Possible cause:
1. Values displayed on counters are incorrect

Correcting measures:
- Have a critical attitude towards values shown on counters.

F25  **Microprocessor watchdog fault**
Possible cause:
1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to the drive.

Correcting measures:
- Reset the fault and restart.
- Should the fault re-occur, contact your local distributor.

F26  **Start-Up prevention**
Possible cause:
1. Start-up of the drive has been prevented.
2. Run request is ON when a new application is loaded to drive

Correcting measures:
- Cancel prevention of 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:
1. Motor is overheated.
2. Thermistor cable is broken.

Correcting measures:
- Check motor 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:
1. Too high load
2. Identification run has not been made which causes the motor to start undermagnetized.

Correcting measures:
- Check load.
- Check motor size.
- Make identification Run.

F32  Fan cooling
Possible cause:
1. Cooling fan of the frequency converter does not start when ON command is given.

Correcting measures:
- Contact your local distributor.

F37  Device change
Option board or power unit changed.

Possible cause:
1. New device of same type and rating.

Correcting measures:
- Reset. Device is ready for use.

F38  Device added
Option board added.

Correcting measures:
- Reset. Device is ready for use. Old board settings will be used.

F39  Device removed
Option board removed.

Correcting measures:
- Reset. Device no longer available.

F40  Device unknown
Unknown option board or drive.

S1 = Unknown device
S2 = Power1 not same type as Power2

Correcting measures:
- Contact the distributor near to you.
F41  IGBT temperature
IGBT inverter bridge overtemperature protection has detected too high a short term overload current.

- Check load.
- Check motor size.
- Make Identification run.

F42  Brake resistor overtemperature
S1: Brake resistor high temperature
Calculation for 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

F43  Encoder fault
Encoder fault is issued when the drive is not able to operate in closed loop control mode (encoder is used). See subcodes for details for the reason of the fault:

S1 = Encoder 1 channel A is missing
S2 = Encoder 1 channel B is missing
S3 = Both encoder 1 channels are missing
S4 = Encoder reversed
S5 = Encoder board missing
S6 = Serial communication fault
S7 = Ch A / Ch B Mismatch
S8 = Resolver/Motor polepair mismatch
S9 = Missed Start Angle
This fault comes when using PMS motor.

1. Modulation type is ASIC while incremental encoder is used.
   - Change modulator type to Software 1
2. Start identification do not work due low identification current
   - Increase identification current
3. Start angle identification is not working at all because there is no saturation based saliency in the motor
   - Use absolute encoder
4. There are too much noise pick-ups in encoder cable
   - check encoder cable shield and grounding in drive

F44  Device changed (Default param.)
Possible cause:
1. Option board or power unit changed.
2. New device of different type or different rating from the previous one.

Correcting measures:
- Reset
- Set the option board parameters again if option board was changed. Set converter parameters again if power unit was changed.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
F45  Device added (default param.)
Possible cause:
1. Option board of different type added.

Correcting measures:
• Reset
• Set the option board parameters again.

F50  4mA supervision
Possible cause:
1. Current at the analogue input is below 4mA.
2. Signal source has failed
3. Control cable is broken or loose

Correcting measures:
• Check the current loop circuitry.

F51  External fault
Possible cause:
1. Digital input fault.

Correcting measures:
• Remove fault situation from external device.

F52  Keypad communication
Possible cause:
1. The connection between the control keypad or NCDrive and the AC drive is broken.

Correcting measures:
• Check keypad connection and possible keypad cable.

F53  Fieldbus communication
Possible cause:
1. The data connection between the fieldbus Master and the fieldbus board is broken.

Correcting measures:
• Check installation.
• If installation is correct contact the nearest Vacon distributor.

F54  Slot fault
Possible cause:
1. Defective option board or slot

Correcting measures:
• Check board and slot.
• Contact the nearest Vacon distributor.
Temperature sensor board 1 fault
Temperature protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. Advance application supports two temperature sensor boards simultaneously. One can be used for the motor winding and the other for the motor bearings.

A1 – Temperature limit has been exceeded.
A2 – Sensor not wired or not working.
A3 – Short circuit.

Possible cause:
1. Temperature limit values set for the temperature board parameters have been exceeded

Correcting measures:
- Find the cause of temperature rise
- Check sensor wiring

Identification
Identification run has failed.
Possible cause:
1. There was load on the motor shaft when making the identification run with rotating motor.
2. Motoring or generator side torque/power limits are too low to achieve a stable run.

Correcting measures:
- Run command was removed before identification was ready
- Motor is not connected to the AC drive.
- There is load on the motor shaft.

Mechanical brake
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 mechanical brake.

SystemBus communication
The master drive sends pulses to all follower drives. If the pulses are missing a system bus communication fault is generated. The master drive also receives pulses back from the follower drives (max. four drives) and generates warnings if pulses are missing.

SystemBus communication is broken between master and follower.

Correcting measures:
- Check expander board parameters.
- Check optical fibre.
- Check option board jumpers.
F60 Cooling
Protection for the liquid-cooled units. An external sensor is connected to the drive (DI: Cooling Monitor) to indicate if cooling liquid is circulating. If the drive is in Stop state only a warning is issued. In Run state a fault is issued and the drive makes a coast stop.

   Possible cause:
   1. Liquid cooled drive cooling circulation have been failed

   Correcting measures:
   • Check reason for cooling failure from external system.

F61 Speed Error
Speed error monitoring function compares the encoder frequency and the ramp generator output. This function is used with PMS motors to detect if the motor is out of synchronization or to disable open loop function that uses encoder speed for slip compensation. The slip compensation is disabled regardless of the response and needs to be re-activated once speed error is detected (set parameter again or power down the drive).

   Possible cause:
   1. Motor speed is not the same as the reference. For example, motor speed is limited by torque limit.
   2. PMS motor has gone off synchronization.
   3. Encoder cable is broken.

F62 Run Disabled
Run Disable warning signal is issued when Run Enable signal has been removed from the IO.

F63 Emergency stop (Not implemented)
Possible cause:
   1. A command has been given from a digital input or the fieldbus to make an emergency stop.

   Correcting measures:
   • New run command is accepted after the emergency stop is reset.

F64 Input switch open (Not implemented)
Possible cause:
   1. Drive input switch is opened

   Correcting measures:
   • Check the main power switch of the drive.
**F65 Temperature sensor board 2 fault**

Temperature protection function is used to measure temperature and give warning and/or fault when set limits are exceeded. Advance application supports two temperature sensor boards simultaneously. One can be used for the motor winding and the other for the motor bearings.

- **A1** – Temperature limit has been exceeded.
- **A2** – Sensor not wired or not working.
- **A3** – Short circuit.

Possible cause:
2. Temperature limit values set for the temperature board parameters have been exceeded

Correcting measures:
- Find the cause of temperature rise
- Check sensor wiring

**F74 Follower fault**

When using the normal master follower function this fault code is given if one or more follower drives trip to fault.

**F80 Synch Fault**

PM motor has fall out of synchronization