VACON® NX
AC DRIVES

Line Synchronization II
APFIFF44
APPLICATION MANUAL
VACON LINE SYNCHRONIZATION II APPLICATION MANUAL

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1. LINE SYNCHRONIZATION-II APPLICATION

Software AP TIFF44

1.1 Introduction

A purpose of AP TIFF44 Line Sync Application is to operate as a smooth soft starter.

This application is mend to run a motor to net frequency and make contactor change so that the motor is running directly from the network. This application supports up to eighth motors with own I/O. The motors used can be of different sizes but the nominal voltage needs to be the same with all motors. Line synchronization itself does not need additional chokes in output due to advanced control. The drive can compensate for delays which are faced in contactors.

1.2 General

This application is not considered to be backwards combatable. Read the application change note or the chapter in this application manual, “Version parameter compatibility issues” to see what needs to be noted when updating the application. See also updated parameter description from NCDrive when making commissioning.

- The digital inputs and all the outputs are freely programmable and the application supports all I/O-boards

Additional functions:

- Line voltage monitoring
- Line frequency monitoring
- DC voltage monitoring
- CANOpen I/O communication monitoring
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Auto fault reset function
- Power limit functions
- Different power limits for motoring and generating side
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Possibility to connect the FB Process data to any parameter and some monitoring values

The parameters of the LineSynch Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.
1.3 Connection example
1.4 OPT-D7

OPTD7 is an AC sinusoidal voltage measurement board used with Vacon NXP drives. Using this board, VACON NXP drive measures the line voltage, frequency and voltage angle.

Vacon NXP can compare this information with its output voltage angle when it is running. This feature can be used to make synchronizations to grid that is measured.

A purpose of APFIFF44 Line Sync Application is to operate as a smooth soft starter.

The OPT-D7 board is delivered with the transformer which is suitable for voltage range up to 690 Vac.

Please note that the transformer cannot be used with the pulse width modulated (PWM) voltage input.

It is possible to use custom built transformer when the input voltage to be measured is not within the OPT-D7 transformer voltage range. The transformation ratio parameter then can be adjusted as per the transformer primary to secondary ratio. See details from OPT-D7 user manual.
2. LINE SYNCHRO GENERAL

2.1 Purpose
This application is meant to run motor to net frequency and make contactor change that motor is running directly from network. Also synchronization to backwards is possible. Drive will synchronize to grid without motor and makes a change to drive control. Application presentation is available from Vacon product managers.

2.2 Operation
The drive measures line voltage frequency and angle. When there is no synchronization command, the application works as a normal Multi-Purpose application.

2.2.1 To Net
When synchronization command is given [P:ActiveSynchro (DI:HIGH)], frequency reference is changed to net voltage frequency. When voltage frequency is within 0,10 Hz hysteresis with network voltage frequency the drive will make small adjustments to frequency reference so that line voltage angle and FC voltage angle are the same with given offset [P:PhaseOffSetToNet].

The drive remains at this synchronization until the command to end synchronization is given or the command to change network is given [P:ActiveDirect] (DI:HIGH). When the command to go to the network net is given (which can be given at the same time as synchronization command) the application checks for 40 ms that [P:PhaseHyst] is correct for change. When an internal decision is made:

- The drive stops modulation within given delay [P:DelayToCoasting].
- The drive opens FC contactor within given delay [P:DelayToOpen].
- The drive closed NET contactor within given delay [P:DelayToClose].

Drive remains in stop state until:

1. SingleMotorControl [P: ControlMode =0 / Single Motor]
   - [P:ActiveDirect] (DI:LOW).

2. MultiMotorControl: [P: ControlMode =1 - 3 / MultiMotor, InSecuence]
   - Controller motor is changed:[P:ControlledMotor].
   - Controlled motor control status is reset [P: Reset Direct]

2.2.2 To FC with flying start
When controlled motor is in net:
Drive waits for back to FC command [ResetDirect (HIGH)] or [ActiveDirect (LOW)].
When command is given drive and start command is active:

- Opens Net contactor immediately.
- Closes FC Contactor within half of [P:StartDelayToFC] time.
- Makes start within [P:StartDelayToFC] time. (Note restart delays)

Depending on the status of [P:ActiveSynchro], the drive will keep synchronization on start or follow the given reference.
Is start command is not active NET contactor is opened without starting modulation.
2.2.3 To FC with Synchronization (BackSynch)

When controlled motor is connected to NET and P:SynchToMotor is active:
Keep or give drive a start command and keep Synchronization command active.
Now drive waits command to reset DOL.
When DOL Reset command is given:

- Drive starts directly to grid frequency (motor frequency).
  - FC Contactor is open
  - NET Contactor is closed.
- Makes synchronization to grid phase angle.
- When Frequency and angle is within hysteresis decision to make the change is done.
- Depending on timing
  - FC Contactor is closed.
  - NET Contactor is opened
- After this synchronization command can be removed and drive will follow normal frequency reference.

2.2.4 Contactors and breakers

Breakers and contactors mechanical timing can change over time. Thus readjustment of timing may be needed.

It has been noticed that in some system where BackSynch feature has been used that after few months’ breakers or contactors timing has been changed considerably.

When in initial commissioning, motor was without current about 6 ms, changeover was happening without problem.

Few months after initial commissioning, over current faults started to happen. When analysing data logger and oscilloscope information, it was notices that motor was now without current about 30 ms. This was causing angle to change so much that when FC contactor was closed over current trip limit was reached.

It’s recommended to check/readjust contactor delays after three months and/or six months and and after that every twelve months to assure proper operation of synchronization.

Vacon do not take responsibility of contactor/breakers timing changes over time.

2.2.5 Motors

For line synchronization it’s recommended to select motors that have relatively high slip frequency. When motor has a high slip frequency change overs are easier to adjust. Low slipmotors require more accurate timing.
2.3 Timing

- **t1:** Application makes decision to change to the network, command to open FC contactor is given.
- **t2:** Drive stops modulation after delay \( P: \text{DelayToCoasting} \).
  - a. Motor BEM voltage starts to decrease.
  - b. Motor current goes to zero.
  - c. FC sees motor BEM voltage
- **t3:** FC Contactor is mechanically open.
  - d. FC does not see motor voltage.
- **t4:** NET contactor is mechanically closed
  - e. Motor voltage is the same as line voltage
  - f. Current goes to motor.

\[ \Delta t1 = \text{DelayToCoasting} \]
\[ \Delta t2 = \text{DelayToOpen} + \text{contactor mechanical delay} \]
\[ \Delta t3 = \text{DelayToClose} + \text{contactor mechanical delay} \]
2.4 Phase Offset To Net

![Diagram showing Line voltage and FC voltage with Phase Offset To Net marked]

2.5 Phase Hysteresis

![Diagram showing Voltage angle reference and FC voltage hysteresis area with 2 x Phase Hysteresis marked]
2.6 Commissioning

During commission delay parameters should be set according to these rules:
- The drive should not be in run state when NET contactor is closed.
- The FC Contactor should not open until the drive is in stop state.
- NET and FC contactors can be closed at the same time for a short period if the drive is not modulating.

During commissioning the following issues needs to be understood:
- Contactor delays may be from 3 ms up to 700 ms.
- NET and FC contactor delays may fluctuate from each other.
- Closing and opening delays may fluctuate.
- Contactor times may fluctuate even if application has same settings.

Use of interlocks:
- The NET contactor cannot have an interlock from FC contactor.
  - What can be used momentarily if contactor delays are not known.
- The FC Contactor can have an interlock from net contactor.
- If DOL thermal protection is used this trip should be connected to ByPass interlock and any situation that can cause motor input to interrupt.

Commissioning steps:

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
1. Use oscilloscope during commissioning.
   a. Motor current
   b. Line voltage
   c. FC Voltage
   d. Motor voltage
2. Make sure that the drive sees line voltages and frequency correctly.
   a. V1.25.1 Line (main) voltage.
      i. Only above 90% of motor nominal voltage is accepted.
   b. V1.25.2 Line frequency voltage
      i. Only positive frequency is accepted
3. Make sure that the direction of FC and NET is the same when synchronized.
   a. Measure voltage between two phases from drive output and motor DOL input.
4. Make test runs without any load on motor shaft, if possible.
5. When the timing of system is known
   a. Increase the coasting delay near the time when the FC contactor is mechanically open.
   b. Decrease or Increase Net contactor delays so that the opening of FC and the closing of Net contactor happens right after modulation stops.
      i. You may need to increase the modulation stop and FC opening delay if NET contactor closing delay is long.
6. Recommended time for no current situation is about 20 ms.
   a. Half of a cycle (5 ms) is the minimum due contactors aging.
7. Change [P: PhaseOffsetToNet] so that the motor BEM voltage and line voltage are at the same position when the line contactor is mechanically closed.

**TIP:**
Adjusting field weakening point voltage higher so that motor BEM voltage is the same as line voltage at the moment of closing the NET contactor this may decrease current spike.
3. VERSION PARAMETER COMPATIBILITY ISSUES
   - No compatibility issues
4. CONTROL I/O

Reference potentiometer 1...10 kΩ

<table>
<thead>
<tr>
<th>OPTA1</th>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+10V+</td>
<td>Reference voltage output</td>
<td>Voltage for potentiometer, etc.</td>
</tr>
<tr>
<td>2</td>
<td>A1+</td>
<td>Analogue input 1.</td>
<td>Analogue input 1 frequency reference.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range 0-10V, R&lt;sub&gt;i&lt;/sub&gt;=200Ω</td>
<td>Input range selected by jumpers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range 0-20 mA R&lt;sub&gt;i&lt;/sub&gt;=250Ω</td>
<td>Default range: Voltage 0 – 10 V</td>
</tr>
<tr>
<td>3</td>
<td>A1-</td>
<td>I/O Ground</td>
<td>Ground for reference and controls</td>
</tr>
<tr>
<td>4</td>
<td>A2+</td>
<td>Analogue input 2.</td>
<td>Analogue input 2 frequency reference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range 0-10V, R&lt;sub&gt;i&lt;/sub&gt;=200Ω</td>
<td>Input range selected by jumpers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range 0-20 mA R&lt;sub&gt;i&lt;/sub&gt;=250Ω</td>
<td>Default range: Current 0 – 20 mA</td>
</tr>
<tr>
<td>6</td>
<td>+24V+</td>
<td>Control voltage output</td>
<td>Voltage for switches, etc. max 0.1 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTA2</th>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>AQA1+</td>
<td>Analogue input 1.</td>
<td>Analogue input 1 frequency reference</td>
</tr>
<tr>
<td>19</td>
<td>AQA1-</td>
<td>Programmable G2.3.1.2</td>
<td>Programmable logic P2.2.1</td>
</tr>
<tr>
<td>20</td>
<td>DOA1</td>
<td>Digital output</td>
<td>Programmable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open collector, I&lt;sub&gt;C&lt;/sub&gt;≤50mA, U&lt;sub&gt;CC&lt;/sub&gt;≤48 VDC</td>
<td></td>
</tr>
</tbody>
</table>

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

Note: See Users 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

- CMA connected to GND
- CMB connected to GND
- CMA isolated from GND
- CMB 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 19.

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).

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.
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. LINESYNCH 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 167.

Column explanations:

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.1</td>
<td>Output frequency</td>
<td>Hz</td>
<td>1</td>
<td>Output frequency to motor</td>
</tr>
<tr>
<td>V1.2</td>
<td>Frequency reference</td>
<td>Hz</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>2</td>
<td>Motor speed in rpm</td>
</tr>
<tr>
<td>V1.4</td>
<td>Motor current</td>
<td>A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>V1.5</td>
<td>Motor torque</td>
<td>%</td>
<td>4</td>
<td>In % of Motor nominal torque</td>
</tr>
<tr>
<td>V1.6</td>
<td>Motor Input Power</td>
<td>kW</td>
<td>5</td>
<td>With one decimal accuracy</td>
</tr>
<tr>
<td>V1.7</td>
<td>Motor voltage</td>
<td>V</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>V1.8</td>
<td>DC link voltage</td>
<td>V</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>V1.9</td>
<td>Unit temperature</td>
<td>°C</td>
<td>8</td>
<td>Heatsink temperature</td>
</tr>
<tr>
<td>V1.10</td>
<td>Motor temperature</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>13</td>
<td>Al1</td>
</tr>
<tr>
<td>V1.12</td>
<td>Analogue input 2</td>
<td>%</td>
<td>14</td>
<td>Al2</td>
</tr>
<tr>
<td>V1.13</td>
<td>Analogue input 3</td>
<td>%</td>
<td>27</td>
<td>Al3</td>
</tr>
<tr>
<td>V1.14</td>
<td>Analogue input 4</td>
<td>%</td>
<td>28</td>
<td>Al4</td>
</tr>
<tr>
<td>V1.15</td>
<td>Analogue Out 1</td>
<td>%</td>
<td>26</td>
<td>AO1</td>
</tr>
<tr>
<td>V1.16</td>
<td>Analogue Out 2</td>
<td>%</td>
<td>50</td>
<td>AO2</td>
</tr>
<tr>
<td>V1.17</td>
<td>Analogue Out 3</td>
<td>%</td>
<td>51</td>
<td>AO3</td>
</tr>
<tr>
<td>V1.18</td>
<td>DIN1, DIN2, DIN3</td>
<td></td>
<td>15</td>
<td>Digital input statuses</td>
</tr>
<tr>
<td>V1.19</td>
<td>DIN4, DIN5, DIN6</td>
<td></td>
<td>16</td>
<td>Digital input statuses</td>
</tr>
<tr>
<td>V1.20</td>
<td>Torque reference</td>
<td>%</td>
<td>18</td>
<td>Used Torque Reference</td>
</tr>
<tr>
<td>V1.21</td>
<td>Measured temperature</td>
<td>°C</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>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>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.23.1</td>
<td>Current</td>
<td>A</td>
<td>113</td>
<td>Unfiltered motor current</td>
</tr>
<tr>
<td>V1.23.2</td>
<td>Torque</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>44</td>
<td>Unfiltered DC link voltage</td>
</tr>
<tr>
<td>V1.23.4</td>
<td>Status Word</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>V1.23.5</td>
<td>Measured temperature 1</td>
<td>Cº</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>V1.23.6</td>
<td>Measured temperature 2</td>
<td>Cº</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>V1.23.7</td>
<td>Measured temperature 3</td>
<td>Cº</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>V1.23.8</td>
<td>Measured temperature 4</td>
<td>Cº</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>V1.23.9</td>
<td>Measured temperature 5</td>
<td>Cº</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>V1.23.10</td>
<td>Measured temperature 6</td>
<td>Cº</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>V1.23.11</td>
<td>Analogue input 1</td>
<td>%</td>
<td>59</td>
<td>AI1</td>
</tr>
<tr>
<td>V1.23.12</td>
<td>Analogue input 2</td>
<td>%</td>
<td>60</td>
<td>AI2</td>
</tr>
<tr>
<td>V1.23.13</td>
<td>Analogue input 3</td>
<td>%</td>
<td>61</td>
<td>AI3</td>
</tr>
<tr>
<td>V1.23.14</td>
<td>Analogue input 4</td>
<td>%</td>
<td>62</td>
<td>AI4</td>
</tr>
<tr>
<td>V1.23.15</td>
<td>Final Frequency Reference</td>
<td>Hz</td>
<td>1131</td>
<td></td>
</tr>
<tr>
<td>V1.23.16</td>
<td>Output power</td>
<td>kW</td>
<td>1508</td>
<td>Drive output power in kW</td>
</tr>
<tr>
<td>V1.23.17</td>
<td>Flux Current</td>
<td>%</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>V1.23.18</td>
<td>ID Run Status</td>
<td></td>
<td>49</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>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.24.1</td>
<td>FB Control Word</td>
<td></td>
<td>1160</td>
<td></td>
</tr>
<tr>
<td>V1.24.2</td>
<td>FB Status Word</td>
<td></td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>V1.24.3</td>
<td>FB Torque Reference</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>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>47</td>
<td>Default Control of FB PD 3</td>
</tr>
<tr>
<td>V1.24.6</td>
<td>FB Analogue Reference</td>
<td>%</td>
<td>48</td>
<td>Default Control of FB PD 4</td>
</tr>
<tr>
<td>V1.24.7</td>
<td>Last Active Fault</td>
<td></td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>V1.24.8</td>
<td>FB Motor Current</td>
<td>A</td>
<td>45</td>
<td>Motor current (drive independent) given with one decimal point</td>
</tr>
<tr>
<td>V1.24.9</td>
<td>DIN Status Word</td>
<td></td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>V1.24.10</td>
<td>DIN Status Word 2</td>
<td></td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>V1.24.11</td>
<td>Last Active Warning</td>
<td></td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>V1.24.12</td>
<td>MC Status</td>
<td></td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.3 FieldBus Monitoring values
6.1.3 *Line Synch Monitoring values*

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.25.1</td>
<td>Line Voltage</td>
<td>V</td>
<td>1650</td>
<td>OPT-D7 measured line voltage</td>
</tr>
<tr>
<td>V1.25.2</td>
<td>Line Voltage Frequency</td>
<td>Hz</td>
<td>1654</td>
<td>OPT-D7 measured line voltage frequency</td>
</tr>
<tr>
<td>V1.25.3</td>
<td>Phase error</td>
<td>Dec</td>
<td>1659</td>
<td>Phase error in Dec. from reference</td>
</tr>
<tr>
<td>V1.25.4</td>
<td>Synchronization Status</td>
<td></td>
<td>1651</td>
<td>Synchronization status for NCDrive in CAN communication. Values are updated at 1 ms interval.</td>
</tr>
<tr>
<td>V1.25.5</td>
<td>Contactor Status</td>
<td></td>
<td>1652</td>
<td>Relay control status from application</td>
</tr>
<tr>
<td>V1.25.6</td>
<td>FB Synchronization control</td>
<td></td>
<td>1640</td>
<td>Line Synchronization control Word from fieldbus.</td>
</tr>
<tr>
<td>V1.25.7</td>
<td>Controlled Motor</td>
<td></td>
<td>1641</td>
<td></td>
</tr>
<tr>
<td>V1.25.8</td>
<td>Line voltage L1 – L2</td>
<td>V</td>
<td>1655</td>
<td>Real time</td>
</tr>
<tr>
<td>V1.25.9</td>
<td>Line voltage L2 – L3</td>
<td>V</td>
<td>1656</td>
<td>Real time</td>
</tr>
<tr>
<td>V1.25.10</td>
<td>Line voltage L3 – L1</td>
<td>V</td>
<td>1657</td>
<td>Real time</td>
</tr>
<tr>
<td>V1.25.11</td>
<td>Synch Status 1 ms</td>
<td></td>
<td>1682</td>
<td></td>
</tr>
<tr>
<td>V1.25.12</td>
<td>FC1 CB Hours</td>
<td>h</td>
<td>1662</td>
<td></td>
</tr>
<tr>
<td>V1.25.13</td>
<td>DL1 CB Hours</td>
<td>h</td>
<td>1663</td>
<td></td>
</tr>
<tr>
<td>V1.25.14</td>
<td>FC1 Counter</td>
<td></td>
<td>1666</td>
<td></td>
</tr>
<tr>
<td>V1.25.15</td>
<td>DL1 Counter</td>
<td></td>
<td>1667</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-4. Synchro Monitoring values*

6.1.4 *Flying Start Monitoring values*

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Unit</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.26.1</td>
<td>End Frequency</td>
<td>Hz</td>
<td>1708</td>
<td></td>
</tr>
<tr>
<td>V1.26.2</td>
<td>End Voltage</td>
<td>%</td>
<td>1713</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6-5. Synchro Monitoring values*
6.2 Monitoring values description

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

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

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

VI.4 Motor current [A] ID 3
1s linear filtering.

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
1s linear filtering

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
Heat sink temperature
V1.10 Motor temperature % ID 9
Calculated motor temperature
105 % is tripping limit if response is fault.

V1.11 Analogue input 1% ID 13

V1.12 Analogue input 2% ID 14
Unfiltered analogue input level.
0 % =0 mA / 0 V, -100 % = -10 V, 100 % =20 mA / 10 V.
Monitoring scaling is determined by the option board parameter.

V1.13 Analogue input 3% ID 27

V1.14 Analogue input 4% ID 28
It is possible to adjust this input value from fieldbus when the input terminal
selection is 0.1. This way it is possible to adjust the free analogue input from
fieldbus and have all analogue input functions available for fieldbus process
data.

V1.15 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</td>
<td>DIN3</td>
</tr>
<tr>
<td>b1</td>
<td>DIN2</td>
</tr>
<tr>
<td>b2</td>
<td>DIN1</td>
</tr>
</tbody>
</table>

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

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

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

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>0</td>
<td>1</td>
</tr>
<tr>
<td>b1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b7</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b9</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b10</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b11</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b12</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b13</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b14</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b15</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

V1.23.5 Measured temperature 1 Cº ID 50
V1.23.6 Measured temperature 2 Cº ID 51
V1.23.7 Measured temperature 3 Cº ID 52
V1.23.8 Measured temperature 4 Cº ID 54
V1.23.9 Measured temperature 5 Cº ID 55
V1.23.10 Measured temperature 6 Cº ID 63

Separate measurement from two PT100 board. The signal has 4 s filtering time.
V1.23.11  Analogue input 1%     ID 13
V1.23.12  Analogue input 2%     ID 14
Unfiltered analogue input level.
0 % = 0 mA / 0 V, -100 % = -10 V, 100 % = 20 mA / 10 V.
Monitoring scaling is determined by the option board parameter.

V1.23.13  Analogue input 3%     ID 27
V1.23.14  Analogue input 4%     ID 28
It is possible to adjust this input value from fieldbus when the input terminal
selection is 0.1. This way it is possible to adjust the free analogue input from
fieldbus and have all analogue input functions available for fieldbus process
data.

V1.23.15  Final Frequency Reference  Hz     ID 1131
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.

V1.23.16  Output Power  kw     ID 1508
Unfiltered electrical drive output power.

V1.23.17  Flux Current  %     ID 72
Motor Flux Current. Can be used as actual value on separate excited motors. In
open loop control it’s not recommended to use this value below 5 Hz.

V1.23.18  ID Run Status     ID 49
6.2.2 FieldBus Monitoring values

### V1.24.1 FB Control Word  ID1160
Control word used in bypass mode. See P2.13.22 and option board ByPass.
More details in Chapter 9 Status and Control Word in detail.

<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></td>
<td>ON, Reset after Fault or b1 and b2</td>
</tr>
<tr>
<td>1</td>
<td>Emergency stop by coast</td>
<td></td>
<td>ON, On normal operation: Keep TRUE</td>
</tr>
<tr>
<td>2</td>
<td>Emergency stop by ramp</td>
<td></td>
<td>ON, On normal operation: Keep TRUE</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
ProfiDrive type status word. Not the same as used by profibus board in
ProfiDrive mode. Needs to be selected with P2.14.19 GSW to be used. See details
in Chapter 9 Status and Control Word in detail.

<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>
V1.24.3  **FB Torque Reference**  %  **ID 1140**
Torque reference value from fieldbus
Default Control of FB PD 1

V1.24.4  **FB Limit Scaling**  %  **ID 46**
Limit scaling input value from fieldbus.
Default Control of FB PD 2.

V1.24.5  **FB Adjust Reference**  %  **ID 47**
Reference adjustment value from fieldbus.
Default Control of FB PD 3.

V1.24.6  **FB Analog Output**  %  **ID 48**
Fieldbus value to control analogue output.
Default Control of FB PD 4.

V1.24.7  **Fault History**  **ID 37**
Fault number of the last active fault.

V1.24.8  **FB Motor Current**  A  **ID 45**
Motor current (drive independent) given with one decimal point.

