VACON® NX

AC DRIVES

# ARFIFF08 POWER GENERATION WITH GENERAL GRID CODES APPLICATION MANUAL

VACON®

# VACON® POWER GENERATION APPLICATION MANUAL

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Document code: DPD02125
Software code: ARFIFF08V040
Date: 26.8.2019

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# 1. INTRODUCTION

In this application is kept backwards compatibility with ARFIFF07. The power generation application is used to generate power to grid using the maximum power point tracker (MPPT) or manual DC reference.

## 1.1 Grid Code Support Information

In this application is used general grid codes.

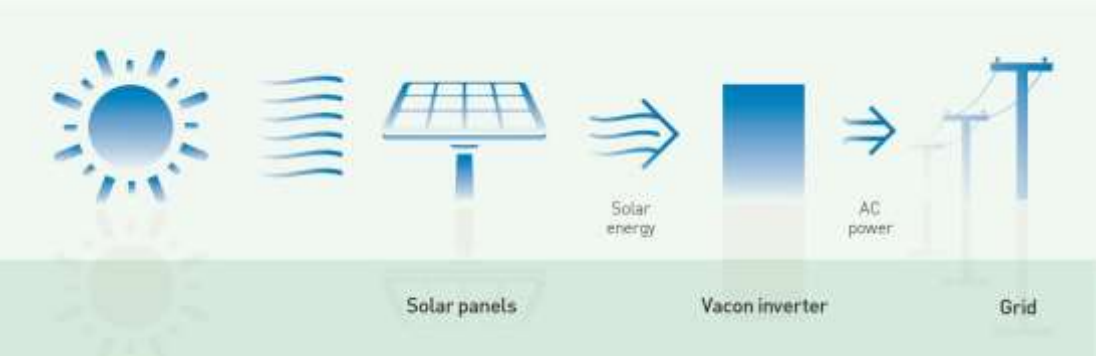
## 1.2 Compatibility issues in parameters between versions

NOTE! This application is not kept backwards compatible. See release notes and this chapter before updating the application.

Update Note 1: When you update the application do not use NCDrive parameter download function. Instead upload parameters from the unit and compare them to the old parameter file. The application is constantly developed, and it includes changing parameter default values. If parameters are directly downloaded to drive, improved default values will be lost.

# 2. GENERAL

The power generation application is an answer to growing renewable energy market. The inverters need only DC voltage and the grid to start producing energy.




*Picture 1. Basic solar system.*

## 2.1 Basic features

The power generation application works with Multi master and Stand-alone configurations. It can be used with thin film and polycrystal Solar panels. Multi master configured system is controlled by external Touch panel.

Additional functions:

- Grid Code functionality.
- Possibility to send Power Limit also from Fieldbus
- Multi-Master functionality with daily master change.
- Maximum Power Point Tracking
- Possibility to set any parameter value through Fieldbus interface.

## 2.2 Stand Alone

There is only one inverter unit which is producing energy to the grid. This system is working alone and there is no need to use any external control systems or backup systems.

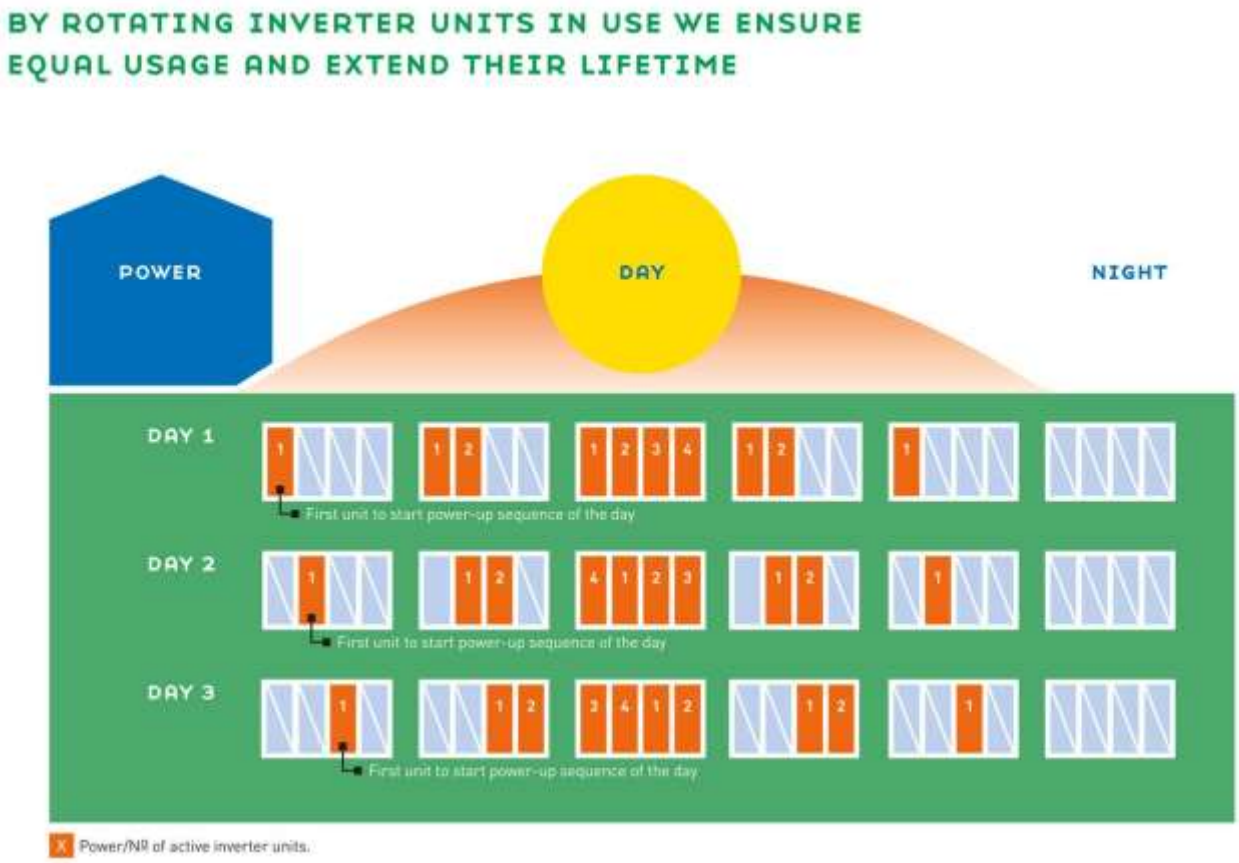
## 2.3 Multimaster (**2 ...** 8 x inverter size)

The multi master functionality is used in bigger systems. There are two to eight inverter units which are producing energy to the grid. This system has always the touch panel, which controls the system. Inverters are equally loaded, because each time system is started, MPPT master is changed, which will extend the lifetime of the inverters.

In the multi master system there is one inverter which is controlling other inverters' DC side behavior and that inverter is called master inverter. Master inverter collects information of the DC bus and makes decisions regarding what DC reference is used.

Other inverters are slave inverters and they follow DC reference coming from the master inverter. Each of the inverters is responsible of its own behavior on the Grid side, i.e. complying with Grid Code Standard.

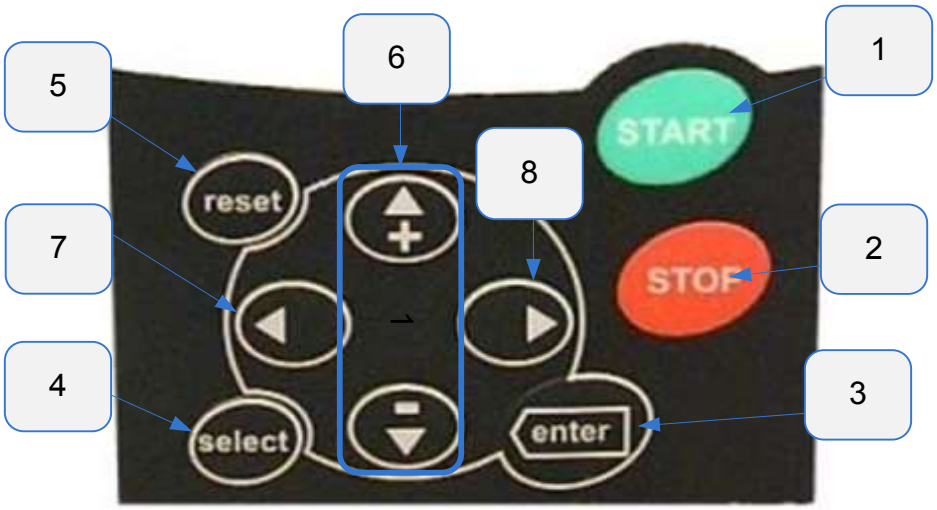
Each unit is sending status information to operator panel and they can be read in touch panel.