V1.24.9  **Din Status Word 1**  **ID 56**
V1.24.10  **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</td>
<td>DIN: A.1</td>
</tr>
<tr>
<td>b1</td>
<td>DIN: A.2</td>
</tr>
<tr>
<td>b2</td>
<td>DIN: A.3</td>
</tr>
<tr>
<td>b3</td>
<td>DIN: A.4</td>
</tr>
<tr>
<td>b4</td>
<td>DIN: A.5</td>
</tr>
<tr>
<td>b5</td>
<td>DIN: A.6</td>
</tr>
<tr>
<td>b6</td>
<td>DIN: B.1</td>
</tr>
<tr>
<td>b7</td>
<td>DIN: B.2</td>
</tr>
<tr>
<td>b8</td>
<td>DIN: B.3</td>
</tr>
<tr>
<td>b9</td>
<td>DIN: B.4</td>
</tr>
<tr>
<td>b10</td>
<td>DIN: B.5</td>
</tr>
<tr>
<td>b11</td>
<td>DIN: B.6</td>
</tr>
<tr>
<td>b12</td>
<td>DIN: C.1</td>
</tr>
<tr>
<td>b13</td>
<td>DIN: C.2</td>
</tr>
<tr>
<td>b14</td>
<td>DIN: C.3</td>
</tr>
<tr>
<td>b15</td>
<td>DIN: C.4</td>
</tr>
</tbody>
</table>

V1.24.11  **Warning**  **ID 74**
Last active warning.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**V1.24.12 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</td>
<td>Not in Ready state</td>
<td>Ready</td>
</tr>
<tr>
<td>b1</td>
<td>Not Running</td>
<td>Running</td>
</tr>
<tr>
<td>b2</td>
<td>Direction Clockwise</td>
<td>Counterclockwise</td>
</tr>
<tr>
<td>b3</td>
<td>No Fault</td>
<td>Fault</td>
</tr>
<tr>
<td>b4</td>
<td>No Warning</td>
<td>Warning</td>
</tr>
<tr>
<td>b5</td>
<td></td>
<td>At reference speed</td>
</tr>
<tr>
<td>b6</td>
<td></td>
<td>At Zero Speed</td>
</tr>
<tr>
<td>b7</td>
<td></td>
<td>Flux Ready</td>
</tr>
<tr>
<td>b8</td>
<td></td>
<td>TC Speed Limiter Active</td>
</tr>
<tr>
<td>b9</td>
<td>Encoder Direction</td>
<td>Counterclockwise</td>
</tr>
<tr>
<td>b10</td>
<td></td>
<td>Under Voltage Fast stop</td>
</tr>
<tr>
<td>b11</td>
<td>No DC brake</td>
<td>DC Brake is active</td>
</tr>
<tr>
<td>b12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td></td>
<td>Restart delay active</td>
</tr>
<tr>
<td>b14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.2.3 Line Synchronization monitor

V1.25.1 Line Voltage ID 1650
Line Voltage measured by OPT-D7

V1.25.2 Line Voltage Frequency ID 1654
Line Voltage frequency measured by OPT-D7

V1.25.3 Phase Error ID 1659
Phase error between drive voltage angle and OPT-D7 measured angle.

V1.25.4 Synchronization Status Word: ID1651

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Drive Ready</td>
</tr>
<tr>
<td>b1</td>
<td>Drive Run</td>
</tr>
<tr>
<td>b2</td>
<td>Active Synchronization</td>
</tr>
<tr>
<td>b3</td>
<td>Fine tuning Start</td>
</tr>
<tr>
<td>b4</td>
<td>Fine tuning OK</td>
</tr>
<tr>
<td>b5</td>
<td>Active Direct</td>
</tr>
<tr>
<td>b6</td>
<td>FC Active</td>
</tr>
<tr>
<td>b7</td>
<td>Connect Direct</td>
</tr>
<tr>
<td>b8</td>
<td>Direct Active</td>
</tr>
<tr>
<td>b9</td>
<td>FC CB Feedback M1</td>
</tr>
<tr>
<td>b10</td>
<td>NET CB Feedback M1</td>
</tr>
<tr>
<td>b11</td>
<td>M1 FC CB Control</td>
</tr>
<tr>
<td>b12</td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td>M1 FC CB Control</td>
</tr>
<tr>
<td>b15</td>
<td>M1 NET CB Control</td>
</tr>
</tbody>
</table>

Line Synch Status Word:
- Drive Ready: Drive is in Ready state
- Drive Run: Drive is in Run state
- Active Synchronization: Command to make synchronization is active
- Fine tuning Start: Line voltage frequency within 0.10 Hz from net frequency
- Fine tuning OK: Voltage angle is within hysteresis
- Active Direct: Command to change to net is active
- FC Active: Final control signal to FC relay
- Connect Direct: Internal command to close NET contactor
- Direct Active: Final control signals to NET relay
- FC CB Feedback M1: Feedback status of drive Circuit Breaker Motor 1, if used.
- NET CB Feedback M1: Feedback status of NET Circuit Breaker Motor 1, if used.
- M1 FC CB Control: Motor 1 drive circuit breaker control status.
- M1 NET CB Control: Motor 1 NET circuit breaker control status.
### V1.25.5 Contactor status Word ID1652

Status of the relay outputs. Note that function that will open all relays e.g. emergency stop, will open all relays but here you will see status of the internal control. Thus you are able to give correct reset commands.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Motor 1 FC Contactor</td>
</tr>
<tr>
<td>b1</td>
<td>Motor 1 NET Contactor</td>
</tr>
<tr>
<td>b2</td>
<td>Motor 2 FC Contactor</td>
</tr>
<tr>
<td>b3</td>
<td>Motor 2 NET Contactor</td>
</tr>
<tr>
<td>b4</td>
<td>Motor 3 FC Contactor</td>
</tr>
<tr>
<td>b5</td>
<td>Motor 3 NET Contactor</td>
</tr>
<tr>
<td>b6</td>
<td>Motor 4 FC Contactor</td>
</tr>
<tr>
<td>b7</td>
<td>Motor 4 NET Contactor</td>
</tr>
<tr>
<td>b8</td>
<td>Motor 5 FC Contactor</td>
</tr>
<tr>
<td>b9</td>
<td>Motor 5 NET Contactor</td>
</tr>
<tr>
<td>b10</td>
<td>Motor 6 FC Contactor</td>
</tr>
<tr>
<td>b11</td>
<td>Motor 6 NET Contactor</td>
</tr>
<tr>
<td>b12</td>
<td>Motor 7 FC Contactor</td>
</tr>
<tr>
<td>b13</td>
<td>Motor 7 NET Contactor</td>
</tr>
<tr>
<td>b14</td>
<td>Motor 8 FC Contactor</td>
</tr>
<tr>
<td>b15</td>
<td>Motor 8 NET Contactor</td>
</tr>
</tbody>
</table>

### V1.25.6 FB Line Synchronization control word ID1640

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Activate synchronization</td>
</tr>
<tr>
<td>b1</td>
<td>Activate changeover to DOL</td>
</tr>
<tr>
<td>b2</td>
<td>Reset DOL contactor(s)</td>
</tr>
<tr>
<td>b3</td>
<td>Single Start</td>
</tr>
<tr>
<td>b4</td>
<td>Single to net</td>
</tr>
<tr>
<td>b5</td>
<td>Single reset</td>
</tr>
<tr>
<td>b6</td>
<td>Motor Bx control</td>
</tr>
<tr>
<td>b7</td>
<td>Start in sequence</td>
</tr>
<tr>
<td>b8</td>
<td>Motor select B0</td>
</tr>
<tr>
<td>b9</td>
<td>Motor select B1</td>
</tr>
<tr>
<td>b10</td>
<td>Motor select B2</td>
</tr>
<tr>
<td>b11</td>
<td>Motor select B3</td>
</tr>
<tr>
<td>b12</td>
<td>Motor select B4</td>
</tr>
<tr>
<td>b13</td>
<td>Motor select B5</td>
</tr>
<tr>
<td>b14</td>
<td>Motor select B6</td>
</tr>
<tr>
<td>b15</td>
<td>Motor select B7</td>
</tr>
</tbody>
</table>
**V1.25.7** Controlled Motor ID1641

Monitoring variable to show what is internally controlled motor.

**V1.25.8** Line Voltage L1-L2 ID1655

**V1.25.9** Line Voltage L2-L3 ID1656

**V1.25.10** Line Voltage L3-L1 ID1657

Real time monitoring values from OPT-D7 option board. Needs to be monitored at 1 ms time level or faster (data logger).

**V1.25.11** Synchronization Status 1 ms ID1682

Fast monitoring of synchronization status. Compared to ID1651 this value needs to be monitored at 1 ms time level to have accurate information.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Line Synch Status Word 1 ms</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Coasting to NET</td>
<td>Internal coasting command is active</td>
</tr>
<tr>
<td>b1</td>
<td>Active Synchro</td>
<td>Command to make synchronization is active</td>
</tr>
<tr>
<td>b2</td>
<td>Active Direct</td>
<td>Command to change to net is active</td>
</tr>
<tr>
<td>b3</td>
<td>Reset Direct</td>
<td>Multi Motor net contactor reset command</td>
</tr>
<tr>
<td>b4</td>
<td>Fine tuning</td>
<td>Line voltage frequency within 0.10 Hz from net frequency</td>
</tr>
<tr>
<td>b5</td>
<td>Fine tuning OK</td>
<td>Voltage angle is within hysteresis</td>
</tr>
<tr>
<td>b6</td>
<td>Connect Direct</td>
<td>Internal command to close NET contactor</td>
</tr>
<tr>
<td>b7</td>
<td>Direct Active</td>
<td>Final control signals to NET relay</td>
</tr>
<tr>
<td>b8</td>
<td>FC Active</td>
<td>Final control signal to FC relay</td>
</tr>
<tr>
<td>b9</td>
<td>Drive Ready</td>
<td>Drive is in Ready state</td>
</tr>
<tr>
<td>b10</td>
<td>Drive Run</td>
<td>Drive is in Run state</td>
</tr>
<tr>
<td>b11</td>
<td>RunEnable</td>
<td>Internal RunEnable status</td>
</tr>
<tr>
<td>b12</td>
<td>RunRequest</td>
<td>Internal RunRequest status</td>
</tr>
<tr>
<td>b13</td>
<td>FC Contactor Ack.</td>
<td>Feedback from M1 FC contactor</td>
</tr>
<tr>
<td>b14</td>
<td>Net Contactor Ack.</td>
<td>Feedback from M1 NET contactor</td>
</tr>
<tr>
<td>b15</td>
<td>Both ON when Run</td>
<td>Drive was running while Net and FC contactor were closed</td>
</tr>
</tbody>
</table>

**V1.25.12** FC1 CB Hours h ID1662

**V1.25.13** DL1 CB Hours h ID1663

**V1.25.14** FC1 Counter ID1666

**V1.25.15** DL1 Counter ID1667

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
6.2.4 Flying Start Monitor

**VI.26.1 End Frequency **  ID 1708
Detected motor frequency during flying start.

**VI.26.2 End Voltage **  ID 1713
Detected motor voltage during flying start.
7. **LINESYNCH APPLICATION – 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>
<tbody>
<tr>
<td>P2.1.1</td>
<td>Minimum frequency</td>
<td>0,00</td>
<td>P2.1.2</td>
<td>Hz</td>
<td>0,00</td>
<td></td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>P2.1.2</td>
<td>Maximum frequency</td>
<td>P2.1.1</td>
<td>320,00</td>
<td>Hz</td>
<td>55,00</td>
<td></td>
<td></td>
<td>102 <strong>NOTE:</strong> If $f_{\text{max}}$ &gt; than the motor synchronous speed, check suitability for motor and drive system</td>
</tr>
<tr>
<td>P2.1.3</td>
<td>Motor nominal voltage</td>
<td>180</td>
<td>690</td>
<td>V</td>
<td>NX2: 230V</td>
<td>110</td>
<td>Check the rating plate of the motor. Note also used connection Delta/Star</td>
<td></td>
</tr>
<tr>
<td>P2.1.4</td>
<td>Motor nominal frequency</td>
<td>8,00</td>
<td>320,00</td>
<td>Hz</td>
<td>50,00</td>
<td></td>
<td></td>
<td>111</td>
</tr>
<tr>
<td>P2.1.5</td>
<td>Motor nominal speed</td>
<td>24</td>
<td>20 000</td>
<td>rpm</td>
<td>1440</td>
<td></td>
<td></td>
<td>112 <strong>The default applies for a 4-pole motor and a nominal size frequency converter.</strong></td>
</tr>
<tr>
<td>P2.1.6</td>
<td>Motor nominal current</td>
<td>0,1 $I_N$</td>
<td>2 $I_N$</td>
<td>A</td>
<td>$I_N$</td>
<td>113</td>
<td>Check the rating plate of the motor.</td>
<td></td>
</tr>
<tr>
<td>P2.1.7</td>
<td>Motor cos $\phi$</td>
<td>0,30</td>
<td>1,00</td>
<td>0,85</td>
<td>120</td>
<td></td>
<td></td>
<td>Check the rating plate of the motor.</td>
</tr>
<tr>
<td>P2.1.8</td>
<td>Magnetization Current</td>
<td>0,0</td>
<td>A</td>
<td>0,0</td>
<td>612</td>
<td></td>
<td>0=No action 1=Identification w/o run 2=Identification with run 3=Encoder ID Run 4=Ident All 5=Absolute encoder, locked rotor <strong>NOTE:</strong> Set motor control mode to Freq Control before identification!</td>
<td></td>
</tr>
<tr>
<td>P2.1.9</td>
<td>Identification</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>631</td>
<td></td>
<td>0=No action 1=Identification w/o run 2=Identification with run 3=Encoder ID Run 4=Ident All 5=Absolute encoder, locked rotor <strong>NOTE:</strong> Set motor control mode to Freq Control before identification!</td>
<td></td>
</tr>
<tr>
<td>P2.1.10</td>
<td>Motor type</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>650</td>
<td></td>
<td>0=Induction Motor 1=PMS Motor 2=Synchronous Machine</td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-1. Basic parameters*
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>I/O Reference</td>
<td>0</td>
<td>14</td>
<td></td>
<td>0</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0=A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=A1+AI2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3=AI1-AI2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4=AI2-AI1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5=AI1xAI2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| P2.2.2| Keypad reference selector| 0 | 9  | 8   | 121    |      |    | 0=A1 |
|       |                          |   |    |     |        |      |    | 1=A2 |
|       |                          |   |    |     |        |      |    | 2=A1+AI2 |
|       |                          |   |    |     |        |      |    | 3=AI1-AI2 |
|       |                          |   |    |     |        |      |    | 4=AI2-AI1 |
|       |                          |   |    |     |        |      |    | 5=AI1xAI2 |
|       |                          |   |    |     |        |      |    | 6=AI1 Joystick |
|       |                          |   |    |     |        |      |    | 7=AI2 Joystick |
|       |                          |   |    |     |        |      |    | 8=Keypad     |
|       |                          |   |    |     |        |      |    | 9=Fieldbus   |

| P2.2.3| Fieldbus control reference| 0 | 9  | 9   | 122    |      |    |       |
|       |                          |   |    |     |        |      |    | See par. 2.2.2 |

| P2.2.4| Load Share               | 0,0| 500,0 |%  | 100,0  | 1248 |    |      |

7.2.2 Constant 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>
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<tbody>
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<td>P2.2.5.1</td>
<td>Jogging speed reference</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>5,00</td>
<td>124</td>
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<td>Multi-step speed 1</td>
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<tr>
<td>P2.2.5.2</td>
<td>Preset speed 1</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>10,00</td>
<td>105</td>
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<td>Multi-step speed 2</td>
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<tr>
<td>P2.2.5.3</td>
<td>Preset speed 2</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>15,00</td>
<td>106</td>
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<td>Preset speed 3</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>20,00</td>
<td>126</td>
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<td>Multi-step speed 4</td>
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<td>P2.2.5.5</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 5</td>
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<td>Preset speed 5</td>
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<td>320,00</td>
<td>Hz</td>
<td>30,00</td>
<td>128</td>
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<td>Multi-step speed 6</td>
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<td>P2.2.5.7</td>
<td>Preset speed 6</td>
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<td>320,00</td>
<td>Hz</td>
<td>40,00</td>
<td>129</td>
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<td>Multi-step speed 7</td>
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<td>P2.2.5.8</td>
<td>Preset speed 7</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>50,00</td>
<td>130</td>
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<td>Multi-step speed 8</td>
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<td>P2.2.5.9</td>
<td>Inching reference 1</td>
<td>-320,00</td>
<td>320,00</td>
<td>Hz</td>
<td>2,00</td>
<td>1239</td>
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<td>Multi-step speed 9</td>
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<td>P2.2.5.10</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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### 7.2.3 Torque Reference

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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>
| P2.2.6.1 | Torque reference selection | 0   | 8   |      | 0       | 641  |    | 0 = Not used  
1 = AI1  
2 = AI2  
3 = AI3  
4 = AI4  
5 = AI1 joystick (-10 – 10 V)  
6 = AI2 joystick (-10 – 10 V)  
7 = Torque reference from keypad, R3.5  
8 = FB Torque Reference |
| P2.2.6.2 | Torque reference max.    | -300| 300 | %    | 100     | 642  |    |                                                                          |
| P2.2.6.3 | Torque reference min.    | -300| 300 | %    | 0       | 643  |    |                                                                          |
| P2.2.6.4 | Torque reference filtering time | 0   | 32000 | ms | 0 | 1244 |    |                                                                          |
| P2.2.6.5 | Torque Select            | 0   | 2   |      | 1       | 1278 |    | 0 = Max Frequency  
1 = Freq Reference  
2 = Preset Speed 7 |
| P2.2.6.6 | Open loop torque control minimum frequency | 0.00 | 50.00 | Hz | 3.00 | 636 |    |                                                                          |
| P2.2.6.7 | Open loop torque controller P gain | 0   | 32000 |     | 150    | 639  |    |                                                                          |
| P2.2.6.8 | Open loop torque controller I gain | 0   | 32000 |     | 10     | 640  |    |                                                                          |
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>P2.2.7.1</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>0,00</td>
<td>509</td>
<td>0=Not used</td>
</tr>
<tr>
<td>P2.2.7.2</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>0,00</td>
<td>510</td>
<td>0=Not used</td>
</tr>
<tr>
<td>P2.2.7.3</td>
<td>Prohibit frequency range 2 low limit</td>
<td>-1,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>0,00</td>
<td>511</td>
<td></td>
</tr>
<tr>
<td>P2.2.7.4</td>
<td>Prohibit frequency range 2 high limit</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>0,00</td>
<td>512</td>
<td></td>
</tr>
<tr>
<td>P2.2.7.5</td>
<td>Prohibit frequency range 3 low limit</td>
<td>-1,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>0,00</td>
<td>513</td>
<td></td>
</tr>
<tr>
<td>P2.2.7.6</td>
<td>Prohibit frequency range 3 high limit</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td>0,00</td>
<td>514</td>
<td></td>
</tr>
<tr>
<td>P2.2.7.7</td>
<td>Ramp time factor</td>
<td>0,1</td>
<td>10,0</td>
<td>x</td>
<td>1,0</td>
<td>0,00</td>
<td>518</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>P2.2.8.1</td>
<td>Motor potentiometer ramp rate</td>
<td>0,10</td>
<td>2000,00</td>
<td>Hz/s</td>
<td>1,00</td>
<td>0,00</td>
<td>331</td>
<td>Ramp rate for motor potentiometer</td>
</tr>
<tr>
<td>P2.2.8.2</td>
<td>Motor potentiometer frequency reference memory reset</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0,00</td>
<td>0,00</td>
<td>367</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>P2.2.9.1</td>
<td>Adjust input</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>0,00</td>
<td>493</td>
<td>0=Not used 1=A1 2=A2 3=A3 4=A4 5=Fieldbus</td>
</tr>
<tr>
<td>P2.2.9.2</td>
<td>Adjust minimum</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>0,00</td>
<td>494</td>
<td>Adjust limit to decrease ref.</td>
</tr>
<tr>
<td>P2.2.9.3</td>
<td>Adjust maximum</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>0,00</td>
<td>495</td>
<td>Adjust limit to increase ref.</td>
</tr>
</tbody>
</table>
### 7.3 Ramp Control

#### 7.3.1 Basic Settings

<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</th>
<th>ID</th>
<th>Note</th>
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<tr>
<td>P2.3.1</td>
<td>Start function</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>505</td>
<td>0</td>
<td>0=Ramp 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>506</td>
<td>0</td>
<td>0=Coasting 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>103</td>
<td></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>104</td>
<td></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>500</td>
<td>0</td>
<td>0=Linear &gt;0=5-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>502</td>
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<td></td>
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<tr>
<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>503</td>
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<tr>
<td>P2.3.8</td>
<td>Ramp 2 shape</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>4</td>
<td>501</td>
<td>0</td>
<td>0=Linear &gt;0=5-curve ramp time</td>
</tr>
<tr>
<td>P2.3.9</td>
<td>Inching Ramp</td>
<td>0.01</td>
<td>320.0</td>
<td>s</td>
<td>1.00</td>
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<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>401</td>
<td>0</td>
<td>Scales active ramp from 100 % to 10 %. 0=Not used 1=AI1 2=AI2 3=AI3 4=AI4 5=Fieldbus</td>
</tr>
<tr>
<td>P2.3.11</td>
<td>Quick Stop Mode</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1276</td>
<td>0</td>
<td>0=Coasting 1=Ramp</td>
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<tr>
<td>P2.3.12</td>
<td>FC Breaker Close Delay from Start Command</td>
<td>0</td>
<td>5000</td>
<td>ms</td>
<td>0</td>
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<td>Synchronization Ramp 2 Freq Limit</td>
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<td>Hz</td>
<td>0.00</td>
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Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.4 Input Signals

7.4.1 Basic Settings

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<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
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<td>P2.4.1.1</td>
<td>Start/Stop logic selection</td>
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<td>7</td>
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<td>300</td>
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<td>Start signal 1</td>
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<td>(Default: DIN1)</td>
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<td></td>
<td></td>
<td></td>
<td>Start signal 2</td>
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<td>(Default: DIN2)</td>
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<td>Start fwd</td>
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<td></td>
<td></td>
<td>Start*/Stop</td>
</tr>
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<td></td>
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<td>Start*/Stop</td>
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<td>Start rvs*</td>
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<td></td>
<td></td>
<td>Reverse</td>
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<td></td>
<td></td>
<td></td>
<td>Run Enable</td>
</tr>
</tbody>
</table>

* = Rising edge required to start

Table 7-4. Input signals: basic settings, G2.2.1
### 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>See P2.2.1.1.</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>See P2.2.1.1.</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>
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<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>
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<td>419</td>
<td>See preset speeds in Basic Parameters (G2.1)</td>
</tr>
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<td>P2.4.2.6</td>
<td>Preset speed 2</td>
<td>0.1</td>
<td>0.1</td>
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</tr>
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<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>A.3</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 (F51) 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 (F51) 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>
</tr>
<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>AI1/AI2 selection</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>422</td>
<td>cc = AI2 is used as reference, when ID117 = 14</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 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 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>Cooling monitor</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>750</td>
<td>Used with liquid-cooled unit</td>
</tr>
<tr>
<td>P2.4.2.24</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>P2.4.2.25</td>
<td>Inching reference 1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>530</td>
<td>Inching reference 1. (Default Forward 2 Hz. See P2.4.16) <strong>This will start the drive</strong></td>
</tr>
<tr>
<td>P2.4.2.26</td>
<td>Inching reference 2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>531</td>
<td>Inching reference 2. (Default Forward 2 Hz. See P2.4.17) <strong>This will start the drive</strong></td>
</tr>
<tr>
<td>P2.4.2.27</td>
<td>Emergency stop</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>1213</td>
<td>Low signal activates EM</td>
</tr>
<tr>
<td>P2.4.2.28</td>
<td>Input switch acknowledgement</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>1209</td>
<td>Low signal generates fault (F64)</td>
</tr>
<tr>
<td>P2.4.2.29</td>
<td>Active synchronization</td>
<td>0.1</td>
<td>A.4</td>
<td></td>
<td>1600</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.30</td>
<td>Active direct</td>
<td>0.1</td>
<td>A.5</td>
<td></td>
<td>1601</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.31</td>
<td>Reset direct</td>
<td>0.1</td>
<td>A.6</td>
<td></td>
<td>1612</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.32</td>
<td>FC Contactor acknowledge</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1630</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.33</td>
<td>Net contactor acknowledge</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1631</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.34</td>
<td>Motor selection B0</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1670</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.35</td>
<td>Motor selection B1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1671</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.36</td>
<td>Motor selection B2</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td>1672</td>
<td></td>
</tr>
<tr>
<td>P2.4.2.37</td>
<td>ByPass Inter Lock Falling (OC) Edge</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
<td>1636</td>
<td>Interlock from device that monitors if motor input is OK. Falling edge will activate protection function F87.</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**Table 7-5. Digital input signals, G2.2.4**