*Picture 2. Multi master system master change function.*

## 2.4 How to use

### *2.4.1* Keypad push buttons




*Picture 3. Keypad push buttons*

1 = Start button.
Pressing this button unit goes to ready state in multi master system or if stand-alone configuration is used it goes to ready state and if there is enough DC voltage, it will try to run.

Pressing start button for 5 seconds when the Control Source is set to Panel forces the drive to start regardless of DC level.

2 = Stop button.
Pressing this button stops the unit

3 = Enter button serves for:
1) confirmation of selections
2) fault history reset (2...3 seconds)

4 = Select button is used to switch between two latest displays. May be useful when you want to see how the changed new value influences some other value.

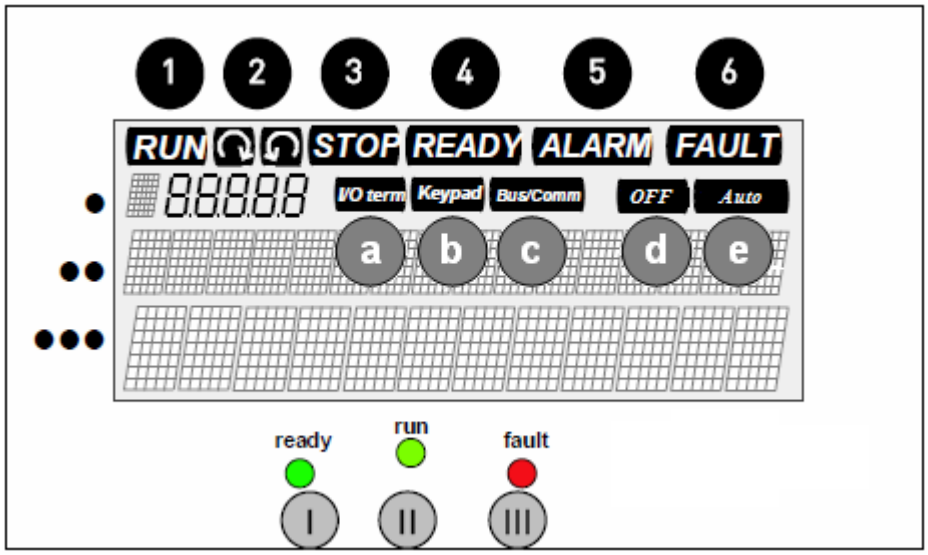
5 = Reset button is used to reset active faults.

6 = Browser button up and down
Browse the main menu and the pages of different submenus.
Edit values.

7 = Menu button left
Move backward in menu.
Move cursor left (in parameter menu).
Exit edit mode.

8 = Menu button right
Move forward in menu.
Move cursor right (in parameter menu).
Enter edit mode.

*2.4.2* Inverter status indications




*Picture 4.Keypad Indicators*

The inverter status indications tell the user what the status of the Inverter and the Inverter is and whether the Inverter control software has detected irregularities in Inverter functions.

1 RUN = Inverter is running;

2 = Indicates the direction of current flow.

3 STOP = Start command has been disabled from unit's control panel.

4 READY = Lights when AC and DC Voltage is on. In case of a trip or stop button is pushed, the symbol will not light up.

5 ALARM = Indicates that the Inverter is running outside a certain limit and a warning is given.

6 FAULT = Indicates that unsafe operating conditions were encountered due to which the Inverter was stopped.

*2.4.3* Control place indications

The symbols I/O term, Keypad and Bus/Comm (see Figure 7-1) indicate the choice of control place made in the Keypad control menu (M3).

a ***I/O term*** = I/O terminals are the selected control place; i.e. START/STOP commands or reference values etc. are given through the I/O terminals.

b ***Keypad*** = Control keypad is the selected control place; i.e. the Inverter can be started or stopped, or its reference values etc. altered from the keypad.

c ***Bus/Comm*** = The inverter is controlled through a fieldbus.

d ***OFF*** = Run enable not active

e ***Auto*** = Unit is ready to start in the morning.

*2.4.4* Status LEDs (green – green – red)

The status LEDs light up in connection with the READY, RUN and FAULT Inverter status indicators.

I (Ready) = Steady ON (no other LEDs): Start command has been given, all start criterions have been fulfilled except that the drive has not detected high enough voltage to start up.

Blinking at 2 Hz: All external start criterions have been fulfilled but no start command has been given.

Steady OFF: Start command has been disabled from unit's control panel.

II (Run) = Steady ON: The Inverter is running.

Blinking: Stop command has been given and the inverter is ramping power down.

III (Fault) = Blinks when unsafe operating conditions were encountered due to which the Inverter was stopped (Fault Trip). Simultaneously, the Inverter status indicator FAULT blinks on the display and the fault description can be seen on the panel.

### *2.4.5* Text lines

The three text lines (•, ••, •••) provide the user with information on his present location in the keypad menu structure as well as with information related to the operation of the Inverter.

| | |
|---|---|
| • = | Location indication; displays the symbol and number of menu, parameter etc. |
| •• = | Description line; Displays the description of menu, value or fault. |
| ••• = | Value line; Displays the numerical and textual values of references, parameters etc. and the number of submenus available in each menu. |

# 3. APPLICATION

## 3.1 Quick Application Commissioning Guide

The Power generation application has been design for easy and fast commissioning. The user only needs to set the Basic parameters and check if the there are any I/O parameters to be changed.

The Basic parameters are meant to be set in numerical order. Then the option board parameters are set correctly automatically and system is ready faster.

### *3.1.1* Commissioning Steps

*Table 1. Application Commissioning Steps*

| Step # | Step | Description |
|---|---|---|
| 1 | If you are updating the application to newer version, write down the following counter values before updating:<br>V1.1.10 Total Energy kWh<br>V1.1.13 RunTime Total<br>V1.1.16 Grid Connections<br>V1.1.17 IntFanRunHours<br>V1.1.18 ExtFanRunHours | These values need to be written down so that the counters can be reset to correct values after application update. |
| 2 | After application update, write the corresponding counter values to these parameters:<br>P2.10.2 TotalEnergyPreset<br>P2.10.3 GridConnPreset<br>P2.10.4 TotalRunTimPrese<br>P2.10.5 IntFanRuntPresVa<br>P2.10.6 ExtFanRuntPresVa<br><br>Change parameter P2.10.1 LoadSaveCountVal to "Save values" | This will set the counters to the values before application update. |
| 3 | Define right grid settings<br><br>P2.1.1 Grid Nom Voltage<br>P2.1.2 Grid Nom Freq<br>P2.1.6 Transf inv. side<br>P2.1.7 Transf grid side | When grid settings are right drive voltage is calculated correct. |
| 4 | Set parameters P2.1.7 and P2.1.8 in numerical order. | By setting the parameters in numerical order the necessary option board parameters are set also automatically to their correct/default values.<br><br>This speeds up the process especially in Multimaster system commissioning. |
| 5 | If commissioning is done before large scale power production is possible, set P2.1.9.1 DC Start Level parameter to a level where the inverter will surely start when the sun is up.<br><br>Otherwise no need to change anything else in Basic Parameters | This parameter indicates the minimum DC voltage needed for the drive to try start up. If this is larger than the current DC level when the drive is stopped (as it is during morning or evening commissioning) the drive will not start. |
| 6 | Set the I/O parameters in G2.3 as required. | Some fault or warning may have been triggered due to wiring in customized cabinet solutions. |
| 7 | Reset any possible faults. | Reset the possible wiring related faults / warnings. |
| 8 | Set P2.9.2.1 SystemBus Test to "Enable" in any one unit | This will start a SystemBus test procedure that will blink the Ready, Run and Fault LEDs in all of the drives in order, starting from the inverter where the parameter was set.<br><br>If the LEDs do not blink in all of the units, check the optical cables, jumper settings in |

| | | |
|---|---|---|
| | | OPT-D2 option boards and Basic parameters in all of the drives. |
| 9 | Set P2.9.1.1 Simulation Mode to "SimModSimDC" in all units and press start in the Beijer panel | This activates the simulation mode where drives use simulated DC voltage (P2.5.1.6) and simulates power production which the Beijer touch panel can see.<br><br>This test ensures that the system works as a whole and the communication between the inverters and Beijer touch panel is working (in multimaster system) alright without actually having DC or real output power.<br><br>You may need to lower the limit for starting up the next follower in the Beijer parameters to enable follower start ups. |
| 10 | When every drive in the system has ran, press stop in the Beijer panel and set P2.9.1.1 Simulation Mode to "Disable" | This disables the simulation mode and enables the drive to run normally. |
| 11 | Give Start command.<br><br>If drive has not started but Ready LED is lit and power production should be possible, press Start button for 5 seconds. | If the DC is above the P2.1.9.1 DC Start Level the drive will start. Pressing the Start button for 5 seconds forces the drive to start regardless of DC level. |
| 12 | Make sure parameter P2.1.9.6 DC Start Level Max is set to appropriate value compared to the specified open circuit voltage of the panel field.<br><br>NOTE: during hot summer days, the actual open circuit voltage can go as low as 90% of the specified OC voltage, set the parameter accordingly! | P2.1.9.6 DC Start Level Max is the absolute maximum value that the addition of offset after natural stops will not exceed. This is to ensure that the start level never rises so high that the drive will never start up. |
| 13 | In Multimaster system when power production is ~75 % from system maximum, use P2.2.2 DC Calibration to tweak the output power of all of the drives to match each other. | This is done to ensure that the small DC voltage measurement errors between the drives are not causing adverse effects on the power production and the produced power values are close to the same in the Multimaster panel. |