**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>0,00</td>
<td>32,000</td>
<td>s</td>
<td>0,00</td>
<td>324</td>
<td></td>
<td>0=No filtering</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=20…100%*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=–10V…+10V*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3=Custom range*</td>
</tr>
<tr>
<td>P2.4.3.3</td>
<td>AI1 signal range</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>320</td>
<td></td>
<td></td>
<td></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>All reference scaling, minimum value</td>
<td>0,00</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>All reference scaling, maximum value</td>
<td>0,00</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>0,00</td>
<td>20,00</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>0,00</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>0,00</td>
<td>320,00</td>
<td>s</td>
<td>0,00</td>
<td>386</td>
<td></td>
<td></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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 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></td>
<td></td>
<td>388</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>1</td>
<td></td>
<td></td>
<td>325</td>
<td>0=0..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>0.00</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>0.00</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>0.00</td>
<td>20.00</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>0.00</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>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>397</td>
<td></td>
<td></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>

Table 7-7. Analogue input 2 parameters, G2.2.3

### 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>AI3 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td>0.1</td>
<td></td>
<td></td>
<td>141</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>AI3 filter time</td>
<td>0.000</td>
<td>32,000</td>
<td>s</td>
<td>0.000</td>
<td>142</td>
<td></td>
<td>0=No filtering</td>
</tr>
<tr>
<td>P2.4.5.3</td>
<td>AI3 signal range</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>143</td>
<td>0=0..100%* 1=20...100%* 4 mA Fault 2=-10V..+10V* 3=Custom range*</td>
</tr>
<tr>
<td>P2.4.5.4</td>
<td>AI3 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td>144</td>
<td></td>
<td>Custom range always active. See ID326</td>
</tr>
<tr>
<td>P2.4.5.5</td>
<td>AI3 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td>145</td>
<td></td>
<td>Custom range always active. See ID327</td>
</tr>
<tr>
<td>P2.4.5.6</td>
<td>AI3 signal inversion</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
<td>151</td>
<td></td>
<td>0=Not inverted 1=Inverted</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

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### 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>AI4 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>152</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>AI4 filter time</td>
<td>0.000</td>
<td>32.000</td>
<td>s</td>
<td>0.000</td>
<td></td>
<td>153</td>
<td>0=No filtering</td>
</tr>
<tr>
<td>P2.4.6.3</td>
<td>AI4 signal range</td>
<td>0</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>P2.4.6.4</td>
<td>AI4 custom minimum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>0.00</td>
<td></td>
<td>155</td>
<td>Custom range always active. See ID326</td>
</tr>
<tr>
<td>P2.4.6.5</td>
<td>AI4 custom maximum setting</td>
<td>-160.00</td>
<td>160.00</td>
<td>%</td>
<td>100.00</td>
<td></td>
<td>156</td>
<td>Custom range always active. See ID327</td>
</tr>
<tr>
<td>P2.4.6.6</td>
<td>AI4 signal inversion</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td></td>
<td>162</td>
<td>0=Not inverted 1=Inverted</td>
</tr>
</tbody>
</table>

*Table 7-9. Analogue input 4 parameters, G2.2.5*
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>A.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>Drive overtemperature active</td>
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Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.5.2 Analogue output 1

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<td>1=Output freq. (0—f_{max})</td>
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<td>3=Motor speed (0—Motor nominal speed)</td>
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<td>4=Motor current (0—I_{motor})</td>
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<td>5=Motor torque (0—T_{motor})</td>
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<td>1000</td>
<td>%</td>
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Table 7-10. Analogue output 1 parameters, G2.3.5

### 7.5.3 Analogue output 2

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<td>1=4 mA (20 %)</td>
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Table 7-11. Analogue output 2 parameters, G2.3.6
### 7.5.4 Analogue output 3

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<td>%</td>
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Table 7-12. Analogue output 3 parameters, G2.3.7

### 7.5.5 Delayed digital output 1 (Keypad: Menu M2 → G2.3.1)

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<td>0=Not used 1=Ready 2=Run 3=Fault 4=Fault inverted 5=FC overheat warning 6=Ext. fault or warning 7=Ref. fault or warning 8=Warning 9=Reverse 10=Jogging spd selected 11=At speed 12=Mot. regulator active 13=Freq. limit 1 superv. 14=Freq. limit 2 superv. 15=Torque limit superv. 16=Ref. limit supervision 17=External brake control 18=I/O control place act. 19=FC temp. limit superv. 20=Reference inverted 21=Ext. brake control inverted 22=Therm. fault or warn. 23=On/Off control 24=Fieldbus input data 1 25=Fieldbus input data 2 26=Fieldbus input data 3 27=D7 Measurement Point</td>
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<td>0.00</td>
<td>487</td>
<td></td>
<td>0,00 =On delay not in use</td>
</tr>
<tr>
<td>P2.5.5.4</td>
<td>Digital output 1 off delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td>488</td>
<td></td>
<td>0,00 =Off delay not in use</td>
</tr>
</tbody>
</table>

Table 7-13. Delayed digital output 1 parameters, G2.3.1

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.5.6 Delayed digital output 2 (Keypad: Menu M2 → G2.3.2)

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.5.6.1</td>
<td>Digital output 2 signal selection</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.6.2</td>
<td>Digital output 2 function</td>
<td>0</td>
<td>28</td>
<td></td>
<td>0</td>
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<td></td>
</tr>
<tr>
<td>P2.5.6.3</td>
<td>Digital output 2 on delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td></td>
<td></td>
<td>0.00 = On delay not in use</td>
</tr>
<tr>
<td>P2.5.6.4</td>
<td>Digital output 2 off delay</td>
<td>0.00</td>
<td>320.00</td>
<td>s</td>
<td>0.00</td>
<td></td>
<td></td>
<td>0.00 = Off delay not in use</td>
</tr>
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Table 7-14. Delayed digital output 2 parameters, G2.3.2

### 7.5.7 Supervision Limits

<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>P2.5.7.1</td>
<td>Output frequency limit 1 supervision</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.2</td>
<td>Output frequency limit 1; Supervised value</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.3</td>
<td>Output frequency limit 2 supervision</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.4</td>
<td>Output frequency limit 2; Supervised value</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.5</td>
<td>Torque limit supervision</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.6</td>
<td>Torque limit supervision value</td>
<td>-300</td>
<td>300.00</td>
<td>%</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.7</td>
<td>Reducing of torque supervision limit</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.8</td>
<td>Reference limit supervision</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.9</td>
<td>Reference limit supervision value</td>
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<td>100.00</td>
<td>%</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.10</td>
<td>FC temperature supervision</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>P2.5.7.11</td>
<td>FC temperature supervised value</td>
<td>-10</td>
<td>100</td>
<td>°C</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>P2.5.7.12</td>
<td>Analogue supervision signal</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.13</td>
<td>Analogue supervision low limit</td>
<td>0.00</td>
<td>100.00</td>
<td>%</td>
<td>10.00</td>
<td></td>
<td></td>
<td>Reset limit</td>
</tr>
<tr>
<td>P2.5.7.14</td>
<td>Analogue supervision high limit</td>
<td>0.00</td>
<td>100.00</td>
<td>%</td>
<td>90.00</td>
<td></td>
<td></td>
<td>Set limit</td>
</tr>
<tr>
<td>P2.5.7.15</td>
<td>Freq SupV Lim 3</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.16</td>
<td>Freq SupV Value 3</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
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<td></td>
<td></td>
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<tr>
<td>P2.5.7.17</td>
<td>Freq SupV Lim 4</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.5.7.18</td>
<td>Freq SupV Value 4</td>
<td>0.00</td>
<td>320.00</td>
<td>Hz</td>
<td>0.00</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table 7-15. Supervision Limit settings, G2.3.4

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

### 7.6.1 Current 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>P2.6.1.1</td>
<td>Current limit</td>
<td>0</td>
<td>2 \times I_L</td>
<td>A</td>
<td>I_L</td>
<td>107</td>
<td></td>
<td>Reaching the limit will lower output frequency</td>
</tr>
<tr>
<td>P2.6.1.2</td>
<td>Scaling of current</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>399</td>
<td></td>
<td>Scaling from 0 to ID107 0=Not used 1=AI1 2=AI2 3=AI3 4=AI4 5=FB Limit Scaling ID46</td>
</tr>
</tbody>
</table>

### 7.6.2 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>P2.6.2.1</td>
<td>Torque limit</td>
<td>0.0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td>609</td>
<td></td>
<td>General maximum limit</td>
</tr>
<tr>
<td>P2.6.2.2</td>
<td>Motoring Torque Limit</td>
<td>0.0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td>1287</td>
<td></td>
<td>Motoring side torque limit</td>
</tr>
<tr>
<td>P2.6.2.3</td>
<td>Generator Torque Limit</td>
<td>0.0</td>
<td>300,0</td>
<td>%</td>
<td>300,0</td>
<td>1288</td>
<td></td>
<td>Generator side torque limit</td>
</tr>
<tr>
<td>P2.6.2.4</td>
<td>Scaling Motoring Torque Limit</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>485</td>
<td></td>
<td>Scaling from 0 to ID1287 0=Not used 1=AI1 2=AI2 3=AI3 4=AI4 5=FB Limit Scaling ID46</td>
</tr>
<tr>
<td>P2.6.2.5</td>
<td>Scaling Generator Torque Limit</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>1087</td>
<td></td>
<td>Scaling from 0 to ID1288 As parameter P2.6.3.9</td>
</tr>
<tr>
<td>P2.6.2.6</td>
<td>Torque limit control P-gain</td>
<td>0,0</td>
<td>32000</td>
<td></td>
<td>3000</td>
<td>610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.6.2.7</td>
<td>Torque limit control I-gain</td>
<td>0,0</td>
<td>32000</td>
<td></td>
<td>200</td>
<td>611</td>
<td></td>
<td></td>
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</tbody>
</table>

### 7.6.3 Frequency 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>Negative frequency</td>
<td>-320,0</td>
<td>320,0</td>
<td>Hz</td>
<td>-320,0</td>
<td>1286</td>
<td></td>
<td>Alternative limit for negative direction</td>
</tr>
<tr>
<td>P2.6.3.2</td>
<td>Positive frequency</td>
<td>-320,0</td>
<td>320,0</td>
<td>Hz</td>
<td>320,0</td>
<td>1285</td>
<td></td>
<td>Alternative limit for positive direction</td>
</tr>
</tbody>
</table>
## 7.6.4 DC-Link 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>
</table>
| P2.6.4.1| Overvoltage controller         | 0   | 2   |      | 1       |      | 607| 0=Not used  
|         |                                |     |     |      |         |      |    | 1=Used (no ramping)  
|         |                                |     |     |      |         |      |    | 2=Used (ramping)                                                   |
| P2.6.4.2| Over Voltage Reference selector| 0   | 2   |      | 1       |      | 1262| 0=High Voltage  
|         |                                |     |     |      |         |      |    | 1=Normal Voltage  
|         |                                |     |     |      |         |      |    | 2=BrakeChopperLevel                                                 |
| P2.6.4.3| Brake chopper                  | 0   | 4   |      | 0       |      | 504 | 0=Disabled  
|         |                                |     |     |      |         |      |    | 1=Used when running  
|         |                                |     |     |      |         |      |    | 2=External brake chopper                                            |
|         |                                |     |     |      |         |      |    | 3=Used when stopped/running                                        |
|         |                                |     |     |      |         |      |    | 4=Used when running (no testing)                                   |
| P2.6.4.4| Undervoltage controller        | 0   | 2   |      | 1       |      | 608 | 0=Not used  
|         |                                |     |     |      |         |      |    | 1=Used (no ramping)                                                |
|         |                                |     |     |      |         |      |    | 2=Used (ramping to zero)                                           |
| P2.6.4.5| Under Voltage Reference Sel    | 0   | 1   |      | 1       |      | 1537| 0=Low  
|         |                                |     |     |      |         |      |    | 1=Automatic                                                        |

## 7.6.5 OPT-D7 Freq. Limits

<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>P2.6.5.1</td>
<td>D7 Min. Freq.</td>
<td>25,00</td>
<td>240,00</td>
<td>Hz</td>
<td>25,00</td>
<td></td>
<td>1717</td>
<td></td>
</tr>
<tr>
<td>P2.6.5.2</td>
<td>D7 Max. Freq.</td>
<td>25,00</td>
<td>240,00</td>
<td>Hz</td>
<td>75,00</td>
<td></td>
<td>1716</td>
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</tr>
</tbody>
</table>
### 7.7 Flux and DC Current handling

#### 7.7.1 Flux and DC Current handling 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>P2.7.1</td>
<td>DC braking current</td>
<td>0.00</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;</td>
<td>A</td>
<td>0.00</td>
<td></td>
<td>507</td>
<td></td>
</tr>
<tr>
<td>P2.7.2</td>
<td>DC braking time at start</td>
<td>0.00</td>
<td>600.00</td>
<td>s</td>
<td>0.00</td>
<td>516</td>
<td></td>
<td>0=DC brake is off at start</td>
</tr>
<tr>
<td>P2.7.3</td>
<td>DC braking time at stop</td>
<td>0.00</td>
<td>600.00</td>
<td>s</td>
<td>0.00</td>
<td>508</td>
<td></td>
<td>0=DC brake is off at stop</td>
</tr>
<tr>
<td>P2.7.4</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>515</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.7.5</td>
<td>Scaling of DC-braking current</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>400</td>
<td></td>
<td>ID46Scaling from 0 to ID507</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>0=Not used</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1=AI1</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=AI2</td>
</tr>
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<td></td>
<td>3=AI3</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>4=AI4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5=FB Limit Scaling</td>
</tr>
<tr>
<td>P2.7.6</td>
<td>DC-Brake Current in Stop</td>
<td>0.00</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;</td>
<td>A</td>
<td>Varies</td>
<td></td>
<td>1080</td>
<td>0=Off</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=On</td>
</tr>
<tr>
<td>P2.7.7</td>
<td>Fluxbrake</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>520</td>
<td></td>
<td>0=Off</td>
</tr>
<tr>
<td>P2.7.8</td>
<td>Flux braking current</td>
<td>0.00</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;</td>
<td></td>
<td>519</td>
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<td></td>
</tr>
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</table>
## 7.8 Motor Control

### 7.8.1 Motor 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>P2.8.1</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 = Speed/Torque control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>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>
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<td>See P2.8.1</td>
</tr>
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</table>

### 7.8.2 U/f Settings

<table>
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<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>P2.8.3.1</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>4</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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 = Programmable, Multi</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>n% x U_{n mot}</td>
<td></td>
</tr>
<tr>
<td>P2.8.3.5</td>
<td>U/f curve midpoint frequency</td>
<td>0,00</td>
<td>P2.8.3.3</td>
<td>Hz</td>
<td>50,00</td>
<td>604</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.6</td>
<td>U/f curve midpoint voltage</td>
<td>0,00</td>
<td>100,00</td>
<td>%</td>
<td>100,00</td>
<td>605</td>
<td>n% x U_{n mot}</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Parameter max. value = P2.6.5</td>
</tr>
<tr>
<td>P2.8.3.7</td>
<td>Output voltage at zero frequency</td>
<td>0,00</td>
<td>40,00</td>
<td>%</td>
<td>0,00</td>
<td>606</td>
<td>n% x U_{n mot}</td>
<td></td>
</tr>
<tr>
<td>P2.8.3.8</td>
<td>MC Options</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.9</td>
<td>U/f curve midpoint frequency 2</td>
<td>0,00</td>
<td>P2.8.3.3</td>
<td>Hz</td>
<td>50,00</td>
<td>1587</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.10</td>
<td>U/f curve midpoint voltage 2</td>
<td>0,00</td>
<td>100,00</td>
<td>%</td>
<td>100,00</td>
<td>1588</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.11</td>
<td>U/f curve midpoint frequency 3</td>
<td>0,00</td>
<td>P2.8.3.3</td>
<td>Hz</td>
<td>50,00</td>
<td>1589</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.3.12</td>
<td>U/f curve midpoint voltage 3</td>
<td>0,00</td>
<td>100,00</td>
<td>%</td>
<td>100,00</td>
<td>1591</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.8.3 PMSM Control 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>P2.8.4.1</td>
<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>
</tr>
<tr>
<td>P2.8.4.2</td>
<td>Start Angle Identification DC Current</td>
<td>0,0</td>
<td>150,0</td>
<td>%</td>
<td>0,0</td>
<td>1756</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.3</td>
<td>Polarity Pulse Current</td>
<td>-10,0</td>
<td>200,0</td>
<td>%</td>
<td>0,0</td>
<td>1566</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.4</td>
<td>Start Angle ID Time</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>0</td>
<td>1755</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.5</td>
<td>If 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>P2.8.4.6</td>
<td>If Control Limit</td>
<td>0,0</td>
<td>300,0</td>
<td>%</td>
<td>10,0</td>
<td>1790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.7</td>
<td>Flux Current Kp</td>
<td>0</td>
<td>32000</td>
<td></td>
<td>5000</td>
<td>651</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.8</td>
<td>Flux Current Ti</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>25</td>
<td>652</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.9</td>
<td>External Id Reference</td>
<td>-150,0</td>
<td>150,0</td>
<td>%</td>
<td>0,0</td>
<td>1730</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.10</td>
<td>Enable Rs Identification</td>
<td>0</td>
<td>1</td>
<td></td>
<td>1</td>
<td>654</td>
<td>0=No, 1=Yes</td>
<td></td>
</tr>
<tr>
<td>P2.8.4.11</td>
<td>Lsd Voltage Drop</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1757</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.4.12</td>
<td>Lsq Voltage Drop</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>1758</td>
<td></td>
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</tbody>
</table>

### 7.8.4 Stabilators

<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>P2.8.5.1</td>
<td>Torque Stabilator Gain</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>100</td>
<td>1412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.5.2</td>
<td>Torque Stabilator Damping</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>800</td>
<td>1413</td>
<td></td>
<td>With PMSM use 980</td>
</tr>
<tr>
<td>P2.8.5.3</td>
<td>Torque Stabilator Gain in FWP</td>
<td>0</td>
<td>1000</td>
<td></td>
<td>50</td>
<td>1414</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 7.8.5 Flying Start Tuning 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>P2.8.6.1</td>
<td>Current Controller Kp</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>40.00</td>
<td>Cust</td>
<td>617</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.2</td>
<td>Modulation Limit</td>
<td>0</td>
<td>150</td>
<td>%</td>
<td>100</td>
<td></td>
<td>655</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.3</td>
<td>AC magnetization Current</td>
<td>0.0</td>
<td>150.0</td>
<td>%</td>
<td>70.0</td>
<td></td>
<td>1701</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.4</td>
<td>AC Scanning Time</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>900</td>
<td></td>
<td>1702</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.5</td>
<td>DC magnetization Current</td>
<td>0.0</td>
<td>150.0</td>
<td>%</td>
<td>100.0</td>
<td></td>
<td>1703</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.6</td>
<td>Flux Build Time</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>300</td>
<td></td>
<td>1704</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.7</td>
<td>Flux Build Torque</td>
<td>0</td>
<td>300.0</td>
<td></td>
<td>10.0</td>
<td></td>
<td>1711</td>
<td></td>
</tr>
<tr>
<td>P2.8.6.8</td>
<td>Magnetization Phases</td>
<td>0</td>
<td>20</td>
<td></td>
<td>10</td>
<td></td>
<td>1707</td>
<td></td>
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<tr>
<td>P2.8.6.9</td>
<td>Flying Start Options</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td></td>
<td>1710</td>
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### 7.8.6 Identification 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>P2.8.7.1</td>
<td>Rs voltage drop</td>
<td>0</td>
<td>30000</td>
<td>Varies</td>
<td></td>
<td>662</td>
<td></td>
<td>Used for torque calculation in open loop</td>
</tr>
<tr>
<td>P2.8.7.2</td>
<td>Ir add zero point voltage</td>
<td>0</td>
<td>30000</td>
<td>Varies</td>
<td></td>
<td>664</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.3</td>
<td>Ir add generator scale</td>
<td>0</td>
<td>30000</td>
<td>Varies</td>
<td></td>
<td>665</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.4</td>
<td>Ir add motoring scale</td>
<td>0</td>
<td>30000</td>
<td>Varies</td>
<td></td>
<td>667</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.5</td>
<td>LsVoltageDrop</td>
<td>0</td>
<td>3000</td>
<td></td>
<td>512</td>
<td>673</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.6</td>
<td>Motor BEM Voltage</td>
<td>0.00</td>
<td>320.00</td>
<td>%</td>
<td>90.00</td>
<td>674</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.7</td>
<td>Iu Offset</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>668</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.8</td>
<td>Iv Offset</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>669</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.8.7.9</td>
<td>Iw Offset</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td>670</td>
<td></td>
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*Table 7-16. Identification parameters, G2.6.4*
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 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>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>656</td>
<td>For dynamic changes</td>
</tr>
<tr>
<td>P2.9.3</td>
<td>Speed controller P gain (open loop)</td>
<td>0</td>
<td>32767</td>
<td></td>
<td>3000</td>
<td>637</td>
<td></td>
</tr>
<tr>
<td>P2.9.4</td>
<td>Speed controller I gain (open loop)</td>
<td>0</td>
<td>32767</td>
<td></td>
<td>300</td>
<td>638</td>
<td></td>
</tr>
</tbody>
</table>

Table 7-17. Speed control basic settings

7.10 Drive Control

7.10.1 Master Follower settings

<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>P2.11.1</td>
<td>MF Mode</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1324</td>
<td></td>
</tr>
<tr>
<td>P2.11.4</td>
<td>DS Follower Fault</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1531</td>
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</tr>
</tbody>
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Table 7-19. Speed control basic settings
7.11 Protections

7.11.1 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>
</table>
| P2.12.1.1 | Input phase supervision                 | 0   | 3   | 0    | 730     |      |    | 0=No response
1=Warning
2=Fault, stop acc. to 2.3.2
3=Fault, stop by coasting                                              |
| P2.12.1.2 | Response to undervoltage fault          | 0   | 1   | 0    | 727     |      |    | 0=Fault stored in history
1=Fault not stored                                                      |
| P2.12.1.3 | Output phase supervision                | 0   | 3   | 2    | 702     |      |    | See P2.12.1.1                                                         |
| P2.12.1.4 | Response to slot fault                  | 0   | 3   | 2    | 734     |      |    | See P2.12.1.1                                                         |
| P2.12.1.5 | Response to external fault 1            | 0   | 3   | 2    | 701     |      |    | 0=No response
1=Warning
2=Fault, stop acc. to 2.3.2
3=Fault, stop by coasting                                              |
| P2.12.1.6 | Earth fault protection                  | 0   | 3   | 2    | 703     |      |    | 0=No response
1=Warning
2=Fault, stop acc. to 2.3.2
3=Fault, stop by coasting                                              |
| P2.12.1.7 | Fieldbus Communication response         | 0   | 3   | 2    | 733     |      |    | 0=No Action
1=Warning
2=Fault
3=Fault, stop by coasting                                              |
| P2.12.1.8 | Cooling Fault Response                  | 1   | 2   | 2    | 762     |      |    | 0=No Action, Warning
1=Warning, Warning
2=Warning, Fault
3=No Action, Fault                                                      |
| P2.12.1.9 | Safe Torque Off Response                | 1   | 2   | 1    | 755     |      |    | 1=Warning, Warning
2=Warning, Fault                                                          |
| P2.12.1.10 | FaultWarnIndicat                       | 0   | 2   | 1    | 1940    |      |    | 0=Static
1=Toggle
2=Marine                                                              |

Table 7-20. Common settings
### 7.11.2 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>
</table>
| P2.12.2.1 | No. of used inputs on board 1                  | 0   | 5   |      | 0       |      | 739| 0=Not used (ID Write)  
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 |
| P2.12.2.2 | Response to temperature fault                  | 0   | 3   |      | 2       |      | 740| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.3 | Board 1 warning limit                          | -30,0 | 200,0 | °C  | 120,0   |      | 741| 0=Not used (ID Write)  
1 =Sensor 1 in use  
2 =Sensor 1 & 2 in use  
3 =Sensor 1 & 2 & 3 in use |
| P2.12.2.4 | Board 1 fault limit                            | -30,0 | 200,0 | °C  | 130,0   |      | 742| 0=Not used (ID Write)  
1 =Sensor 1 in use  
2 =Sensor 1 & 2 in use  
3 =Sensor 1 & 2 & 3 in use |
| P2.12.2.5 | No. of uses inputs on board 2                  | 0   | 5   |      | 0       |      | 743| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.6 | Response to temperature fault                  | 0   | 3   |      | 2       |      | 766| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.7 | Board 2 warning limit                          | -30,0 | 200,0 | °C  | 120,0   |      | 745| 0=Not used (ID Write)  
1 =Sensor 1 in use  
2 =Sensor 1 & 2 in use  
3 =Sensor 1 & 2 & 3 in use |
| P2.12.2.8 | Board 2 fault limit                            | -30,0 | 200,0 | °C  | 130,0   |      | 746| 0=Not used (ID Write)  
1 =Sensor 1 in use  
2 =Sensor 1 & 2 in use  
3 =Sensor 1 & 2 & 3 in use |
| P2.12.2.9.1 | Channel 1B Warn                               | -30,0 | 200,0 | °C  | 0       |      | 764| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.2 | Channel 1B Fault                              | -30,0 | 200,0 | °C  | 0       |      | 765| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.3 | Channel 1C Warn                               | -30,0 | 200,0 | °C  | 0       |      | 768| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.4 | Channel 1C Fault                              | -30,0 | 200,0 | °C  | 0       |      | 769| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.5 | Channel 2B Warn                               | -30,0 | 200,0 | °C  | 0       |      | 770| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.6 | Channel 2B Fault                              | -30,0 | 200,0 | °C  | 0       |      | 771| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.7 | Channel 2C Warn                               | -30,0 | 200,0 | °C  | 0       |      | 772| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.2.9.8 | Channel 2C Fault                              | -30,0 | 200,0 | °C  | 0       |      | 773| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |

Table 7-21. PT: 100 protections

### 7.11.3 Stall 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>
</table>
| P2.12.3.1 | Stall protection        | 0   | 3   |      | 0       |      | 709| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.3.2 | Stall current            | 0,1 | 2 x Iₐ | A    | Iₐ     |      | 710| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.3.3 | Stall time limit         | 1,00 | 120,00 | s    | 15,00  |      | 711| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |
| P2.12.3.4 | Stall frequency limit    | 1,00 | P2.1 | Hz   | 25,00  |      | 712| 0=No response  
1=Warning  
2=Fault, stop acc. to 2.3.2  
3=Fault, stop by coasting |

Table 7-22. Stall protection
### 7.11.4 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</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.4.1</td>
<td>Thermal protection of the motor</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>2</td>
<td>704</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>P2.12.4.2</td>
<td>Motor ambient temperature factor</td>
<td></td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>705</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.4.3</td>
<td>Motor cooling factor at zero speed</td>
<td>0,0</td>
<td>150,0</td>
<td>%</td>
<td>40,0</td>
<td>706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.4.4</td>
<td>Motor thermal time constant</td>
<td>1</td>
<td>200</td>
<td>min</td>
<td>45</td>
<td>707</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.4.5</td>
<td>Motor duty cycle</td>
<td>0</td>
<td>100</td>
<td>%</td>
<td>100</td>
<td>708</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.4.6</td>
<td>Response to thermistor fault</td>
<td>0</td>
<td>3</td>
<td>%</td>
<td>2</td>
<td>732</td>
<td></td>
<td>See P2.12.5.1</td>
</tr>
</tbody>
</table>

Table 7-23. Motor thermal protections

### 7.11.5 4 mA (Living Zero) monitoring

<table>
<thead>
<tr>
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<th>Parameter</th>
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<th>Max</th>
<th>Unit</th>
<th>Default</th>
<th>Cust</th>
<th>ID</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.12.5.1</td>
<td>Response to 4mA reference fault</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td>700</td>
<td></td>
<td>0=No response 1=Warning 2=Warning+Previous Freq. 3=Warning+PresetFreq 2.12.6.2 4=Fault, stop acc. to 2.3.2 5=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.5.2</td>
<td>4mA reference fault frequency</td>
<td>0,00</td>
<td></td>
<td>Hz</td>
<td>0,00</td>
<td>728</td>
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Table 7-24. Living zero monitoring

### 7.11.6 Underload protection

<table>
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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>P2.12.6.1</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>P2.12.6.2</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>P2.12.6.3</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>P2.12.6.4</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>
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</tr>
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Table 7-25. Underload protection

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.11.7 Line Synch Protection functions

<table>
<thead>
<tr>
<th>Code</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>DC Low Response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1680</td>
<td>1680</td>
<td>0=No response&lt;br/&gt;1=Warning&lt;br/&gt;2=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.7.2</td>
<td>DC Low Limit</td>
<td>333</td>
<td>1200</td>
<td>V</td>
<td>470</td>
<td>1681</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.3</td>
<td>Line Voltage low response</td>
<td>0</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1685</td>
<td>1685</td>
<td>0=No response&lt;br/&gt;1=Warning&lt;br/&gt;2=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.7.4</td>
<td>Line Voltage low limit</td>
<td>180</td>
<td>800</td>
<td>V</td>
<td>180</td>
<td>1686</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.5</td>
<td>Line Voltage Fault Delay</td>
<td>0,00</td>
<td>5,00</td>
<td>s</td>
<td>0,00</td>
<td>1691</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.6</td>
<td>DOL Conflict Fault Mode</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1687</td>
<td>1687</td>
<td>0=No response&lt;br/&gt;1=Warning&lt;br/&gt;2=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.7.7</td>
<td>DOL Conflict Fault Delay</td>
<td>0,00</td>
<td>5,00</td>
<td>s</td>
<td>0,50</td>
<td>1688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.12.7.8</td>
<td>Vac &lt;90 % Response</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1689</td>
<td>1689</td>
<td>1=Warning&lt;br/&gt;2=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.7.9</td>
<td>Synchronization time limit</td>
<td>0</td>
<td>2</td>
<td></td>
<td>0</td>
<td>1792</td>
<td>1792</td>
<td>0=No response&lt;br/&gt;1=Warning&lt;br/&gt;2=Fault, stop by coasting</td>
</tr>
<tr>
<td>P2.12.7.10</td>
<td>Synchronization time limit</td>
<td>0,0</td>
<td>320,0</td>
<td>s</td>
<td>10,0</td>
<td>1791</td>
<td></td>
<td></td>
</tr>
</tbody>
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*Table 7-26. Common settings*
### 7.12 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>
<tbody>
<tr>
<td>P2.13.1</td>
<td>Fieldbus min scale</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td></td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>P2.13.2</td>
<td>Fieldbus max scale</td>
<td>0,00</td>
<td>320,00</td>
<td>Hz</td>
<td>0,00</td>
<td></td>
<td>851</td>
<td></td>
</tr>
<tr>
<td>P2.13.3</td>
<td>Fieldbus process data out 1 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1</td>
<td></td>
<td>852</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Output Frequency</td>
</tr>
<tr>
<td>P2.13.4</td>
<td>Fieldbus process data out 2 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>2</td>
<td></td>
<td>853</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Motor Speed</td>
</tr>
<tr>
<td>P2.13.5</td>
<td>Fieldbus process data out 3 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>3</td>
<td></td>
<td>854</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Motor Current to FB</td>
</tr>
<tr>
<td>P2.13.6</td>
<td>Fieldbus process data out 4 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>4</td>
<td></td>
<td>855</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Motor Torque</td>
</tr>
<tr>
<td>P2.13.7</td>
<td>Fieldbus process data out 5 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>5</td>
<td></td>
<td>856</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Motor Power</td>
</tr>
<tr>
<td>P2.13.8</td>
<td>Fieldbus process data out 6 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>6</td>
<td></td>
<td>857</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Motor Voltage</td>
</tr>
<tr>
<td>P2.13.9</td>
<td>Fieldbus process data out 7 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>7</td>
<td></td>
<td>858</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: DC-Link Voltage</td>
</tr>
<tr>
<td>P2.13.10</td>
<td>Fieldbus process data out 8 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>37</td>
<td></td>
<td>859</td>
<td>Choose monitoring data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: Last Active Fault</td>
</tr>
<tr>
<td>P2.13.11</td>
<td>Fieldbus process data in 1 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>1140</td>
<td></td>
<td>876</td>
<td>Choose controlled data with parameter ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Def: FB Torque Reference</td>
</tr>
<tr>
<td>P2.13.12</td>
<td>Fieldbus process data in 2 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>46</td>
<td></td>
<td>877</td>
<td>Choose controlled data with parameter ID</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: FB Limit Scaling</td>
</tr>
<tr>
<td>P2.13.13</td>
<td>Fieldbus process data in 3 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>47</td>
<td></td>
<td>878</td>
<td>Choose controlled data with parameter ID</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Def: FB Adjust Reference</td>
</tr>
<tr>
<td>P2.13.14</td>
<td>Fieldbus process data in 4 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>48</td>
<td></td>
<td>879</td>
<td>Choose controlled data with parameter ID</td>
</tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Def: FB Analogue Output.</td>
</tr>
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<td>Fieldbus process data in 5 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td></td>
<td>880</td>
<td>Choose controlled data with parameter ID</td>
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<td>P2.13.16</td>
<td>Fieldbus process data in 6 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td></td>
<td>881</td>
<td>Choose controlled data with parameter ID</td>
</tr>
<tr>
<td>P2.13.17</td>
<td>Fieldbus process data in 7 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td></td>
<td>882</td>
<td>Choose controlled data with parameter ID</td>
</tr>
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<td>P2.13.18</td>
<td>Fieldbus process data in 8 selection</td>
<td>0</td>
<td>10000</td>
<td></td>
<td>0</td>
<td></td>
<td>883</td>
<td>Choose controlled data with parameter ID</td>
</tr>
<tr>
<td>P2.13.19</td>
<td>General Status Word ID</td>
<td>0</td>
<td>10000</td>
<td>67</td>
<td></td>
<td></td>
<td>897</td>
<td>Choose monitoring data in General Status Word</td>
</tr>
<tr>
<td>P2.13.20</td>
<td>State Machine</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td>896</td>
<td>1 = Standard</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 = ProfiDrive</td>
</tr>
</tbody>
</table>

Table 7-27. Fieldbus parameters

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 7.13 Value Control (Keypad: Menu M2 → G2.2.9)

<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>P2.14.1.1</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>
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<td>0</td>
<td></td>
<td>1584</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.6</td>
<td>Control Output Signal ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1585</td>
<td></td>
</tr>
<tr>
<td>P2.14.1.7</td>
<td>Control Mode</td>
<td>0</td>
<td>5</td>
<td></td>
<td>0</td>
<td></td>
<td>1586</td>
<td>0=5R ABS, 1=Scale ABS, 2=Scale INV ABS, 3=5R, 4=Scale, 5=Scale INV</td>
</tr>
</tbody>
</table>

Table 7-28. Power reference input signal selection, G2.2.8

### 7.13.1 DIN ID Control 1

<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>P2.14.2.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1570</td>
<td>Slot : Board input No.</td>
</tr>
<tr>
<td>P2.14.2.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1571</td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.2.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1572</td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.2.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1573</td>
<td>Value when DI is high</td>
</tr>
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Table 7-29. DIN ID Control parameters

### 7.13.2 DIN ID Control 2

<table>
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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>P2.14.3.1</td>
<td>ID Control DIN</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td></td>
<td>1590</td>
<td>Slot : Board input No.</td>
</tr>
<tr>
<td>P2.14.3.2</td>
<td>Controlled ID</td>
<td>0</td>
<td>10000</td>
<td>ID</td>
<td>0</td>
<td></td>
<td>1575</td>
<td>Select ID that is controlled by digital input</td>
</tr>
<tr>
<td>P2.14.3.3</td>
<td>False value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1592</td>
<td>Value when DI is low</td>
</tr>
<tr>
<td>P2.14.3.4</td>
<td>True value</td>
<td>-32000</td>
<td>32000</td>
<td></td>
<td>0</td>
<td></td>
<td>1593</td>
<td>Value when DI is high</td>
</tr>
</tbody>
</table>

Table 7-30

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
7.14 **Auto reset 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>P2.15.1</td>
<td>Wait time</td>
<td>0.10</td>
<td>10.00</td>
<td>s</td>
<td>0.50</td>
<td></td>
<td>717</td>
<td></td>
</tr>
<tr>
<td>P2.15.2</td>
<td>Trial time</td>
<td>0.00</td>
<td>60.00</td>
<td>s</td>
<td>0.10</td>
<td></td>
<td>718</td>
<td></td>
</tr>
<tr>
<td>P2.15.3</td>
<td>Start function</td>
<td>0</td>
<td>2</td>
<td></td>
<td>2</td>
<td>719</td>
<td></td>
<td>0=Ramp&lt;br&gt;1=Flying start&lt;br&gt;2=According to Stop Function</td>
</tr>
<tr>
<td>P2.15.4</td>
<td>Number of tries after undervoltage trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>720</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.15.5</td>
<td>Number of tries after overvoltage trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>721</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.15.6</td>
<td>Number of tries after overcurrent trip</td>
<td>0</td>
<td>3</td>
<td></td>
<td>0</td>
<td>722</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.15.7</td>
<td>Number of tries after reference trip</td>
<td>0</td>
<td>10</td>
<td></td>
<td>0</td>
<td>723</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.15.8</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></td>
<td></td>
</tr>
<tr>
<td>P2.15.9</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></td>
<td></td>
</tr>
<tr>
<td>P2.15.10</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></td>
<td></td>
</tr>
<tr>
<td>P2.15.11</td>
<td>Fault Simulation</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1569</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-31. Autorestart parameters, G2.16*
### 7.15 Line Synch 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>Control Mode</td>
<td>0</td>
<td>0</td>
<td></td>
<td>1</td>
<td>1626</td>
<td></td>
<td>0=Single motor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Multi motor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2=In Secuence</td>
</tr>
<tr>
<td>P2.16.2</td>
<td>Controlled motor</td>
<td>0</td>
<td>7</td>
<td></td>
<td>0</td>
<td>1611</td>
<td></td>
<td>Controlled motor when using multi motor mode</td>
</tr>
<tr>
<td>P2.16.3</td>
<td>Delay to Coasting</td>
<td>0</td>
<td>30000</td>
<td>ms</td>
<td>15</td>
<td>1621</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.4</td>
<td>Delay to Open</td>
<td>0</td>
<td>30000</td>
<td>ms</td>
<td>0</td>
<td>1623</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.5</td>
<td>Delay to Close</td>
<td>0</td>
<td>30000</td>
<td>ms</td>
<td>5</td>
<td>1624</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.6</td>
<td>Number of motors</td>
<td>1</td>
<td>8</td>
<td>Pcs</td>
<td>1</td>
<td>1627</td>
<td></td>
<td></td>
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</table>

### 7.15.1 Back To FC SlyStart

<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>P2.16.7.1</td>
<td>Start Delay to FC</td>
<td>0</td>
<td>30000</td>
<td>ms</td>
<td>200</td>
<td></td>
<td>1628</td>
<td></td>
</tr>
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</table>

### 7.15.2 Back To FC Synch (BackSynch)

<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>P2.16.8.1</td>
<td>Synch To Motor</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>0</td>
<td>1632</td>
<td>0=Disabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Enabled</td>
</tr>
<tr>
<td>P2.16.8.2</td>
<td>DOL Open Delay</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>0</td>
<td>1633</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.3</td>
<td>FC Delay To Close</td>
<td>0</td>
<td>30000</td>
<td>ms</td>
<td>50</td>
<td>1629</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.4</td>
<td>Phase Offset to FC</td>
<td>-179,0</td>
<td>179,0</td>
<td>Dec</td>
<td>-20,0</td>
<td>1609</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.5</td>
<td>Phase Hysteresis to FC</td>
<td>0,0</td>
<td>180,0</td>
<td>Deg</td>
<td>2,0</td>
<td>1638</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.6</td>
<td>Synch OK FC Delay</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>1000</td>
<td>1639</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.7</td>
<td>FWPV at Synch</td>
<td>0,00</td>
<td>150,00</td>
<td>%</td>
<td>90,00</td>
<td>1642</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.8</td>
<td>FWPV Ramp Rate</td>
<td>0,00</td>
<td>100,00</td>
<td>%/s</td>
<td>10,00</td>
<td>1643</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.8.9</td>
<td>FWPV Switch Delay</td>
<td>0,00</td>
<td>320,00</td>
<td>s</td>
<td>0,10</td>
<td>1644</td>
<td></td>
<td></td>
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</table>

*Table 7-32. Line Synch parameters, G2.12*
7.15.3  **Synchronization Tuning**

<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>P2.16.9.1</td>
<td>Smoot / Speed ratio</td>
<td>0</td>
<td>10</td>
<td></td>
<td>3</td>
<td>1690</td>
<td></td>
<td>0=smoothest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Fastest</td>
</tr>
<tr>
<td>P2.16.9.2</td>
<td>Phase Hysteresis</td>
<td>0.0</td>
<td>180.0</td>
<td>Dec</td>
<td>5.0</td>
<td>1620</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.3</td>
<td>Phase offset to NET</td>
<td>-179.0</td>
<td>179.0</td>
<td>Dec</td>
<td>-16.0</td>
<td>1608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.4</td>
<td>Generator Side Operation</td>
<td>0</td>
<td>1</td>
<td></td>
<td>0</td>
<td>1538</td>
<td></td>
<td>0=Enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1=Disabled</td>
</tr>
<tr>
<td>P2.16.9.5</td>
<td>Synchronization options</td>
<td>0</td>
<td>65535</td>
<td></td>
<td>0</td>
<td>1700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.6</td>
<td>Line Synch Frequency Reference Filter TC</td>
<td>0</td>
<td>100</td>
<td>ms</td>
<td>10</td>
<td>1900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.7</td>
<td>Frequency Hysteresis for Synchronization</td>
<td>0.00</td>
<td>50.00</td>
<td>Hz</td>
<td>0.60</td>
<td>1613</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.8</td>
<td>Frequency Hysteresis for Change</td>
<td>0.00</td>
<td>50.00</td>
<td>Hz</td>
<td>0.10</td>
<td>1614</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.9</td>
<td>Delay To Synch</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>500</td>
<td>1619</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2.16.9.10</td>
<td>Synch OK Delay</td>
<td>0</td>
<td>32000</td>
<td>ms</td>
<td>40</td>
<td>1649</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7-33. Line Synch parameters, G2.12*

7.15.4  **Commissioning**

<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>2.16.10.1</td>
<td>Commissioning Test modes</td>
<td>0</td>
<td>4</td>
<td></td>
<td>0</td>
<td>1634</td>
<td></td>
<td>0=Line Synchronization 1=FC, DL Timing 2=FC On, DL Off 3=FC Off, DL On</td>
</tr>
<tr>
<td>2.16.10.2</td>
<td>Commissioning test activation</td>
<td>0.1</td>
<td>E.10</td>
<td></td>
<td>0.1</td>
<td>1635</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.15.5  **Counters**

<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>2.16.11.1</td>
<td>M1FC CB Hours</td>
<td>0</td>
<td>2^32</td>
<td>h</td>
<td></td>
<td>1673</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.16.11.2</td>
<td>M1DL CB Hours</td>
<td>0</td>
<td>2^32</td>
<td>h</td>
<td></td>
<td>1674</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.16.11.3</td>
<td>M1FB CB Count</td>
<td>0</td>
<td>2^32</td>
<td></td>
<td></td>
<td>1675</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.16.11.4</td>
<td>M1DL CB Count</td>
<td>0</td>
<td>2^32</td>
<td></td>
<td></td>
<td>1676</td>
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<td></td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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>P2.1.2</td>
<td>Hz</td>
<td>0,00</td>
<td>123</td>
<td>0</td>
<td>Forward</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>1</td>
<td>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>0</td>
<td>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>Stop button always enabled</td>
</tr>
<tr>
<td>R3.5</td>
<td>Torque reference</td>
<td>0,0</td>
<td>100,0</td>
<td>%</td>
<td>0,0</td>
<td>114</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.34. 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 Minimum frequency ID101 “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.

**P2.1.2 Maximum frequency ID102 “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: Set this value higher than nominal frequency of grid where synchronization is made.

Note: Do not change this parameter to lower value that current output frequency if changed during running. The change will be executed without ramp.

**P2.1.3 Motor Nominal Voltage ID110 “Motor Nom Voltg”**
Find this value $U_n$ on the rating plate of the motor.

**P2.1.4 Motor Nominal Frequency ID111 “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”.

**P2.1.5 Motor nominal speed ID112 “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 $[FW]PolePairNumber$.

**P2.1.6 Motor nominal current ID113 “Motor Nom Currnt”**
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.

**P2.1.7 Motor cos phi ID120 “Motor Cos Phi”**
Find this value “cos phi” on the rating plate of the motor.
**P2.1.8 Magnetizing current**  

d612 “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

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

\[
\text{Motor Magnetization Current} = \frac{5 \cdot \sqrt{1 - (\cos \varphi)^2} - 1}{5 - \sqrt{1 - (\cos \varphi)^2}} \cdot \text{Motor Nominal Current}
\]

\[
[RW]\text{Rotor Flux} = \left( \frac{f(Motor Nom Freq)}{f(Out)} \right)^2, \text{ when } f(Out) > f(Motor Nom Freq)
\]

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

**DriveSynch Operation**  
Motor Nominal magnetization current / Number of drives in parallel using Vacon Drive Synch.

**P2.1.9 Identification**  
d631 “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.  

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
0 = “No Action”  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

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
3 = “Enc. ID Run” - Encoder identification run

The motor shaft needs to be able to rotate freely.

**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.

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

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

4 = “Ident All” - Identified All

The motor shaft needs to be able to rotate freely.

All the above identification selections are made in sequence.

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**: Marine application has all identified values stored to parameters, no need to redo identification if previous parameters are loaded back to the dive if e.g. control board is changed.

**P2.1.10 Motor Type**

ID650 "Motor Type"

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
Select used motor type with this parameter

0  "Induction" - **Induction motor**
   - Asynchronous motor

1  "PMSM" - **Permanent magnet synchronous motor**
   - Contact factory before using with externally magnetized motor.