### *3.1.2* Multimaster PLC out of commission

If it happens that the multimaster control PLC is out of order, the drives are able to work using master-follower operation mode where all of the drives are always working at the same time:

| Step # | Step | Description |
|---|---|---|
| 1 | Set parameter P2.1.8 Configuration to "SB Master" in the unit #1 | This setting indicates for the unit #1 that it needs to send the start command to the other drives via SystemBus |
| 2 | Set P3.1 Control Source in the master to Panel | This way the user can use the Panel to give the Start command to the master unit and the drive no longer listens to commands from Fieldbus |
| 3 | Set P3.1 Control Source in all of the other drives to SystemBus | This way the follower drives listen for the Start command from SystemBus |
| 4 | Reset possible faults and give Start command to the master unit.<br><br>If drives have not started but Ready LED is lit in the Master unit and large scale power production is possible, press Start button for 5 seconds. | The drives start up and start producing power. |

# 4. MONITORING SIGNALS

The monitoring values are the actual values of parameters and signals as well as statuses and measurements.
On the next pages you will find the lists of monitoring values within the respective monitor values groups. The monitor values descriptions are given on pages 16 to 25.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Values = Name of monitor value
Unit = Unit of monitor value; Given if available
ID = ID number of the parameter

All monitoring value is possible to monitoring from fieldbus by ID number

## 4.1 Basic monitor values

### *4.1.1* Monitoring values 1

*Table 2. Monitoring values 1*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.1.1 | DC-Link Voltage | V | 1108 | Measured DC Link voltage in volts, filtered. |
| V1.1.2 | DC Voltage Ref. | % | 1200 | Used DC voltage reference by the regenerative unit in % of Nominal DC voltage. Nominal DC voltage = 1.35 * supply voltage |
| V1.1.3 | Output Current | A | 1834 | Output current of the inverter coming out of the cabinet. |
| V1.1.4 | Reactive Current | % | 1157 | |
| V1.1.5 | Power kW | kW | 1707 | Output Power in the drive's output terminals. |
| V1.1.6 | Supply Frequency | Hz | 1123 | Drive output frequency |
| V1.1.7 | Supply Voltage | V | 1107 | Drive output voltage |
| V1.1.8 | Grid Frequency | Hz | 1835 | Measured line frequency |
| V1.1.9 | Grid Voltage | V | 1709 | Measured line voltage |
| V1.1.10 | Total Energy kWh | kWh | 1837 | Total energy produced. |
| V1.1.11 | Energy Today kWh | kWh | 1708 | Energy produced today. |
| V.1.1.12 | Energy Yesterday | kWh | 1733 | Energy produced yesterday. |
| V1.1.13 | Run Time Total | h | 1836 | Total time the inverter has been running. |
| V1.1.14 | RunTime Today | h | 1731 | The time the inverter has been running today. |
| V.1.1.15 | RunTimeYesterday | h | 1732 | The time the inverter was running yesterday. |
| V1.1.16 | Grid Connections | | 1706 | Total number of times the inverter has closed the main contactor and connected to the grid. |
| V1.1.17 | Int Fan Run Hours | h | 1511 | Total time internal fan has been running |
| V1.1.18 | Ext Fan Run Hours | h | 1512 | Total time external fan has been running |
| V1.1.19 | StandbyRemaining | s | 1201 | Remaining time in standby mode, if standby mode is activated. |