2  "Synch. Machin" – **Synchronous Motor**
   - Separately excited motor.
8.2 Reference Handling – “Ref Handling”

8.2.1 Basic Parameters

P2.2.1 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 Poten.mete”.
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 select between ”I/O Reference” and ”I/O
   Reference 2” if selection is different than 14 [this one].
**P2.2.2 Keypad frequency reference selection**  
**ID121**  
"Keypad Ref Sel"

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

<table>
<thead>
<tr>
<th>Control Place</th>
<th>Analogue Input Group</th>
<th>Analogue Input 1</th>
<th>Analogue Input 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0=“AI1” - Analogue Input 1.</td>
<td>Signal scaling in “G2.4.3: Input Signals \ Analogue Input 1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1=“AI2” - Analogue Input 2.</td>
<td>Signal scaling in “G2.4.4: Input Signals \ Analogue Input 2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.</td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3=“AI1-AI2”</td>
<td>Analogue Input 1 - Analogue Input 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4=“AI2-AI1”</td>
<td>Analogue Input 2 - Analogue Input 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5=“AI1xAI2”</td>
<td>Analogue Input 1 x Analogue Input 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6=“AI1 Joystick”</td>
<td>Analogue input 1, -10 Vdc... +10 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7=“AI2 Joystick”</td>
<td>Analogue input 2, -10 Vdc... +10 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8=“Keypad Ref”</td>
<td>Reference from keypad R3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9=“Fieldbus”</td>
<td>Reference is taken from Fieldbus, alternative scaling can select in “G: Fieldbus”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**P2.2.3 Fieldbus frequency reference selection**  
**ID122**  
"Fieldbus Ctr Ref"

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

<table>
<thead>
<tr>
<th>Control Place</th>
<th>Analogue Input Group</th>
<th>Analogue Input 1</th>
<th>Analogue Input 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0=“AI1” - Analogue Input 1.</td>
<td>Signal scaling in “G2.4.3: Input Signals \ Analogue Input 1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1=“AI2” - Analogue Input 2.</td>
<td>Signal scaling in “G2.4.4: Input Signals \ Analogue Input 2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2=“AI1+AI2” - Analogue Input 1 + Analogue Input 2.</td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3=“AI1-AI2”</td>
<td>Analogue Input 1 - Analogue Input 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4=“AI2-AI1”</td>
<td>Analogue Input 2 - Analogue Input 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5=“AI1xAI2”</td>
<td>Analogue Input 1 x Analogue Input 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6=“AI1 Joystick”</td>
<td>Analogue input 1, -10 Vdc... +10 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7=“AI2 Joystick”</td>
<td>Analogue input 2, -10 Vdc... +10 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8=“Keypad Ref”</td>
<td>Reference from keypad R3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9=“Fieldbus”</td>
<td>Reference is taken from Fieldbus, alternative scaling can select in “G: Fieldbus”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**P2.2.4 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**

**P2.2.5.1 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

**P2.2.5.2 Preset speed 1 ID105 “Preset Speed 1”**

**P2.2.5.3 Preset speed 2 ID106 “Preset Speed 2”**

**P2.2.5.4 Preset speed 3 ID126 “Preset Speed 3”**

**P2.2.5.5 Preset speed 4 ID127 “Preset Speed 4”**

**P2.2.5.6 Preset speed 5 ID128 “Preset Speed 5”**

**P2.2.5.7 Preset speed 6 ID129 “Preset Speed 6”**

**P2.2.5.8 Preset speed 7 ID130 “Preset Speed 7”**

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

<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*

- Related parameters
  - Digital inputs P2.4.2.5-7 Preset Speed 1-3

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

**P2.2.5.9**  **Inching reference 1**  **ID1239**  **“Inching Ref 1”**
**P2.2.5.10**  **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”.

**P2.2.6.1**  **Torque reference selection**  **ID641**  **“Torq Ref Select”**

0=“Not Used”
1=“A11” - **Analogue Input 1**.
   Signal scaling in “G: Input Signals \ Analogue Input 1”
2=“A12” - **Analogue Input 2**.
   Signal scaling in “G: Input Signals \ Analogue Input 2”
3=“A13”
4=“A14”
5=“A11 Joystick”
   Analogue input 1, -10 Vdc... +10 Vdc. For joystick inputs the maximum negative reference is negated “Torq Ref Max”.
6=“A12 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/
P2.2.6.2 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.

P2.2.6.3 Torque reference scaling, minimum value  ID642 “Torq Ref Min”
Minimum torque reference for analogue input reference selections 1-4.

P2.2.6.4 Torque reference filtering time  ID1244 “TorqRefFilterTC”
Defines the filtering time for torque reference. Filtering is after load share function and before torque step function.

P2.2.6.5 Torque Speed Limit  ID644 “Torq Speed Limit”
This parameter defines the speed limiting mode in torque control mode.

0=”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.
1. "Freq Ref" – 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.

3. "Preset Sp 7" – Preset Speed 7 is limiting torque control speed.

**P2.2.6 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.

**P2.2.7 Open loop torque controller P gain ID639 “OL TorqCtrl P”**
Defines the gain for open loop torque control.

**P2.2.8 Open loop torque controller I gain ID640 “OL TorqCtrl I”**
Defines the integration gain for open loop torque control.
### 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.

**P2.2.7.1** Prohibit frequency area 1; Low limit

**P2.2.7.2** Prohibit frequency area 1; High limit

**P2.2.7.3** Prohibit frequency area 1; Low limit

**P2.2.7.4** Prohibit frequency area 1; High limit

**P2.2.7.5** Prohibit frequency area 1; Low limit

**P2.2.7.6** Prohibit frequency area 1; High limit

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

**P2.2.7.7** Ramp time factor for prohibited range

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)

**P2.2.8.1 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.

**P2.2.8.2 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”
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.

\[ \text{FW} \quad \text{FreqRef1} \]
\[ \text{FW} \quad \text{FreqRef1} \]
\[ \text{FU} \quad \text{FreqRef2} \]
\[ \text{FU} \quad \text{FreqRef2} \]

P2.2.9.1 Adjust Input  \hspace{1em} \text{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

P2.2.9.2 Adjust minimum  \hspace{1em} \text{ID494 “Adjust minimum”}

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

P2.2.9.3 Adjust maximum  \hspace{1em} \text{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 midpoint 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/
Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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 from 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 let’s 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.

**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 1](image1)

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

![Graph 2](image2)

*Figure 8-3. 10 % S ramp with 3 s 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 Time 2”
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.

![Image of Ramp Time Factor graph](image-url)

*Figure 8-4. Reducing acceleration and deceleration times*
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 FC Breaker Delay  D1712 “FCBreakerDelay”
In some cases when motor is needed to stop before starting to follow reference. In these cases DC Brake is used. When DC Brake is used this time needs to be set longer that is FC contactor closing delay. DC Brake operates in current reference mode; if current is not reached output voltage will increase. If voltage reached e.g. motor nominal voltage while FC breaker is open drive will trip to over current when breaker closes.
NOTE: Can be used only when costing stop of motor is allowed.

P2.3.13 Synchro Ramp 2 Time Freq Limit  ID1669 “SynchRamp2TFreqL”
If greater than zero this parameter will activate ramp time 2 when synchronisation is active.
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”

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

The first selected direction has the highest priority.
When the DIN1 contact opens the direction of rotation starts the change.

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

Figure 8-5. Start forward/Start reverse

Figure 8-6. Start, Stop, Reverse

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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-MotUP" – 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. This is for Start Place A, selected with P2.4.2.39 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. This is for Start Place A, selected with P2.4.2.39 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>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>
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<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.

P2.4.2.16  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/AI2 Sel”.

If selection for P2.2.1 I/O Reference is other than “14 / AI1/AI2 Sel” this digital input will change reference between P2.2.1 I/O Reference and P2.2.41 I/O Reference 2.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
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  \( \text{ID409} \) “I/O Term Control”
- Contact closed: Force control place to I/O terminal

P2.4.2.19 Control from keypad  \( \text{ID410} \) “Keypad Control”
- Contact closed: Force control place to keypad

P2.4.2.20 Control from Fieldbus  \( \text{ID411} \) “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 \( \text{ID125} \) (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  \( \text{ID496} \) “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 “Motor Ctrl Mode 1/2”**  
This digital input is used to change between the 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 Cooling monitor ID750 “Cooling Monitor”**  
When using a liquid-cooled drive, connect this input to the Cooling OK signal from Vacon flow control application or any input that shows state of used cooling unit. See details of operation from G2.11.9 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.

**P2.4.2.24 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.

**P2.4.2.25 Inching reference 1 ID530 “Inching 1”**

**P2.4.2.26 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 Inching Ramp ID1257 “Inching Ramp”  
- P2.2.7.9 Inching reference 1 ID1239 “Inching Ref 1”  
- P2.2.7.10 Inching reference 2 ID1240 “Inching Ref 2”

**P2.4.2.27 Quick Stop ID1213 “Quick Stop”**

Digital input for Quick Stop function

**P2.4.2.28 Input switch acknowledgement ID1209**

Select the digital input to acknowledge the status of the input switch. The input switch is normally a switch fuse unit or main contactor with which the power is fed to the drive. If the input switch acknowledgement is missing, drive trips at input switch open fault (F64).
P2.4.2.29 Active synchronization ID1600
This parameter defines what input is used to activate synchronization. When input is activated drive uses line frequency as frequency reference and will adjust voltage angle to correspond line voltage angle with given hysteresis.

P2.4.2.30 Active direct ID1601
This parameter defines what input is used to activate change to direct in line contactor. When synchronization is ready and active direct input is active drive will make change to net. See operation details from chapter 2. When using single motor control mode this input low signal will open the net contactor. For multi-motor control see ID1612.

P2.4.2.31 Reset Direct ID1612
This parameter resets the NET contactor control signal when using multi-motor control mode. In single motor control Active Direct low command will be Reset Direct command.

P2.4.2.32 FC Contactor acknowledgment ID1630
With this parameter select where connected feedback from the FC contactor is. Used for monitoring purposes and to generate F80.

P2.4.2.33 NET Contactor acknowledgment ID1631
With this parameter select where connected feedback from the NET contactor is. Used for monitoring purposes and to generate F80.

P2.4.2.34 Motor selection B0 ID1670
P2.4.2.35 Motor selection B1 ID1671
P2.4.2.36 Motor selection B2 ID1672
These digital inputs are used to select the controlled motor. In none of these inputs are equal or higher than DigIN: A. 1 parameter ID1608 is used for motor selection.

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>2</th>
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</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
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<td></td>
</tr>
<tr>
<td>B1</td>
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</tr>
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</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.4.2.37  **ByPass Inter Lock Falling Edge**   **ID1636**

Input from external monitoring device. HIGH will mean that motor DOL input is OK. This input will generate fault 87. Used e.g. when motor DOL overload protection is opening motor contactor.

P2.4.2.38  **ByPass Inter Lock Rising Edge**   **ID1637**

Input from external net monitoring device. LOW will mean that Net is OK. This input will generate fault 87. Used e.g. when motor DOL overload protection is opening motor contactor.
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.

*Figure 8-9. AI1 signal 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 %.
3 “Custom Range”
With custom range it is possible to freely adjust what input level corresponds to the minimum and maximum frequencies.

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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.4.3.8 Analogue Input 1 joystick input dead zone  ID382 “AI1 JoysDeadZone”
P2.4.4.8 Analogue Input 2 joystick input dead zone  ID395 “AI2 JoysDeadZone”

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.

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

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.
P2.4.3.10  AI1 sleep delay  ID386 “AI1 Sleep Delay”
P2.4.4.10  AI2 sleep delay  ID397 “AI2 Sleep Delay”
This parameter defines the time the analogue input signal has to stay under the sleep limit in order to stop the drive.

P2.4.3.11  AI1 joystick offset  ID165 “AI1 Joyst. Offset”
P2.4.4.11  AI2 joystick offset  ID166 “AI2 Joyst. Offset”
Defines 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 form 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  ID141 “AI3 Signal Sel”
P2.4.6.1  AI4 signal selection  ID152 “AI4 Signal Sel”
Connect the AI3/AI4 signal to the analogue input of your choice with this parameter. 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 ID142 “AI3 Filter Time”
P2.4.6.2 Analogue input 4 signal filtering time ID153 “AI3 Filter Time”

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

P2.4.3.3 Analogue input signal 3 signal range ID143 “AI3 Signal Range”
P2.4.4.3 Analogue input signal 4 signal range ID154 “AI4 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 %.

3 **“Custom Range”**
With custom range it is possible to freely adjust what input level corresponds to the minimum and maximum frequencies.
P2.4.5.4  AI3 custom setting minimum  ID144  “AI3 Custom Min”
P2.4.5.5  AI3 custom setting maximum  ID145  “AI3 Custom Max”
P2.4.6.4  AI4 custom setting minimum  ID155  “AI4 Custom Min”
P2.4.6.5  AI4 custom setting maximum  ID156  “AI4 Custom Max”

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

P2.4.5.6  AI3 signal inversion  ID151  “AI3 Signal Inv”
P2.4.6.6  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
8.5 Output signals

8.5.1 Digital output signals

In the Marine 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 Faul/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 on 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.

P2.5.1.14 Output frequency limit 1 supervision ID447 "FreqOut Supvl.im1"
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.

P2.5.1.15 Output frequency limit 2 supervision ID448 "FreqOut Supvl.im2"
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.

P2.5.1.16 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.

P2.5.1.17 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.

P2.5.1.18 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.

P2.5.1.19 Motor thermal protection ID452 "MotTherm 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.

P2.5.1.20 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.
P2.5.1.21  Limit Control active     ID454 “Limit Control ON”
One or more of the drive limit controllers is active.

8.5.1.1  **Fieldbus digital inputs connection**

P2.5.1.22  Fieldbus input data 1     ID455 “FB Dig Input 1”
P2.5.1.23  Fieldbus input data 2     ID456 “FB Dig Input 2”
P2.5.1.24  Fieldbus input data 3     ID457 “FB Dig Input 3”
P2.5.1.25  Fieldbus input data 4     ID169 “FB Dig Input 4”
P2.5.1.26  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.

P2.5.1.27  Charge DC link     ID1218
Charge DC. Used to charge the inverter drive through 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.

P2.5.1.27  Safe disable active     ID756 “Safe Disable Act”
Select the digital output to show the status of the Safe Torque Off.

P2.5.1.29  Drive in Synch     ID1625
This digital output indicates when the drive has been synchronized to net.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.5.1.30   Motor 1 FC Contactor control  ID1602
P2.5.1.31   Motor 1 NET Contactor control ID1603
P2.5.1.32   Motor 2 FC Contactor control  ID1604
P2.5.1.33   Motor 2 NET Contactor control ID1605
P2.5.1.34   Motor 3 FC Contactor control  ID1606
P2.5.1.35   Motor 3 NET Contactor control ID1607
P2.5.1.36   Motor 4 FC Contactor control  ID1615
P2.5.1.37   Motor 4 NET Contactor control ID1616
P2.5.1.38   Motor 5 FC Contactor control  ID1617
P2.5.1.39   Motor 5 NET Contactor control ID1618
P2.5.1.40   Motor 6 FC Contactor control  ID1645
P2.5.1.41   Motor 6 NET Contactor control ID1646
P2.5.1.42   Motor 7 FC Contactor control  ID1647
P2.5.1.43   Motor 7 NET Contactor control ID1648
P2.5.1.44   Motor 8 FC Contactor control  ID1664
P2.5.1.45   Motor 8 NET Contactor control ID1665

Digital output to control FC and DOL contactors.

P2.5.1.46   Synch Problem

Drive can’t reach synchronization frequency or angle within set time limit

P2.5.1.47   Frequency Out supervision limit 3  ID1914     “FreqOut SupVLim3”
P2.5.1.48   Frequency Out supervision limit 3  ID1915     “FreqOut SupVLim4”
8.5.2 Analogue outputs 1 & 2 & 3

**P2.5.2.1 Analogue output 1 signal selection**  ID464  “lout 1 Signal”

**P2.5.3.1 Analogue output 2 signal selection**  ID471  “lout 2 Signal”

**P2.5.4.1 Analogue output 3, signal selection**  ID478  “lout 3 Signal”

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

**P2.5.2.2 Analogue output function**  ID307  “lout Content”

**P2.5.3.2 Analogue output 2 function**  ID472  “lout 2 Content”

**P2.5.3.2 Analogue output 3, function**  ID479  “lout 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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**APFIFF44 LINE SYNCH-2**

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”

First order filtering is used for analogue output signals.

![Graph showing filter times and percentages](image)

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”

Inverts the analogue output signal:

![Graph showing inversion and percentages](image)

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

---

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogue output offset</td>
<td>ID375</td>
<td>&quot;Iout Offset&quot;</td>
</tr>
<tr>
<td>Analogue output 2 offset</td>
<td>ID477</td>
<td>&quot;Iout 2 Offset&quot;</td>
</tr>
<tr>
<td>Analogue output 3 offset</td>
<td>ID484</td>
<td>&quot;Iout 3 Offset&quot;</td>
</tr>
</tbody>
</table>
8.5.3 Delayed Digital Output 1 & 2 & 3

P2.5.5.1 Digital output 1 signal selection ID486 “Dig.Out 1 Signal”

P2.5.6.1 Digital output 2 signal selection ID489 “Dig.Out 2 Signal”

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

P2.5.5.2 Digital output function ID312 “D01 Content”

P2.5.6.2 Digital output 2 function ID490 “D02 Content”

0 = “Not used”
1 = “Ready”
   The AC drive is ready to operate.
   Common reasons when ‘Ready’ signals are missing:
   o Run enable signal is low
   o DC Voltage is too low
   o DC Voltage is too high
2 = “Run”
   The frequency converter is modulating.
3 = “Fault”
   A fault trip has occurred
4 = “FaultInvert”
   No active faults in the drive.
5 = “OverheatWarn”
   Drive temperature has exceeded normal operation conditions. Temperature limit may vary depending on drive type and size.
6 = “ExtFaul/Warn”
   External fault or warning depending on parameter response to external fault
7 = “RefFaul/Warn”
   Fault or warning depending on parameter Response to the 4mA reference fault - occurs if analogue reference is 4–20 mA and signal is <4mA
8 = “Warning”
   Always if a warning is on
9 = “Reversed”
   Drive output frequency is negative
10 = “JogSpeedSel”
   The jogging, preset or inching speed has been activated with digital input.
11 = “At speed”
   Induction motor: speed is within nominal slip of the reference.
   PMS motor: output frequency is within 1 Hz of the reference.
12 = “MotorRegAct”
   One of the limit regulators is active.
13 = “FreqLim1Sup”
   Output frequency limit 1 supervision
   The output frequency goes outside the set supervision low limit/high limit.
14 = “FreqLim2Sup”
   Output frequency limit 2 supervision
   The output frequency goes outside the set supervision low limit/high limit.
15 = “TorqLimSprv”
   Torque limit supervision
   The motor torque goes beyond the set supervision low limit/high.

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
I/O 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 = “ThermFlt/Wrn”
Thermistor fault or warning
The thermistor input of option board indicates overtemperature. Fault or warning depending on the response parameter.

23 = “Al 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

27 = “ID.Bit”
Select the signal for controlling the DO. The parameter has to be set in format xxxx.yy where xxxx is the ID number of a signal and yy is the bit number. For example, the value for DO control is 1174.02. 1174 is the ID number of Warning Word 1. So the digital output is ON when bit number 02 of the warning word (ID no. 1174) i.e. Motor underload is high.
With these parameters you can set on- and off-delays to digital outputs. Note that Delayed DO3 is operating at ms time accuracy.

Figure 8-10. Digital outputs 1 and 2, on- and off-delays
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.

**P2.5.7.1 Output frequency limit supervision function**  
ID315 “Freq Supv Lim 1”

**P2.5.7.3 Output frequency limit 2 supervision function**  
ID346 “Freq Supv Lim 2”

**P2.5.7.5 Torque limit, supervision function**  
ID348 “Torque Supv Lim”

**P2.5.7.8 Reference limit, supervision function**  
ID350 “Ref Superv Lim”

**P3.6.7.10 Drive temperature limit supervision function**  
ID354 “Temp Lim Superv.”

0 = No supervision
1 = Low limit supervision
2 = High limit supervision

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

**P2.5.7.2 Output frequency limit supervision value**  
ID316 “Freq Supv Val 1”

**P2.5.7.4 Output frequency limit 2 supervision value**  
ID347 “Freq Supv Val 2”

**P2.5.7.6 Torque limit, supervision value**  
ID349 “Torque Supv Val”

**P2.5.7.9 Reference limit, supervision value**  
ID351 “Ref Superv Value”

**P2.5.7.11 Drive temperature limit value**  
ID355 “Temp Supv Value”

---

**Figure 8-11. Supervision function**

**P2.5.7.7 Torque Supervision value scaling input**  
ID402 “Torque Superv Scl”

This parameter is used to change the torque limit supervision level between zero and P2.5.8.6 Torque Supv Val

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

P2.5.7.12 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

P2.5.7.13 Analogue Low supervision control limit ID357 “Ain Supv Llim”
P2.5.7.14 Analogue High supervision control limit ID358 “Ain Supv Hlim”

Figure 8-12. An example of On/Off-control
The following five parameters are used to set a limit value to be monitored with the corresponding parameter above.

- **P2.5.7.15** Output frequency limit supervision function ID1910 “Freq Supv Lim 3”
- **P2.5.7.17** Output frequency limit supervision function ID1912 “Freq Supv Lim 4”

0  No supervision  
1  Low limit supervision  
2  High limit supervision

*Figure 8-13. Supervision function*
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.
8.6.2 Torque limit handling

P2.6.2.1 Torque Limit  ID609  "Torque Limit"

The general torque limit for both motoring and generator sides. This value is the final limit for all scaling functions. This value should not be used for scaling but for maximum safety limit because the ramp up rate function is ineffective when this parameter is changed. Only the motoring side torque limit has a ramp up limiting function.

P2.6.2.2 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.

P2.6.2.3 Generator Torque limit  ID1288  "GenTorqueLimit"

Generator side torque limit. This limit is used for all scaling functions generator side torque limit is not included in ramp up rate function.

P2.6.2.4 Motoring Torque limit scaling  ID485  "MotTorqLimSclng"

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

P2.6.2.5 Generating torque limit scaling  ID1087  "GenTorqLimSclng"

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

P2.6.2.6 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.

P2.6.2.7 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 Frequency limit handling

P2.6.3.1 Negative frequency limit ID1286 “Neg Freq Limit”
Positive direction frequency limit. When changed in closed loop control mode change is made without ramp.

P2.6.3.2 Positive frequency limit ID1285 “Pas Freq Limit”
Negative direction frequency limit. When changed in closed loop control mode change is made without ramp.

8.6.4 DC Link handling

P2.6.4.1 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).

P2.6.4.2 Overvoltage Reference Select ID1262 “OverVolt.Ref.Sel”
Overvoltage reference level depending on the status of the brake chopper.

<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>
</tbody>
</table>
P2.6.3 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>500 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>
</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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.6.4.4 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 under voltage 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 under voltage the controller drive will ramp to zero speed and generate an under voltage fault.

P2.6.4.5 Under Voltage Reference Selector ID1537 "UnderVoltRef.Sel"

Overvoltage reference level depending on the status of the brake chopper.

<table>
<thead>
<tr>
<th>ID1537</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 / Low Voltage</td>
<td>500 V Unit: 412 V</td>
</tr>
<tr>
<td></td>
<td>690 V Unit: 567 V</td>
</tr>
<tr>
<td>1 / Automatic</td>
<td>0.80*Estimated DC nominal voltage</td>
</tr>
</tbody>
</table>

8.6.5 OPT-D7 Frequency Limit

P2.6.5.1 OPT-D7 Minimum Frequency ID1717
P2.6.5.1 OPT-D7 Maximum Frequency ID1716

Measured Line Frequency must be between these minimum and maximum limit, otherwise synchronization will not be started to OPT-D7 signal.
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.


8.7.1 Open loop settings

P2.7.1 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.

P2.7.2 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.
P2.7.3 **DC-braking time at stop ID508 “Stop D-BrakeTm”**

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.

![Diagram showing DC braking time at stop](image)

**Figure 8-14. DC-braking time when Stop mode =Coasting, from nominal speed and 50% of nominal speed.**

**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 8-15.
**P2.7.4 DC braking frequency at stop  ID515 “Stop D-BrakeFr”**
The output frequency at which the DC braking is applied when making ramping stop.

**P2.7.5 Scaling of DC-braking current  ID400 “DC-current Sclng”**
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

**P2.7.6 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*

**P2.7.7 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

**P2.7.8 Flux braking current  ID519 “FluxBrakeCurrent”**

Defines the flux braking current value. The value setting range depends on the used unit size.
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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.8.1 Motor control mode**  
**ID600 “Motor Ctrl Mode”**  

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 Speed/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.

**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.

![U/f Settings Diagram](image)

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 magnetizing 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).

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
Set then the midpoint voltage to $\sqrt{2} \times$ Zero Point Voltage and the midpoint frequency to (Zero Point Voltage/100%)\*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 ration 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 MC Options** ID1740 “MC Options”

B00 =1= Enable angle identification in open loop (PMSM)
P2.8.3.9  **U/f curve, middle point frequency 2**  ID604 "U/f Mid Freq 2"

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.

P2.8.3.10  **U/f curve, middle point voltage 2**  ID605 "U/f mid Voltg 2"

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.

P2.8.3.11  **U/f curve, middle point frequency 3**  ID604 "U/f Mid Freq 3"

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.

P2.8.3.12  **U/f curve, middle point voltage 3**  ID605 "U/f mid Voltg 3"

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.
8.8.2 **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 stat 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”.

**P2.8.4.1 PMSM Shaft Position ID649 “PMSMShaftPosition”**

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.

**P2.8.4.2 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 it’s 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. Supports: OPT-A4, OPT-A5, OPT-A7 and OPT-AE boards.

**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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
P2.8.4.3 Start Angle Identification Current ID1759 ”StartAngleIdCurr”
This parameter defines the current level that is used in start angle identification. The
correct level depends of the motor type used. In general, 50% of motor nominal current
seems to sufficient, but depending for example on the motor saturation level, higher
current might be needed.

P2.8.4.4 Polarity Pulse Current ID1566 ”PolarityPulseCur”
This parameters 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 disabled by
setting any negative parameter value, which is recommended especially if there occurs
F1 faults during the identification.

P2.8.4.5 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 pratical 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 disabled otherwise
overriding this function.
8.8.2.1 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.

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

**P2.8.4.6 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.

**P2.8.4.7 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.
8.8.2.2 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 Id 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.

P2.8.4.8 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.

P2.8.4.9 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.

P2.8.4.10 ExtldRef ID1730 "ExtldRef"

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.

P2.8.4.11 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.
8.8.2.3  *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.

![Diagram of motor with d-axis and q-axis](image)

**P2.8.4.11  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.

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

**P2.8.4.12  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.

\[
X_q[\text{Drive scale}] = \frac{X_q[\Omega] \times I_n[A] \times \sqrt{3}}{U_n[V] \times 2560}
\]
8.8.3 Stabilization settings

8.8.3.1 Torque stabiliser

The torque stabiliser is basically a first order high-pass filter for the estimated torque \( T \). The output of the filter is a frequency correction term \( df \) added to the output frequency reference. The purpose of the torque stabiliser is to stabilise the possible oscillations in the estimated torque. The controller gain is changing linearly between the zero and field weakening point frequencies. The zero and field weakening point gains can be controlled independently with gains. The stabiliser operates at frequencies above 3 Hz.

The discrete implementation of the filter is:

\[
\frac{1000}{\text{TorqStabDamp}} df_k = \frac{1000}{\text{TorqStabDamp}} G(T_k - T_{k-1}) + df_{k-1} = G_f(T_k - T_{k-1}) + df_{k-1}
\]

Where \( G_f \) is the total gain of the filter. The gain and the corner frequency of the filter is controlled by the following parameters

P2.8.5.1 Torque stabiliser Gain \( \text{ID1412} \) \"TorqStabGain\"

These parameters define together with the Torque Stabiliser Damping the actual gain of the filter. Torque Stabiliser Gain is the gain at the zero frequency. Torque stabiliser Gain in FWP is the gain at the field-weakening frequency. The gain changes linearly with the frequency between these two points so that the gain is

\[
G = \text{TorqStabGainFWP} + \text{TorqStabGain} - \frac{f}{f_{\text{FWP}}} \text{TorqStabGain}, \quad \text{if } f < f_{\text{FWP}}
\]

\[
G = \text{TorqStabGainFWP}, \quad \text{if } f \geq f_{\text{FWP}}
\]

The final gain is obtained by considering the value of Torque Stabiliser Damping and the scaling in which 256 means the gain 1. So, the final and the actual gain of the filter is obtained from

\[
G_f = \frac{1000 \times G}{256 \times \text{TorqStabDamp}}
\]
P2.8.5.2 Torque stabiliser damping ID1413 “TorqStabDamp”

If a PMS motor is used in open loop control mode it is recommended to use value 980 instead of 800. The value ‘980’ is set automatically when PMS motor is selected.

This parameter defines the corner frequency of the high-pass filter. The time constant of the filter is calculated as

\[ T_c = T_s \frac{\text{TorqStabDamp}}{1000 - \text{TorqStabDamp}} = 1ms \frac{\text{TorqStabDamp}}{1000 - \text{TorqStabDamp}} \]

It follows that the corner frequency of the filter is obtained from

\[ \omega_c = \frac{1}{T_c} \text{rad/s} \]

For example, if Torque stabilizer damping = 600, it follows that \( T_c \) = 1.5 ms and \( \omega_c \) = 667 rad/s.

P2.8.5.3 Torque stabiliser Gain in FWP area ID1414 “TorqStabGainFWP”

Gain of the torque stabiliser at field weakening point in open loop motor control operation. See details from Torque Stabiliser Gain.

P2.8.5.4 Torque stabiliser Limit ID1720 “TorqStabLimit”

This defines how much torque stabiliser can affect output frequency.

8.8.4 Flying Start tuning

P2.8.6.1 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 %.

P2.8.6.2 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 %.

P2.8.6.3 AC magnetization Current ID1701

Current reference during AC scanning phase.

P2.8.6.4 AC Scanning Time ID1702

Reference time for AC scanning when motor slip is 1 Hz. If slip is 0.50 Hz actual scanning time is double.
**P2.8.6.5 DC magnetization Current ID1703**
Current reference during DC scanning phase.

**P2.8.6.6 Flux Build Time ID1704**
Time when rotor flux is increased to nominal after flying start has found motor actual speed. If zero speed has find this is not used.

**P2.8.6.7 Flux Build Torque ID1711**
Torque reference during Flux built time.

**P2.8.6.8 Magnetization Phases ID1707**

**P2.8.6.9 Flying Start Options ID1610**
- \( b_0 = +1 \) = Disable movement to reverse direction
- \( b_1 = +2 \) = Disable AC Scanning
- \( b_2 = +4 \) = Disable Fly Brake phase
- \( b_3 = +8 \) = Use encoder information for frequency estimate
- \( b_4 = +16 \) = Use frequency reference for initial guess
- \( b_5 = +32 \) = Disable DC scanning for step-up application
8.8.5 Identification settings

P2.8.7.1 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

\[ RsVoltageDrop = \frac{l - R_s}{U_n} \]

P2.8.7.2 Ir: Add zero point voltage ID664 “IrAddZeroPVoltage”

Defines how much voltage is applied to motor in zero speed when torque boost is used.

P2.8.7.3 Ir: Add generator scale ID665 “IrAddGeneScale”

Defines the scaling factor for generator side IR-compensation when torque boost is used.

P2.8.7.4 Ir: Add motoring scale ID667 “IrAddMotorScale”

Defines the scaling factor for motoring side IR-compensation when torque boost is used.

P2.8.7.5 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.

P2.8.7.6 Motor BEM Voltage ID674 “Motor BEM Voltage”

Motor-induced back voltage.

P2.8.7.7 IU Offset ID668 “IU Offset”
P2.8.7.8 IV Offset ID669 “IV Offset”
P2.8.7.9 IW Offset ID670 “IW Offset”

Offsets the value for phase current measurement. Identified during identification run.
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 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 drooping time](image)
P2.9.3  **Speed controller P gain, Open Loop**  ID637  “OL Speed Reg P”  
Defines the P gain for the speed controlled in Open Loop control mode.

P2.9.4  **Speed controller I gain, Open Loop**  ID638  “OL Speed Reg I”  
Defines the I gain for the speed controlled in Open Loop control mode.
8.10 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>3.6</td>
</tr>
<tr>
<td>0003–0061 NX_2</td>
<td>1.0</td>
<td>10.0</td>
<td>3.6</td>
</tr>
<tr>
<td>0072–0520 NX_5</td>
<td>1.0</td>
<td>6.0</td>
<td>1.5</td>
</tr>
<tr>
<td>0041–0062 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.

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.

1 =Software Modulator 1
Symmetric vector modulator with symmetrical zero vectors. Current distortion is less than with software modulator 2 if boosting is used.

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.

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

P2.10.3 Control Options  ID1084 “Control Options”
Reserved for future use.

P2.10.4 Advanced Options 1 ID1560 “AdvancedOptions1”
B00 = Disable Synchronous modulation
B03 = Disable slip compensation for reverse direction
B06 = Enable synchronous symmetrical modulation

P2.10.5 Advanced Options 2 ID1561 “AdvancedOptions1”
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.

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 “AdvancedOptions6”
B05 = To reduce aliasing effects in current measurement, it is possible to take an average from all internal samples taken at fast time level. It must be noted, that this mode does not affect the motor control, only monitoring.

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.

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

8.11.1 Master Follower: DriveSynch system

DriveSynch is used to control parallel drives. Up to four drives can be connected parallelly. The motor can be a single winding motor or there can be several winding motors. VACON® DriveSynch works in open loop and closed loop motor control modes. With closed loop motor control, the encoder feedback needs to be wired only to the master drive. If redundancy is required, it may be necessary to wire the encoder feedback also to follower drives using the double encoder option board OPTA7.

Note:
In a DriveSynch system, only Master drive monitoring signals are reliable. Only directly measured values are reliable in follower units. Even the Output Frequency of DriveSynch follower is not directly observed and thus may not show actual output frequency that is controlled by DriveSynch Master Drive.

Note!
The maximum switching frequency for the drives using VACON® DriveSynch is 3.6 kHz. Minimum recommended switching frequency in Open Loop control is 1.7 kHz. Minimum recommended switching frequency in Closed Loop control is 2.5 kHz.

Note!
The VACON® NXP control board must be VB00761 (NXP3) or newer. OPT-D2 boards needs to VB276 Or newer. Master needs to be #1 and cannot be changed.
<table>
<thead>
<tr>
<th>Parameter settings</th>
<th>Master (D1)</th>
<th>Follower (D2)</th>
<th>Follower (D3)</th>
<th>Follower (D4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Nominal Voltage</td>
<td>Motor Nominal voltage from the motor name plate</td>
<td>Motor Nominal voltage from the motor name plate</td>
<td>Motor Nominal voltage from the motor name plate</td>
<td>Motor Nominal voltage from the motor name plate</td>
</tr>
<tr>
<td>Motor Nominal Frequency</td>
<td>Motor Nominal frequency from the motor name plate</td>
<td>Motor Nominal frequency from the motor name plate</td>
<td>Motor Nominal frequency from the motor name plate</td>
<td>Motor Nominal frequency from the motor name plate</td>
</tr>
<tr>
<td>Motor Nominal Current</td>
<td>Motor Nominal current from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal current from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal current from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal current from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
</tr>
<tr>
<td>Motor COS PHI (Motor nominal power factor)</td>
<td>Motor COS PHI from the motor name plate</td>
<td>Motor COS PHI from the motor name plate</td>
<td>Motor COS PHI from the motor name plate</td>
<td>Motor COS PHI from the motor name plate</td>
</tr>
<tr>
<td>Motor Nominal Power</td>
<td>Motor Nominal power from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal power from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal power from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor Nominal power from the motor name plate / Number of drives in parallel using VACON® Drive Synch</td>
</tr>
<tr>
<td>Master Follower Mode</td>
<td>Master, DriveSynch</td>
<td>Follower, DriveSynch</td>
<td>Follower, DriveSynch</td>
<td>Follower, DriveSynch</td>
</tr>
<tr>
<td>Motor Control Mode (Open Loop)</td>
<td>Open Loop Frequency</td>
<td>If used as Secondary Master: Open Loop Frequency. When used as Follower: no meaning.</td>
<td>No meaning, internally handled. Recommended to have same setting as in master.</td>
<td>No meaning, internally handled. Recommended to have same setting as in master.</td>
</tr>
<tr>
<td>Motor Control Mode (Closed Loop)</td>
<td>Closed Loop Speed /Torque</td>
<td>If used as Secondary Master: Closed Loop Speed/Torque. When used as Follower: no meaning.</td>
<td>No meaning, internally handled. Recommended to have same setting as in master.</td>
<td>No meaning, internally handled. Recommended to have same setting as in master.</td>
</tr>
<tr>
<td>Magnetizing current (needed only for closed loop motor control)</td>
<td>Motor nominal magnetizing current / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor nominal magnetizing current / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor nominal magnetizing current / Number of drives in parallel using VACON® Drive Synch</td>
<td>Motor nominal magnetizing current / Number of drives in parallel using VACON® Drive Synch</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>Max 3.6 KHz</td>
<td>Same as in Master</td>
<td>Same as in Master</td>
<td>Same as in Master</td>
</tr>
<tr>
<td>Modulator Type</td>
<td>1, Software</td>
<td>Same as in Master</td>
<td>Same as in Master</td>
<td>Same as in Master</td>
</tr>
<tr>
<td>Follower Phase shift (single winding motor)</td>
<td>0 degrees</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Follower Phase shift (multiple winding motor)</td>
<td>0 degrees</td>
<td>As per motor name plate</td>
<td>As per motor name plate</td>
<td>As per motor name plate</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 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 VACON® NCDrive PC software when commissioning Master Follower functions or line systems. Older boards have X6, leave this to ON (X6:1-2).

#### OPT-D2 Jumper X5 : TX1

- **Master**
  - SBinUse = Yes
  - SBID = 1
  - SBNextID = 2
  - SBLastID = 4

- **Follower**
  - SBinUse = Yes
  - SBID = 2
  - SBNextID = 3
  - SBLastID = 4

<table>
<thead>
<tr>
<th>H1 (RX)</th>
<th>H2 (TX)</th>
</tr>
</thead>
</table>

#### OPT-D2 Jumper X5 : TX2

- **Master**
  - SBinUse = Yes
  - SBID = 1
  - SBNextID = 2
  - SBLastID = 4

- **Follower**
  - SBinUse = Yes
  - SBID = 3
  - SBNextID = 4
  - SBLastID = 4

<table>
<thead>
<tr>
<th>H1 (RX)</th>
<th>H2 (TX)</th>
</tr>
</thead>
</table>

#### OPT-D2 Jumper X5 : TX2

- **Master**
  - SBinUse = Yes
  - SBID = 1
  - SBNextID = 2
  - SBLastID = 4

- **Follower**
  - SBinUse = Yes
  - SBID = 4
  - SBNextID = 1
  - SBLastID = 4

<table>
<thead>
<tr>
<th>H1 (RX)</th>
<th>H2 (TX)</th>
</tr>
</thead>
</table>

---

**Figure 8-16. 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** = “DSynchMaster” - Drive Synch Master
  - Drive number 1 must be selected as the parallel drive configuration master (in redundancy mode drive number 2 can be selected as master but certain diagnostic functions are no longer available).
- **2** = “DSynchFlwr” - Drive Synch Follower
  - Selection for parallel drive configuration follower drive

### P2.11.2 DriveSynch Follower Fault ID1531 “DS Follower Fault”

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

- **0** = No response
- **1** = Warning
- **2** = Fault, stop mode after fault according to Stop function

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

8.12.1 General settings

P2.12.1.1 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

P2.12.1.2 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

P2.12.1.3 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

P2.12.1.4 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
**P2.12.1.5 Response to external fault  ID701 “External Fault 1”**

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

**P2.12.1.6 Earth fault protection  ID703 (2.7.7)**

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

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.

**P2.12.1.7 Response to fieldbus fault  ID733 “FBComm.FaultResp”**

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

0 = No response
1 = Warning
2 = Fault, 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

**P2.12.1.8 Cooling fault delay  ID755**

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.

**P2.12.1.9 Safe Torque Off Response  ID755**

1 = Warning, Warning
2 = Warning, Fault
**P2.12.1.10 FaultWarnIndicat ID1940**

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

0 = Static

Static signal, as long as warning or fault is active

1 = Toggle

New fault or warning toggles signal for one second.

2 = Marine

Signal toggles in new fault or warning and status needs to be reset to get signal down.
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 marine application supports two OPT-BH and OPT-B8 board simultaneously. One can be used for the motor winding and one for the motor bearings.

P2.12.2.1 Number of used inputs in board 1 ID739 “Board1 Channels”

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

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

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

P2.12.2.2 Board 1 Temperature response ID740 “Board1 Response”

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

P2.12.2.3 Board 1 warning limit ID741 “Board1Warn.Limit”

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

P2.12.2.5 Board 1 fault limit ID742 “Board1 Fault Lim.”

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

P2.12.2.5 Number of used inputs in board 2 ID743 “Board2 Channels”

If you have two temperature sensor boards installed in your 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

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
**P2.12.2.6** Board 2 Temperature response \( ID766 \) "Board2 Response"

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

**P2.12.2.7** Board 2 warning limit \( ID745 \) "Board2 Warn. Lim"

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

**P2.12.2.8** Board 2 fault limit \( ID746 \) "Board2 FaultLim"

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

**8.12.2.1 Individual channel monitoring**

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

**P2.12.2.9.1** Channel 1B Warn \( ID764 \)

**P2.12.2.9.2** Channel 1B Fault \( ID765 \)

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

**P2.12.2.9.3** Channel 1C Warn \( ID768 \)

**P2.12.2.9.4** Channel 1C Fault \( ID769 \)

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

**P2.12.2.9.5** Channel 2B Warn \( ID770 \)

**P2.12.2.9.6** Channel 2B Fault \( ID771 \)

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

**P2.12.2.9.7** Channel 2C Warn \( ID772 \)

**P2.12.2.9.8** Channel 2C Fault \( ID773 \)

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

Motor Current

Stall Area

Stall Current Limit

Stall Freq. Limit

Output Freq.
P2.12.3.4 Stall time  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 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.

**P2.12.4.1 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

**P2.12.4.2 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

**P2.12.4.3 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.
**P2.12.4.4 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.

**P2.12.4.5 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.

![Motor temperature calculation](image)

*Figure 8-17. Motor temperature calculation*
P2.12.4.6  **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.
8.12.5  **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.

**P2.12.5.1 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

**P2.12.5.2 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.
8.12.6 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.

P2.12.6.1 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.

P2.12.6.2 Underload protection, zero frequency load  ID715 "UP F0 Torque"

The torque limit can be set between 5.0—150.0 % x TnMotor. This parameter gives the value for the minimum torque allowed with zero frequency.

P2.12.6.3 Underload protection, field weakening area load  ID714 "UP from Torque"

The torque limit can be set between 10.0—150.0 % x TnMotor. This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point.
P2.12.6.4 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.

8.12.7 Line Synch protection Functions

P2.12.7.1 DC Low Response ID1680

Select response for DC Low fault. This function will activate Fault 85. See details in the Line Synchronization chapter on protection functions. Use selection No Action, if Frequency Converter is disconnected from net when synchronization is finished.

0 = No action
1 = Warning
   Drive will open all contactors and wait until the reset command is given to open all contactors. After the DOL reset command the actual warning will reset automatically.
2 = Fault
   Drive will open all contactors and wait until the reset command is given to open all contactors. After the DOL reset command the actual fault can be reset.

P2.12.7.2 DC Low Limit ID1681

DC voltage Fault limit for F85.
P2.12.7.3  Line Voltage low response  ID1685
Select response for AC Low fault. This function will activate Fault 86. See details in the Line Synchronization chapter on protection functions. Use selections 0 or 1 if measurements are disconnected from net when synchronization is finished.

0 = No action
1 = Warning
2 = Fault
   Drive will open all contactors and wait until the reset command is given to open all contactors. After the DOL reset command, the actual fault can be reset.

P2.12.7.4  Line Voltage low limit  ID1686
AC voltage Fault limit for F86.

P2.12.7.5  Line Voltage Fault Delay  "LineVolt.F. Delay" ID1691
Defines delay to line voltage low limit ID1686

P2.12.7.6  DOL Conflict Fault Mode  ID1687
This parameter is used to select action if DOL control for M1 is opposite compared to feedback single. If feedback is not used, set value to no action.

P2.12.7.7  DOL Conflict Fault Delay  ID1688
This parameter defines delay for DOL conflict fault.

P2.12.7.8  Vac < 90 % Response  ID1689
Defines response for fault F83

P2.12.7.9  Synchronization time limit response  ID1792
   0 = No response
   1 = Warning
   2 = Fault, stop by coasting

P2.12.7.10  Synchronization time limit  ID1791
Time limit if synchronization is not reached.

   Active Synchro command time limit will be acceleration time + this parameter, if synchronization frequency is not reached within this time action defined by P2.12.7.9 is taken.

   Active Direct command time limit is this parameter, if angle synchronization is not reached within this time action defined by P2.12.7.9 is taken.
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.

![Graph showing fieldbus reference input scaling](https://via.placeholder.com/150)

Using this custom scaling function also affects the scaling of the actual value.

![Graph showing output frequency scaling](https://via.placeholder.com/150)
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 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>

P2.13.19  **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).
**P2.13.20 State Machine**

Application has possibility to select what kind of state machine is used.

1: **Standard**  
This mode makes fieldbus control behave as in explained in used fieldbus board manual.

2: **ProfiDrive**  
This mode uses ProfiDrive type state machine in application level. This mode is possible to use on fieldbus boards that does not have state machine itself or has possibility to bypass state machine functionality in option board.

See chapter 9: Status and Control Word in detail
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
Input value is scaled linearly between On and Off values.

5 = Scale Inverted
Inverted value is scaled linearly between On and Off values.
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](image)

- **P2.14.2.1 ID Control Digital Input ID1570**
  
  "ID Control DIN"

- **P2.14.3.1 ID Control Digital Input ID1590**
  
  "ID Control DIN"

- **P2.14.4.1 ID Control Digital Input ID1578**
  
  "ID Control DIN"

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

- **P2.14.2.2 DIN Controlled ID ID1571**
  
  "Controlled ID"

- **P2.14.3.2 DIN Controlled ID ID1575**
  
  "Controlled ID"

- **P2.14.4.2 DIN Controlled ID ID1579**
  
  "Controlled ID"

Select parameter ID controlled by ID1570.

- **P2.14.2.3 Value for Low digital input (FALSE) ID1572**
  
  "FALSE Value"

- **P2.14.3.3 Value for Low digital input (FALSE) ID1592**
  
  "FALSE Value"

- **P2.14.4.3 Value for Low digital input (FALSE) ID1594**
  
  "FALSE Value"

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

- **P2.14.2.4 Value for High digital input (TRUE) ID1573**
  
  "TRUE Value"

- **P2.14.3.4 Value for High digital input (TRUE) ID1593**
  
  "TRUE Value"

- **P2.14.4.4 Value for High digital input (TRUE) ID1596**
  
  "TRUE Value"

Set 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'.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.15 **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 Marine application, the default start function requires a rising edge command after fault trigger.

**P2.15.1 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.

**P2.15.2 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.

![Figure 8-18. Example of Automatic restarts with three restarts](image)

**P2.15.3 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.
P2.15.4 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.

P2.15.5 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.

P2.15.6 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.

P2.15.7 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)

P2.15.8 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

P2.15.9 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/
P2.15.10  **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

P2.15.11  **Fault Simulation  ID1569  "Fault Simulation"**

With this parameter it's possible to simulate different faults without actually making e.g. over current situation. In drive interface point of view behaviour is identical to actual fault situation.

- **B00 = 1** = Simulates over current fault (F1)
- **B01 = 2** = Simulates over voltage fault (F2)
- **B02 = 4** = Simulates under voltage fault (F9)
- **B03 = 8** = Simulates output phase supervision fault (F11)
- **B04 = 16** = Simulates earth fault (F3)
- **B05 = 32** = Reserved
- **B06 = 64** = Reserved
- **B07 = 128** = Simulates over temperature warning (W14)
- **B08 = 256** = Simulates over temperature fault (F14)
- **B09 = 512** = Reserved
8.16 Line Synchronization

**P2.16.1 Control Mode ID1626**

This parameter defines what kind of motor starting and stopping configuration is used.

0 = Single Drive
- Only one motor is used in the system. Active direct command will also open the NET contactor when there is a LOW signal.

1 = Multi-Motor
- Drive needs a command signal what motor will be synchronized to network. Also separate input is needed [Reset Direct] to open Net contactor. This parameter can also be used with one motor ID1627.

2 = In Sequence
- All motors in the system are set to Net in sequence when synchronization and active direct commands are active. Use ID1700 to select if rising edge is required for these commands.

**P2.16.2 Controlled motor ID1611**

This parameter defines what motor is controlled from the drive when using multi-motor control mode. Use of digital inputs for selection will bypass this parameter selection.

**P2.16.3 Delay to coasting ID1621**

This parameter defines the delay when modulation will be stopped from internal decision to make the change. See operation details from chapter 2.

**P2.16.4 Delay to Open ID1623**

This parameter defines the delay when the FC contactor will be opened from internal decision to make the change. See operation details from chapter 2.

**P2.16.5 Delay to Close ID1624**

This parameter defines the delay when the NET contactor will be closed from internal decision to make the change net. See operation details from chapter 2.

**P2.16.6 Number of motors ID1627**

Number of motors in the system. Used in multi-motor and In Sequence control modes.

8.16.1 Back To FC Flying Start

**P2.16.7.1 Start Delay to FC ID1628**

This parameter defines the delay when the drive will start after the command to open the NET contactor has been given. FC Contactor will be closed half of this time.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
8.16.2  **Back To FC Synchronization (BackSynch)**

**P2.16.8.1 Synch To Motor  ID1632**
This parameter enables synchronization to motor when changing back to FC control. If disabled drive will make normal flying start to motor when same change command to FC control is given.

0=Disabled  
1=Enabled

**P2.16.8.2 DOL Open Delay ID1633**
This parameter defines the delay when the DOL contactor will be opened from internal decision to make the change.

**P2.16.8.3 FC Delay To Close  ID1629**
This parameter defines the delay when the FC contactor will be closed from internal decision to make the change FC control.

**P2.16.8.4 Phase Offset to FC  ID1609**
This parameter defines the FC voltage angle advance to net voltage angle when synchronizing back to FC control. This parameter is adjusted depending on the motor load and the delay when the motor does not have current.

**P2.16.8.5 Phase Hysteresis to FC ID1638**
This parameter defines hysteresis when FC voltage angle and NET voltage angle are considered to be in synch.

**P2.16.8.6 Synch OK FC Delay  ID1639**
Delay how long internal status to change to FC control needs to be active before actual decision to make change is done.

**P2.16.8.7 FWPV at Synch  ID1642**
When motor is disconnected from grid, voltage of motor start to decrease immediately. First with a step and then with a motor time constant. This parameter should be adjusted to level what motor voltage is at the time when FC contactor closes.

**P2.16.8.8 FWPV Ramp Rate  ID1643**
This parameter defined ramp rate for voltage that is used to increase motor voltage back to nominal.

**P2.16.8.9 FWPV Switch Delay  ID1644**
Delay when ramping of voltage is started after FC contactor close command is given. This value should be bit longer than is contactor mechanical delay.
8.16.3  **Line Synchronization Fine Tuning**

2.15.9.1  **Smoot / Speed ratio**  ID1690  
This parameter is used to select speed of synchronization; there are 10 settings, where selection 0 is smoothest and selection 10 fastest. To get maximum speed for synchronization brake resistor or AFE may be needed.

2.15.9.2  **Phase hysteresis**  ID1620  
This parameter defines hysteresis when FC voltage angle and NET voltage angle are considered to be in synch.

2.15.9.3  **Phase offset to NET**  ID1608  
This parameter defines the FC voltage angle advance to net voltage angle when the synchronization command is on. This parameter is adjusted depending on the motor load and the delay when the motor does not have current.

2.15.9.4  **Generator Side Operation**  ID1538  
0 = Enable
   Drive will start phase synchronization regardless if frequency for synchronization needs to be increased or decreased.
1 = Disable
   Drive will start phase synchronization only on motoring side, i.e. frequency is only increased when synchronization is made. May be used on high inertia system, when synchronized without load.
2.15.9.5 **Synchronization options**  ID1700

This parameter is used to activate certain functions

- **b0** = Reserved
- **b1** = Single to Net
  
  The drive will monitor the rising edge of synchronization command and change to net command. In sequence mode the drive starts the next motor but follows normal frequency reference until the rising edge command is given.

- **b2** = Reserved
- **b3** = Single Reset
  
  Only one motor is taken from Net when this is active. If not active all motors that are in Net will be disconnected when Reset DOL command is given.

- **b4** = Reserved
- **b5** = Reserved
- **b6** = Reserved
- **b7** = Reserved
- **b8** = Reserved
- **b9** = Reserved
- **b10** = Reserved
- **b11** = Reserved
- **b12** = Disable Current Monitoring
  
  Motor current is not monitored for interlock

- **b13** = Disable Volt Monitoring
  
  Line voltage is not monitored from interlock

- **b14** = Disable Freq Monitoring
  
  Line voltage frequency is not monitored for interlock

- **b15** = Disable Phase Current Monitoring
  
  Motor Phase currents are not monitored for interlock.

2.15.9.6 **Line Frequency Reference Filter TC**  ID1900

When synchronized to weak generator grid frequency of the generator may change during acceleration. This parameter can be used to filter out fast changes in grid frequency.

2.15.9.7 **Freq. Hysteresis for synch**  ID1613

Frequency hysteresis when phase synchronization can be started.

2.15.9.8 **Frequency Hysteresis for Change**  ID1614

Frequency hysteresis for DOL change. This parameter allow higher frequency range of change. i.e. if phase angle is within hysteresis but frequency not change can be made still made. Useful on weak/unstable grids.

2.15.9.9 **Delay To Synch**  ID1619

When frequency is within Freq Hysteresis for Synch (P2.16.7.9) this parameter defines delay when phase synchronization is started. Useful when weak generator is used and frequency has destabilized during motor acceleration.

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

**P2.16.10.1 Commissioning; Test modes ID1634**

Test modes for commissioning purposes, to activate test modes see also P2.15.7.12

0 = Line synchronization mode

1 = FC and NET contactor timing mode.
This mode will control motor 1 contactor without actual synchronization, only delay parameters for opening and closing are used. Change between FC and NET contactor is made with [Active Direct] command.

2 = FC On, Net Off
This selection will force the FC contactor to close and the NET contactor to open.

3 = FC Off, Net On
This selection will force FC contactor to open and Net contactor to close.

**P2.16.10.2 Commissioning test activation ID1635**

This DI needs to be TRUE before test modes are activated. Use virtual input 0.2 if actual digital input is not available. This “extra” parameter has been added as a safety feature. When input is not active drive operates in normal Line Synch Mode.
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%.
9. PROTECTION FUNCTIONS

In this chapter you will find additional information on special parameter groups. Such groups are:

- Parameters of Motor thermal protection (Chapter 9.1)
- Parameters of Stall protection (Chapter 9.2)
- Parameters of Underload protection (Chapter 9.3)
- Fieldbus control parameters (Chapter 9.4)
- Line synchronization protections (Chapter 9.45)
9.1 Parameters of motor thermal protection (ID’s 704 to 708):
General

The motor thermal protection is to protect the motor from overheating. The Vacon 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.

The thermal stage of the motor can be monitored on the control keypad display V1.10 ID9. See the product's User’s Manual.

CAUTION! The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill.

9.2 Parameters of Stall protection (ID’s 709 to 712):
General

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, ID710 (Stall current) and ID712 (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 overcurrent protection.
9.3 Parameters of Underload protection (ID’s 713 to 716):

General

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.

Motor underload protection can be adjusted by setting the underload curve with parameters ID714 (Field weakening area load) and ID715 (Zero frequency load), see below. 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. If other than nominal motor is used with the drive, the accuracy of the torque calculation decreases.
9.4 Fieldbus control parameters (ID’s 850 to 859)

The Fieldbus control parameters are used when the frequency or the speed reference comes from the fieldbus (Modbus, Profinet, DeviceNet etc.). With the Fieldbus Data Out Selection 1...8 you can monitor values from the fieldbus.

Process Data OUT (Slave -> Master)

The fieldbus master can read the frequency converter’s actual values using process data variables. Basic, Standard, Local/Remote, Multi-Step, PID control and Pump and fan control applications use process data as follows:

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<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>

The Multipurpose application has a selector parameter for every Process Data. The monitoring values and drive parameters can be selected using the ID number. Default selections are as in the table above.

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>
Process Data IN (Master -> Slave)
ControlWord, Reference and Process Data are used with All-in-One applications as follows:

**Basic, Standard, Local/Remote, Multi-Step applications**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>Speed Reference</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>ControlWord</td>
<td>Start/Stop Command</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Fault reset Command</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PD1 – PD8</td>
<td>Not used</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Multipurpose control application**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>Speed Reference</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>ControlWord</td>
<td>Start/Stop Command</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Process Data IN1</td>
<td>Torque Reference</td>
<td>%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Process Data IN2</td>
<td>Free Analogue INPUT</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Process Data IN3</td>
<td>Adjust Input</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>PD3 – PD8</td>
<td>Not Used</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**PID control and Pump and fan control applications**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>Speed Reference</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>ControlWord</td>
<td>Start/Stop Command</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Process Data IN1</td>
<td>Reference for PID controller</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Process Data IN2</td>
<td>Actual Value 1 to PID controller</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Process Data IN3</td>
<td>Actual Value 2 to PID controller</td>
<td>%</td>
<td>0.01%</td>
</tr>
<tr>
<td>PD4 – PD8</td>
<td>Not Used</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
9.5 Line synchronization protection functions

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Both ON</td>
<td>Both contactors have been closed while drive is run state.</td>
</tr>
<tr>
<td>81</td>
<td>CAN Communication</td>
<td>Communication to externals CAN I/O has stopped. Communication can not be started again until drive is powered down.</td>
</tr>
<tr>
<td>82</td>
<td>Frequency error D7</td>
<td>Measured frequency is not within hysteresis. Check that drive sees correct and positive frequency.</td>
</tr>
<tr>
<td>83</td>
<td>Voltage error D7</td>
<td>Measured voltage is not within hysteresis. Check that all phases are measured.</td>
</tr>
<tr>
<td>84</td>
<td>Motor Current</td>
<td>Motor current is not within hysteresis to make synchronization to net. FC Contactor has not been closed or motor nominal current has been set too high related to used motor.</td>
</tr>
<tr>
<td>85</td>
<td>DC Low</td>
<td>Measured DC voltage was too low</td>
</tr>
<tr>
<td>86</td>
<td>AC Voltage</td>
<td>Measured line voltage was too low</td>
</tr>
<tr>
<td>87</td>
<td>ByPass interlock</td>
<td>External line measurement indicated that line is down</td>
</tr>
</tbody>
</table>

9.5.1 Fault 80, both contactor on while running
This fault is active when feedback from the first motor contactors is being used. This fault will appear if feedback from both contactors indicates that contactors are closed and the drive is modulating. When this happens, the drive will stop modulation immediately. Check the timing of the coasting delay, contactor opening delay and contactor closing delay.

9.5.2 Fault 81, Can communication
Communication to external CAN I/O has interrupted. When this fault happens, the drive will internally force the contactor control to off and the fault will not reset until the drive is powered down.

9.5.3 Fault 82, Frequency error D7
Measured line frequency is not within hysteresis. Measured line voltage frequency must be higher than +25 Hz and less than +75 Hz. If frequency is not within these hysteresis, the drive will not try to make synchronization to net.

9.5.4 Fault 83, Voltage error D7
Measured line voltage is less than 90 % of motor nominal voltage. If measured voltage is zero, two or all phase measurements are not connected to net; if some voltage is measured then probably one phase is not connected to net. Drive will not make synchronization if voltage is below 90 % of motor nominal voltage.

9.5.5 Fault 84, Motor current
Measured motor current is less than 15% of motor nominal current while in FC control. This usually means that the FC contactor has not been closed properly. Drive will not make changeover to net if the current is below 15% of motor nominal current.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
9.5.6 **Warning or Fault 85, DC Low**
This function monitors the drive's own DC voltage. If the voltage goes below a set limit, the drive will force open all contactors. This function is used to prevent DOL start if net is lost while motors are connected to net. If the drive is separated from net when synchronization is done, set response to No Response. When the warning/fault has occurred give command to open all NET contactors. This fault is possible to reset when internal logic sees that no DOL control is active (contactor control word is zero). Warning will reset automatically.

9.5.7 **Fault 86, AC Voltage**
This function monitors line rms voltage. If voltage goes below a set limit, the drive will force all contactors open. This function is used to prevent DOL start if net is lost while motors are connected to net. If the measurements are isolated from net when synchronization is done, set response to No Response. When the fault has occurred give command to open all NET contactors. This fault is possible to reset when internal logic sees that no DOL control is active (contactor control word is zero).

9.5.8 **Fault 87, ByPass interlock**
This function monitors DI where is connected input from any device that can indicate if three phase voltage input is interrupted to motor (NET monitor device, motor DOL thermal protection). This function is used to prevent DOL start if net is lost while motors are connected to net. When fault is activated drive will open all DO controls that are controlling DOL contactors. Normal operation can be started again when command to open all DO’s has been given (contactor control word is zero).

9.5.9 **OPT-AF and Emergency Stop**
When emergency stop or OPT-AF functions are activated drive will force all contactors open. This is not however part of the Safe Torque Off functionality.
### 10. CONTROL AND STATUS WORD IN DETAIL

**NOTE:** Combination 2 is not fully implemented as of 24.10.2013.

<table>
<thead>
<tr>
<th>Combination</th>
<th>P7.x.1.4 Operate Mode</th>
<th>P2.13.20 State machine</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/ ProfiDrive</td>
<td>1/ Standard</td>
<td>Control and 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.</td>
</tr>
<tr>
<td>3</td>
<td>2/ ByPass</td>
<td>1/ Standard</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>

10.1 Combination 1, ProfiDrive – Standard with Profibus option board

10.1.1 Control Word Combination 1, ProfiDrive – Standard with profibus option board

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>STOP 1 (by ramp)</td>
<td>ON 1</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b1</td>
<td>STOP 2 (by cost)</td>
<td>ON 2</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b2</td>
<td>STOP 3 (by ramp)</td>
<td>ON 3</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b3</td>
<td>RUN DISABLE ENABLE</td>
<td>ENABLE</td>
<td>Use this for start and stop command</td>
</tr>
<tr>
<td>b4</td>
<td>No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b5</td>
<td>No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b6</td>
<td>No Action</td>
<td>START</td>
<td>Keep this TRUE</td>
</tr>
<tr>
<td>b7</td>
<td>No Action</td>
<td>Fault Reset 0 &gt; 1</td>
<td>Use this for fault reset</td>
</tr>
<tr>
<td>b8</td>
<td>No Action</td>
<td>No Action</td>
<td>Not used</td>
</tr>
<tr>
<td>b9</td>
<td>No Action</td>
<td>No Action</td>
<td>Not used</td>
</tr>
<tr>
<td>b10</td>
<td>Disable Profibus control</td>
<td>Enable fieldbus control</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b11</td>
<td>Fieldbus DIN1=OFF</td>
<td>Fieldbus DIN1=ON</td>
<td>See P2.5.1.17 - 18</td>
</tr>
<tr>
<td>b12</td>
<td>Fieldbus DIN2=OFF</td>
<td>Fieldbus DIN2=ON</td>
<td>See P2.5.1.19 - 20</td>
</tr>
<tr>
<td>b13</td>
<td>Fieldbus DIN3=OFF</td>
<td>Fieldbus DIN3=ON</td>
<td>See P2.5.1.21 - 22</td>
</tr>
<tr>
<td>b14</td>
<td>Fieldbus DIN4=OFF</td>
<td>Fieldbus DIN4=ON</td>
<td>See P2.5.1.23 - 24</td>
</tr>
<tr>
<td>b15</td>
<td>Fieldbus DIN5=OFF</td>
<td>Fieldbus DIN5=ON</td>
<td>Not used</td>
</tr>
</tbody>
</table>

10.1.2 Status Word Combination 1, ProfiDrive – Standard with profibus option board

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Not Ready (initial)</td>
<td>READY 1 (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b1</td>
<td>Not Ready</td>
<td>READY 2 (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b2</td>
<td>DISABLE</td>
<td>ENABLE (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b3</td>
<td>NO FAULT</td>
<td>FAULT ACTIVE</td>
<td>Directly from the drive</td>
</tr>
<tr>
<td>b4</td>
<td>STOP 2</td>
<td>NO STOP 2 (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b5</td>
<td>STOP 3</td>
<td>NO STOP 3 (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b6</td>
<td>START ENABLE</td>
<td>START DISABLE (SM)</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b7</td>
<td>No Warning</td>
<td>Warning</td>
<td>Directly from the drive</td>
</tr>
<tr>
<td>b8</td>
<td>Reference ≠ Actual value</td>
<td>Reference = Actual value</td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td>Fieldbus control OFF</td>
<td>Fieldbus control ON</td>
<td>See profibus manual</td>
</tr>
<tr>
<td>b10</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>b11</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>b12</td>
<td>FC Stopped</td>
<td>Running</td>
<td>Directly from the drive</td>
</tr>
<tr>
<td>b13</td>
<td>FC not ready</td>
<td>Ready</td>
<td>Directly from the drive</td>
</tr>
<tr>
<td>b14</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>b15</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
</tbody>
</table>

SM = Profibus board State Machine

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
10.2 Combination 2, ByPass – ProfiDrive

Combination 2 is not fully implemented as of 24.10.2013.

10.2.1 State Diagram

Power supply on

S1: Switching On Disabled
SW.B6 = TRUE | B0, B1, B2 = FALSE

CW.B0 = FALSE (OFF)
CW.B1 = TRUE (No Coast Stop)
CW.B2 = TRUE (No Quick Stop)

CW.B1 = FALSE (Coast Stop)
CW.B2 = FALSE (Quick Stop)

S2: Ready For Switching On
SW.B0 = TRUE | B1, B2, B6 = FALSE

CW.B0 = TRUE (ON)
CW.B0 = FALSE (OFF)

S3: Switched On
SW.B0, B1 = TRUE | B2, B6 = FALSE

CW.B1 = FALSE (Coast Stop)
CW.B2 = FALSE (Quick Stop)

CW.B3 = TRUE (Enable Operation)
CW.B3 = FALSE (Disable Operation)

S4: Operation
SW.B0, B1, B2 = TRUE | B6 = FALSE

CW.B0 = TRUE (ON)
CW.B0 = FALSE (OFF)

CW.B2 = FALSE (Quick Stop)
CW.B2 = FALSE (Quick Stop)

CW.B2 = FALSE (Quick Stop)
CW.B2 = FALSE (Quick Stop)

S5: Switching Off
SW.B0, B1 = TRUE | B2, B6 = FALSE

Modulation Stopped

Modulation Stopped
10.2.2  **State Machine**

### 10.2.2.1  Costing Stop

\[
\begin{align*}
W & \quad \text{CW.B01 (Coasting Stop)} \\
V & \quad \text{NOT IN} \\
& \quad \text{OR} \\
& \quad \text{IN 1} \\
& \quad \text{IN 2} \\
& \quad \text{IN 3} \\
R & \quad \text{SW.B04 (Coast Stop Not Active)} \\
& \quad \text{V Coast Stop} \\
\end{align*}
\]

### 10.2.2.2  Quick stop

\[
\begin{align*}
W & \quad \text{CW.B01 (Coasting Stop)} \\
R & \quad \text{SW.B05 (Quick Stop Not Active)} \\
& \quad \text{SET} \\
& \quad \text{RESET} \\
& \quad \text{AND IN 1} \\
& \quad \text{IN 2} \\
& \quad \text{NOT IN} \\
& \quad \text{V Quick Stop} \\
& \quad \text{R SW.B06 (Switch On Inhibited)}
\end{align*}
\]

### 10.2.2.3  Switch On Inhibit

### 10.2.2.4  Ready to Switch-On, Operate and Running

\[
\begin{align*}
R & \quad \text{SW.B06 (Switch On Inhibited)} \\
V & \quad \text{Drive Ready State} \\
V & \quad \text{No Active Fault} \\
& \quad \text{AND IN 1} \\
& \quad \text{IN 2} \\
& \quad \text{V Ramp Stop} \\
& \quad \text{V Drive Modulating} \\
& \quad \text{AND IN 1} \\
& \quad \text{IN 2} \\
& \quad \text{Internal Conditions for Ready To Operate} \\
& \quad \text{AND IN 1} \\
& \quad \text{IN 2} \\
& \quad \text{In 3} \\
R & \quad \text{SW.B00 (Ready to Switch On)} \\
& \quad \text{V RunRequest} \\
& \quad \text{V Flux Ready} \\
& \quad \text{V Brake Open}
\end{align*}
\]

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 10.2.3 FB Control Word

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 ON</td>
<td>0=1 will reset the Switch On Inhibit state and bring the drive to Ready Run. Should be reset after fault, Coasting 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 =3/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.

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

10.2.3.1 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.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
B08: FALSE = No Function, TRUE = Jogging

**Jogging 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 P2.13.10.3 FB WD Delay. When value is zero pulse is not monitored.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### FB Status Word

| Signal          | Comment                                           |
|-----------------|                                                  |
| b0 Ready to switch On | 0=The drive NOT ready to switch ON  
1=The drive is ready to switch ON |
| b1 Ready to Operate | 0=The drive is NOT ready to run  
1=The drive is ready to run |
| b2 Running       | 0=The drive is NOT running  
1=The drive is running and ready to release the reference |
| b3 Fault Active  | 0=No fault active  
1=Fault IS active |
| b4 Cost Stop NOT active | 0=Coast stop active  
1=Coast stop NOT active |
| b5 EM Stop not Active | 0=Emergency stop active  
1=Emergency stop NOT active |
| b6 Switch On Inhibit | 0=No Inhibit  
1=The drive is out of fault and coast / emergency stop state. |
| b7 Warning       | 0=NO alarm  
1=Alarm IS active |
| b8 Speed At Ref  | 0=Speed actual is NOT equal to speed reference  
1=Speed actual is equal to speed reference |
| b9 FB Control Active | 0=Fieldbus Control NOT active  
1=Fieldbus Control active |
| b10 Above Limit  | 0=Speed actual is below the limit P2.4.16  
1=Speed actual is above the speed limit |
| b11              |                                                  |
| b12              |                                                  |
| b13              |                                                  |
| b14              |                                                  |
| b15 Watch Dog Feedback |                                                  |

**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 flux 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.
10.3 Combination 3, ByPass – Standard

10.3.1 Control Word Combination 3, ByPass – Standard

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>STOP</td>
<td>START</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>Clockwise</td>
<td>Counter clockwise</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>No action</td>
<td>FAULT RESET (0 -&gt; 1)</td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b4</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b12</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

10.3.2 Status Word Combination 3, ByPass – Standard

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 ID65 V1.24.2 FB Status Word. Below Status Word can be selected with P2.13.9 GSWID by setting it to ID64.

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>TRUE</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Not Ready</td>
<td>READY</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>STOP</td>
<td>RUN</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>Clockwise</td>
<td>Counter clockwise</td>
<td></td>
</tr>
<tr>
<td>b3</td>
<td>NO FAULT</td>
<td>FAULT ACTIVE</td>
<td></td>
</tr>
<tr>
<td>b4</td>
<td>No Warning</td>
<td>Warning</td>
<td></td>
</tr>
<tr>
<td>b5</td>
<td>Reference ≠ Actual value</td>
<td>Reference = Actual value</td>
<td></td>
</tr>
<tr>
<td>b6</td>
<td>Speed &gt; Zero</td>
<td>At Zero Speed</td>
<td></td>
</tr>
<tr>
<td>b7</td>
<td>Flux Not Ready</td>
<td>Flux Ready</td>
<td></td>
</tr>
<tr>
<td>b8</td>
<td>TC Speed Limit Active</td>
<td>TC Speed Limit Not Active</td>
<td></td>
</tr>
<tr>
<td>b9</td>
<td>Detected Encoder Direction Clockwise</td>
<td>Encoder Direction Counter clockwise</td>
<td></td>
</tr>
<tr>
<td>b10</td>
<td>UV Fast Stop Active</td>
<td>UV Fast Stop Not Active</td>
<td></td>
</tr>
<tr>
<td>b11</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b12</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b13</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b14</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>b15</td>
<td>Not used</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

SM = Profibus board State Machine

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
10.4 LineSynch Control and Status

10.4.1 FB Line Synchronization control word ID1640

Control Word for synchronization. Use Synchronization status word to complete sequences correctly.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0</td>
<td>Activate synchronization: Drive will synchronize to net frequency</td>
</tr>
<tr>
<td>b1</td>
<td>Activate changeover to DOL: Drive will make change to DOL when synchronized</td>
</tr>
<tr>
<td>b2</td>
<td>Reset DOL contactor(s): Drive will open closed net contactor(s)</td>
</tr>
<tr>
<td>b3</td>
<td>Single Start: Drive will not start automatically to next motor, rising edge start command required in FB control.</td>
</tr>
<tr>
<td>b4</td>
<td>Single to net: Drive will not make changeover to DOL automatically, rising edge for synchronization and changeover required. (ID1700.B1)</td>
</tr>
<tr>
<td>b5</td>
<td>Single reset: Rising edge of Reset DOL will open only one NET contactor. (ID1700.B3)</td>
</tr>
<tr>
<td>b6</td>
<td>Motor Bx control: B12 to 14 are used to select controlled motor in FB control.</td>
</tr>
<tr>
<td>b7</td>
<td>Start in sequence: Drive will put all motors to net while B0-B2 are active, cannot be used at the same time with B8.</td>
</tr>
<tr>
<td>b8</td>
<td>Motor select B0</td>
</tr>
<tr>
<td>b9</td>
<td>Motor select B1</td>
</tr>
<tr>
<td>b10</td>
<td>Motor select b2</td>
</tr>
<tr>
<td>b11</td>
<td>Motor select b2</td>
</tr>
</tbody>
</table>

B00: FALSE = No Synchronization, TRUE = Synchronization Active

No Synchronization: Drive will operate in normal frequency reference control.

Synchronization Active: Drive will use OPT-D7 frequency information for reference and synchronizes voltage angles accordingly set parameters.

During synchronization and changeover needs to be high until changeover is completed, otherwise drive returns to normal reference operation.

If BackSynch is used this bit needs to by High, otherwise normal flying start is made when changing back to drive control.

When making BackSynch start command needs to be active.

B01: FALSE = No Action, TRUE = Change to DOL

No Action: No operation from drive.

Synchronization Active: If B00 command is active and drive has synchronized to grid change to DOL will be made.
B02: FALSE = No Action, TRUE = Reset DOL Contactor

No Action: No operation from drive.

Reset DOL Contactor: DOL Contactor is opened, depending on setting coasting, flying start or BackSynch is made.

If BackSynch is made this command needs to be high until change to FC control has been made.

BackSynch is made if:
- This is activated from parameter.
- Start Command is active.
- Synchronization command is active.

When DOL Contactor command is given drive will:
- Start directly to OPT-D7 frequency
- Make synchronization to voltage angle
- Close FC contactor and open DOL contactor in order depending on set delay parameters.

When motor is in FC control B02 and B00 can be set zero (use Synchronization status word to determine timing) and drive will follow normal frequency reference.
### 10.4.2 Synchronization Status Word ID1651

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Drive Ready</td>
<td>Drive is in Ready state</td>
</tr>
<tr>
<td>b1 Drive Run</td>
<td>Drive is in Run state</td>
</tr>
<tr>
<td>b2 Active Synchro</td>
<td>Command to make synchronization is active</td>
</tr>
<tr>
<td>b3 Fine tuning Start</td>
<td>Line voltage frequency within 0,10 Hz from net frequency</td>
</tr>
<tr>
<td>b4 Fine tuning OK</td>
<td>Voltage angle is within hysteresis</td>
</tr>
<tr>
<td>b5 Active Direct</td>
<td>Command to change to net is active</td>
</tr>
<tr>
<td>b6 FC Active</td>
<td>Final control signal to FC relay</td>
</tr>
<tr>
<td>b7 Connect Direct</td>
<td>Internal command to close NET contactor</td>
</tr>
<tr>
<td>b8 Direct Active</td>
<td>Final control signals to NET relay</td>
</tr>
<tr>
<td>b9, b10, b11</td>
<td></td>
</tr>
<tr>
<td>b12 Start Command</td>
<td>Start Command is active</td>
</tr>
</tbody>
</table>

**B02:** FALSE = No Synchronization, TRUE = Active Synchronization

- **No Synchronization:** There is not active command to make synchronization.
- **Active Synchronization:** There is command active to make synchronization.

**B03:** FALSE = Freq Not In Hyst, TRUE = Frequency In Hysteresis

- **Freq Not In Hyst:** Frequency is not in hysteresis to start synchronization
- **Frequency In Hysteresis:** Frequency is within hysteresis to start synchronization

**B04:** FALSE = Angle not in Hysteresis, TRUE = Synchronization done

- **Angle not in hysteresis:** Voltage angle is not within hysteresis.
- **Frequency In Hysteresis:** Drive voltage and grid voltage angles are within hysteresis.

**B05:** FALSE = No Command, TRUE = Request to close direct

- **No Command:** There is not active command to make DOL change.
- **Request to close DOL:** Request to close DOL contactor is active.

**B06:** FALSE = No Command, TRUE = Close FC Contactor

- **No Command:** No internal command to close FC Contactor.
- **Close FC Contactor:** Command to close FC contactor is active.

**B07:** FALSE = No Command, TRUE = Close DOL Contactor

- **No Command:** No internal command to close FC Contactor.
- **Close DOL Contactor:** Internal command to close DOL contactor is active (pulse).

**B08:** FALSE = No Command, TRUE = DO Command to DOL Contactor

- **No Command:** No final command to close DOL.
- **DO Command to DOL Contactor:** Final command to close DOL contactor.

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
### 10.4.3 Synchronization Status Word 2 ID1682

<table>
<thead>
<tr>
<th>Signal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 Coasting to NET</td>
<td>Internal coasting command is active</td>
</tr>
<tr>
<td>b1 Active Synchro</td>
<td>Command to make synchronization is active</td>
</tr>
<tr>
<td>b2 Active Direct</td>
<td>Command to change to net is active</td>
</tr>
<tr>
<td>b3 Reset Direct</td>
<td>Multi Motor net contactor reset command</td>
</tr>
<tr>
<td>b4 Fine tuning</td>
<td>Line voltage frequency within 0,10 Hz from net frequency</td>
</tr>
<tr>
<td>b5 Fine tuning OK</td>
<td>Voltage angle is within hysteresis</td>
</tr>
<tr>
<td>b6 Connect Direct</td>
<td>Internal command to close NET contactor</td>
</tr>
<tr>
<td>b7 Direct Active</td>
<td>Final control signals to NET relay</td>
</tr>
<tr>
<td>b8 FC Active</td>
<td>Final control signal to FC relay</td>
</tr>
<tr>
<td>b9 Drive Ready</td>
<td>Drive is in Ready state</td>
</tr>
<tr>
<td>b10 Drive Run</td>
<td>Drive is in Run state</td>
</tr>
<tr>
<td>b11 RunEnable</td>
<td>Internal RunEnable status</td>
</tr>
<tr>
<td>b12 RunRequest</td>
<td>Internal RunRequest status</td>
</tr>
<tr>
<td>b13 FC Contactor Ack.</td>
<td>Feedback from M1 FC contactor</td>
</tr>
<tr>
<td>b14 Net Contactor Ack.</td>
<td>Feedback from M1 NET contactor</td>
</tr>
<tr>
<td>b15 Both ON when Run</td>
<td>Drive was running while Net and FC contactor were closed</td>
</tr>
</tbody>
</table>

**B01:** FALSE = No Synchronization, TRUE = Active Synchronization  
*No Synchronization:* There is not active command to make synchronization.  
*Active Synchronization:* There is command active to make synchronization.  

**B02:** FALSE = No Command, TRUE = Request to close direct  
*No Command:* There is not active command to make DOL change.  
*Request to close DOL:* Request to close DOL contactor is active.  

**B03:** FALSE = No Command, TRUE = Reset DOL  
*No Command:*  
*Reset DOL:*  

**B04:** FALSE = Freq Not In Hyst, TRUE = Frequency In Hysteresis  
*Freq Not In Hyst:* Frequency is not in hysteresis to start synchronization  
*Frequency In Hysteresis:* Frequency is within hysteresis to start synchronization  

**B05:** FALSE = Angle not in Hysteresis, TRUE = Synchronization done  
*Angle not in hysteresis:* Voltage angle is not within hysteresis.  
*Frequency In Hysteresis:* Drive voltage and grid voltage angles are within hysteresis.  

**B06:** FALSE = No Command, TRUE = Close DOL Contacter  
*No Command:* No Internal command to close FC Contacter.  
*Close DOL Contacter:* Internal command to close DOL contactor is active (pulse).  

**B07:** FALSE = No Command, TRUE = DO Command to DOL Contacter  
*No Command:* No final command to close DOL.  
*DO Command to DOL Contacter:* Final command to close DOL contactor.
11. PROBLEM SOLVING

While proper information is needed form 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.

**Recommended signals for NCDrive**

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Actual</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Word</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Torque</td>
<td>-0.2</td>
<td></td>
</tr>
<tr>
<td>Output Frequency</td>
<td>0</td>
<td>Hz</td>
</tr>
<tr>
<td>ContactoStatus</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Phase Error</td>
<td>0</td>
<td>Deg</td>
</tr>
<tr>
<td>Line/voltage req.</td>
<td>0</td>
<td>Hz</td>
</tr>
<tr>
<td>Synch Status</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

Note that Datalogger settings can be changed to catch correct situation and it's also 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 1. Datalogger window opening and Service Info upload.*
12. **FAULT CODES**

The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults only. The items written in white on black background present faults for which you can program different responses in the application. See parameter group Protections.

**Note:** When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display.

<table>
<thead>
<tr>
<th>Fault code</th>
<th>Fault</th>
<th>Possible cause</th>
<th>Correcting measures</th>
</tr>
</thead>
</table>
| 1          | Overcurrent | Frequency converter has detected too high a current (>4*I<sub>H</sub>) in the motor cable:  
- sudden heavy load increase  
- short circuit in motor cables  
- unsuitable motor  
Subcode in T.14:  
S1 = Hardware trip  
S2 = Reserved  
S3 = Current controller supervision | - Check loading.  
- Check motor.  
- Check cables.  
- Make Identification run |
| 2          | Overvoltage | The DC-link voltage has exceeded the drive limit. See User manual.  
- Too short a deceleration time  
- High overvoltage spikes in supply  
Subcode in T.14:  
S1 = Hardware trip  
S2 = Overvoltage control supervision | - Make the deceleration time longer.  
- Use brake chopper or brake resistor (available as options)  
- Activate over voltage controller.  
- Check input voltage |
| 3          | Earth fault | Current measurement has detected that the sum of motor phase current is not zero.  
- Insulation failure in cables or motor | - Check motor cables and motor. |
| 5          | Charging switch | The charging switch is open, when the START command has been given.  
- Faulty operation  
- Component failure | - Reset the fault and restart.  
- Should the fault re-occur, contact your local distributor. |
| 6          | Emergency stop | Stop signal has been given from the option board. | - Check emergency stop circuit |
| 7          | Saturation trip | Various causes:  
- Defective component  
- Brake resistor short-circuit or overload | - Cannot be reset from the keypad.  
- Switch off power.  
- DO NOT RE-CONNECT POWER!  
- Contact your local distributor.  
- If this fault appears simultaneously with Fault 1, check motor cables and motor |
|   | System fault | - component failure  
|   |             | - faulty operation  
|   |             | Note exceptional fault data record  
|   |             | Subcode in T.14:  
|   |             | S1 = Reserved  
|   |             | S2 = Reserved  
|   |             | S3 = Reserved  
|   |             | S4 = Reserved  
|   |             | S5 = Reserved  
|   |             | S6 = Reserved  
|   |             | S7 = Charging switch  
|   |             | S8 = No power to driver card  
|   |             | S9 = Power unit communication (TX)  
|   |             | S10 = Power unit communication (Trip)  
|   |             | S11 = Power unit comm. (Measurement)  
|   |             | Reset the fault and restart. Should the fault re-occur, contact your local distributor.  
|   | Undervoltage | DC-link voltage is under the drive fault voltage limit. See user manual.  
|   |             | - most probable cause: too low a supply voltage  
|   |             | - frequency converter internal fault  
|   |             | - One of input fuse is broken.  
|   |             | - External charge switch have not been closed.  
|   |             | Subcode in T.14:  
|   |             | S1 = DC-link too low during run  
|   |             | S2 = No data from power unit  
|   |             | S3 = Undervoltage control supervision  
|   |             | - In case of temporary supply voltage break, reset the fault and restart the frequency converter.  
|   |             | - Check the supply voltage.  
|   |             | - If it is adequate, an internal failure has occurred.  
|   |             | - Check input fuses  
|   |             | - Check DC charge function  
|   |             | - Contact your local distributor.  
|   | Input line supervision | Input line phase is missing.  
|   |             | Subcode in T.14:  
|   |             | S1 = Phase supervision diode supply  
|   |             | S2 = Phase supervision active front end  
|   |             | Check supply voltage, fuses and cable.  
|   | Output phase supervision | Current measurement has detected that there is no current in one motor phase.  
|   |             | Check motor cable and motor.  
|   | Brake chopper supervision | - no brake resistor installed  
|   |             | - brake resistor is broken  
|   |             | - brake chopper failure  
|   |             | - Check brake resistor and cabling.  
|   |             | - If ok, the chopper is faulty. Contact your local distributor.  
|   | Frequency converter under-temperature | Heatsink temperature is under –10°C  
|   |             | Check the correct amount and flow of cooling air.  
|   |             | - Check the heatsink for dust.  
|   |             | - Check the ambient temperature.  
|   |             | - Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.  
|   | Frequency converter over-temperature | Heatsink temperature is over 90°C  
|   |             | Overtemperature warning is issued when the heatsink temperature exceeds 85°C.  
|   |             | - Check the correct amount and flow of cooling air.  
|   |             | - Check the heatsink for dust.  
|   |             | - Check the ambient temperature.  
|   |             | - Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.  
|   | Motor stalled | Motor stall protection has tripped.  
|   |             | Check motor and load.  
|   | Motor over-temperature | Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.  
|   |             | Decrease the motor load. If no motor overload exists, check the temperature model parameters.  
|   | Motor underload | Motor underload protection has tripped.  
|   |             | Check load.  

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
<table>
<thead>
<tr>
<th>Number</th>
<th>Code</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Unbalance (Warning only)</td>
<td>Unbalance between power modules in paralleled units. Subcode in <strong>T.14</strong>: S1 = Current unbalance S2 = DC-Voltage unbalance</td>
<td>Should the fault re-occur, contact your local distributor.</td>
</tr>
<tr>
<td>22</td>
<td>EEPROM checksum fault</td>
<td>Parameter save fault – faulty operation – component failure</td>
<td>Should the fault re-occur, contact your local distributor.</td>
</tr>
<tr>
<td>24</td>
<td>Counter fault</td>
<td>Values displayed on counters are incorrect</td>
<td>Have a critical attitude towards values shown on counters.</td>
</tr>
<tr>
<td>25</td>
<td>Microprocessor watchdog fault</td>
<td>– faulty operation – component failure</td>
<td>Reset the fault and restart. Should the fault re-occur, contact your local distributor.</td>
</tr>
<tr>
<td>26</td>
<td>Start-up prevented</td>
<td>- Start-up of the drive has been prevented. - Run request is ON when new application is loaded to drive</td>
<td>- Cancel prevention of start-up if this can be done safely. - Remove Run Request.</td>
</tr>
<tr>
<td>29</td>
<td>Thermistor fault</td>
<td>The thermistor input of option board has detected too high a motor temperature</td>
<td>Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)</td>
</tr>
<tr>
<td>31</td>
<td>IGBT temperature (hardware)</td>
<td>IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current</td>
<td>- Check loading. - Check motor size. - Make identification Run</td>
</tr>
<tr>
<td>32</td>
<td>Fan cooling</td>
<td>Cooling fan of the frequency converter does not start, when ON command is given</td>
<td>Contact your local distributor.</td>
</tr>
<tr>
<td>34</td>
<td>CAN bus communication</td>
<td>Sent message not acknowledged.</td>
<td>Ensure that there is another device on the bus with the same configuration.</td>
</tr>
<tr>
<td>35</td>
<td>Application</td>
<td>Problem in application software</td>
<td>Contact your distributor. If you are application programmer check the application program.</td>
</tr>
<tr>
<td>37</td>
<td>Device changed (same type)</td>
<td>Option board or power unit changed. New device of same type and rating.</td>
<td>Reset. Device is ready for use. Old parameter settings will be used.</td>
</tr>
<tr>
<td>38</td>
<td>Device added (same type)</td>
<td>Option board added.</td>
<td>Reset. Device is ready for use. Old board settings will be used.</td>
</tr>
<tr>
<td>39</td>
<td>Device removed</td>
<td>Option board removed.</td>
<td>Reset. Device no longer available.</td>
</tr>
<tr>
<td>40</td>
<td>Device unknown</td>
<td>Unknown option board or drive. Subcode in <strong>T.14</strong>: S1 = Unknown device S2 = Power1 not same type as Power2</td>
<td>Contact the distributor near to you.</td>
</tr>
<tr>
<td>41</td>
<td>IGBT temperature</td>
<td>IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current</td>
<td>- Check loading. - Check motor size. - Make Identification run</td>
</tr>
<tr>
<td>43</td>
<td>Encoder fault</td>
<td>Problem detected in encoder signals. Sub code in <strong>T.14</strong>: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed 5 = Encoder board missing</td>
<td>- Check encoder channel connections. - Check the encoder board. - Check encoder frequency in open loop</td>
</tr>
<tr>
<td>44</td>
<td>Device changed (different type)</td>
<td>Option board or power unit changed. New device of different type or different rating than the previous one.</td>
<td>Reset. Set the option board parameters again if option bard changed. Set converter parameters again if power unit changed.</td>
</tr>
</tbody>
</table>

Local contacts: http://drives.danfoss.com/danfoss-drives/local-contacts/
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Details</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Analogue input ( I_n &lt; 4\text{mA} ) (sel. signal range 4 to 20 mA)</td>
<td>Current at the analogue input is (&lt;4\text{mA} ). - signal source has failed control cable is broken or loose</td>
<td>Check the current loop circuitry.</td>
</tr>
<tr>
<td>51</td>
<td>External fault</td>
<td>Digital input fault.</td>
<td>- Remove fault situation from external device.</td>
</tr>
<tr>
<td>52</td>
<td>Keypad communication fault</td>
<td>The connection between the control keypad or NCDrive and the frequency converter is broken.</td>
<td>Check keypad connection and possible keypad cable.</td>
</tr>
<tr>
<td>53</td>
<td>Fieldbus fault</td>
<td>The data connection between the fieldbus Master and the fieldbus board is broken</td>
<td>Check installation. If installation is correct contact the nearest Vacon distributor.</td>
</tr>
<tr>
<td>54</td>
<td>Slot fault</td>
<td>Defective option board or slot</td>
<td>Check board and slot. Contact the nearest Vacon distributor.</td>
</tr>
<tr>
<td>56</td>
<td>PT100 board temp. fault</td>
<td>Temperature limit values set for the PT100 board parameters have been exceeded</td>
<td>Find the cause of temperature rise</td>
</tr>
<tr>
<td>57</td>
<td>Identification (Warning only)</td>
<td>Identification run have been failed</td>
<td>- Run command was removed before identification was ready</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Motor is not connected to frequency converter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- There is load on motor shaft.</td>
</tr>
<tr>
<td>58</td>
<td>Brake</td>
<td>Actual status of the brake is opposite than control signal.</td>
<td>Check mechanical brake condition and connections.</td>
</tr>
<tr>
<td>59</td>
<td>Follower Communication</td>
<td>SystemBus or CAN communication is broken between master and follower</td>
<td>Check parameters from expanderboard and optical fibre or CAN cable.</td>
</tr>
<tr>
<td>60</td>
<td>Cooling</td>
<td>Liquid cooled drive cooling circulation have been failed</td>
<td>Check reason for cooling failure from external system.</td>
</tr>
<tr>
<td>61</td>
<td>Speed Error</td>
<td>Motor speed is not the same than reference.</td>
<td>- Check encoder connection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- PMS motor has been gone over pull out torque.</td>
</tr>
<tr>
<td>62</td>
<td>Run Disable</td>
<td>- Run Enable signal is Low</td>
<td>- Check reason for Run Enable signal.</td>
</tr>
<tr>
<td>63</td>
<td>Emergency stop (Warning only)</td>
<td>Digital input or fieldbus have give command to make emergency stop</td>
<td>New run command is accepted after emergency stop is reset.</td>
</tr>
<tr>
<td>64</td>
<td>Input switch open</td>
<td>Drive input switch is opened</td>
<td>Check the main power switch of the drive.</td>
</tr>
<tr>
<td>65</td>
<td>PT100 board two temp. fault</td>
<td>Temperature limit values set for the PT100 board parameters have been exceeded</td>
<td>Find the cause of temperature rise</td>
</tr>
<tr>
<td>80</td>
<td>Both ON</td>
<td>Both contactors have been closed while drive is run state</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>CAN Communication</td>
<td>Communication to externals CAN I/O have stopped.</td>
<td>Communication can not be started again until drive is powered down.</td>
</tr>
<tr>
<td>82</td>
<td>Frequency error D7</td>
<td>Measured frequency is not within hysteresis.</td>
<td>Check that drive sees correct and positive frequency.</td>
</tr>
<tr>
<td>83</td>
<td>Voltage error D7</td>
<td>Measured voltage is not within hysteresis.</td>
<td>Check that all phases are measured.</td>
</tr>
<tr>
<td>84</td>
<td>Motor Current</td>
<td>Motor current is not within hysteresis to make synchronization to net</td>
<td>FC Contactor has not been closed or motor nominal current has been set too high related to used motor.</td>
</tr>
<tr>
<td>85</td>
<td>DC Low</td>
<td>Measured DC voltage was going too low</td>
<td></td>
</tr>
</tbody>
</table>
### Table 12-1. Fault codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>86</td>
<td>AC Voltage</td>
<td>Measured line voltage was going too low</td>
</tr>
<tr>
<td>87</td>
<td>Net Is Down</td>
<td>External line measurement indicated that line is down</td>
</tr>
<tr>
<td>88</td>
<td>DOL Conflict</td>
<td>Feedback and control signals are opposite</td>
</tr>
<tr>
<td>89</td>
<td>Synch Limit</td>
<td>Drive can’t reach synchronization frequency or angle. This is usually companion of other fault or warning,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drive at current limit Unstable grid</td>
</tr>
</tbody>
</table>

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