### *4.1.2* Monitoring values 2

*Table 3. Monitoring values 2*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.2.1 | Cos Phii Actual | | 1717 | |
| V1.2.2 | Unit Temperature | °C | 1109 | |
| V1.2.3 | Reactive Current Reference | % | 1389 | |
| V1.2.4 | Active Current | % | 1125 | |
| V1.2.5 | InverterStatus 1 | | 1819 | Diagnostic statusword 1 |
| V1.2.6 | InverterStatus 2 | | 1820 | Diagnostic statusword 2 |
| V1.2.7 | InverterStatus 3 | | 1821 | Diagnostic statusword 3 |
| V1.2.8 | InverterStatus 4 | | 1822 | Diagnostic statusword 4 |
| V1.2.9 | EEPROMSaveStatus | | 1106 | Status of the nonvolatile memory (EEPROM) storing activated by the application<br>0 = IDLE<br>1 = ACTIVE<br>2 = RESOURCE ERROR<br>3 = WRITE ERROR<br>4 = NOT FOUND<br>5 = NOT SUPPORTED (e.g. NXP2) |
| V1.2.10 | Status Word | | 43 | |
| V1.2.11 | Used DC start level | V | 1965 | Monitoring Value for the currently used DC Start Level value. |
| V1.2.12 | Mindex | % | 1874 | Modulation Index |
| V1.2.13 | Calibrated DC Voltage | V | 1839 | |

### *4.1.3* Fieldbus monitoring values

*Table 4. Fieldbus*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.3.1 | FB Control Word | | 1478 | Control word from fieldbus |
| V1.3.2 | FB Status Word | | 1479 | Status word to fieldbus |
| V1.3.3 | FB GenPowerLim | | 1481 | Power limit sent by the fieldbus |
| V1.3.4 | FB Q/PF Ref | Q: %<br>PF: - | 1480 | Reactive Current or Power Factor reference sent by the fieldbus |
| V1.3.5 | Day from PLC | | 1719 | Day index sent from the PLC |

### *4.1.4* I/O monitoring values

*Table 5. I/O Monitor*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.4.1 | DIN1, DIN2, DIN3 | | 15 | |
| V1.4.2 | DIN4, DIN5, DIN6 | | 16 | |
| V1.4.3 | DIN Status 1 | | 56 | |
| V1.4.4 | DIN Status 2 | | 57 | |
| V1.4.5 | Analogue Input 1 | % | 13 | |
| V1.4.6 | Analogue Input 2 | % | 14 | |
| V1.4.7 | Custom AnOut 1 | % | 1240 | |

### *4.1.5* MPPT

*Table 6. MPPT*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.5.1 | MPPT Reference | | 1816 | The DC reference from the MPP tracker. Shows without ramping if ramping is used. |
| V1.5.2 | Actual Step Size | | 1815 | This value shows the actual momentary step size of the MPP tracker. |
| V1.5.3 | Actual Step Ratio | | 1825 | This value shows the actual step ratio. Power change divided by actual step size. The value is used for evaluating the size of the next step. |
| V1.5.4 | Actual Step State | | 1817 | State of the MPP tracker. For debugging purpose only. |
| V1.5.5 | Power Window On | | 0 | Power window status. |
| V1.5.6 | Optimal DC Point | | 1724 | Estimated optimal DC Point is the DC Reference point which giving the best simulated power. |

### *4.1.6* License key activation

*Table 7. License key activation*

| Code | Values | Unit | ID | Description |
|---|---|---|---|---|
| V1.6.1 | Serial Number Key | | 1997 | Give this number to the technical support of the manufacturer in case of licence key problems. |

### *4.1.7* Grid code

| Code | Parameter | Unit | Form. | ID | Description |
|---|---|---|---|---|---|
| V1.7.1 | Line State | | # | 2202 | |
| V1.7.2 | Line Voltage GC | % | #,## | 1912 | Line Voltage used by Grid Code |
| V1.7.3 | Line Frequency GC | % | #,## | 1913 | Line Frequency used by Grid Code |
| V1.7.4 | Line Voltage L1-L2 | % | #,## | 2203 | |
| V1.7.5 | Line Voltage L2-L3 | % | #,## | 2204 | |
| V1.7.6 | Line Voltage L3-L1 | % | #,## | 2205 | |
| V1.7.7 | Trip State | | | 2206 | |

### *4.1.8* PID Controller

| Code | Parameter | Unit | Form. | ID | Description |
|---|---|---|---|---|---|
| V1.8.1 | PID Reference | | #,# | 20 | |
| V1.8.2 | PID Actual Value | | #,# | 21 | |
| V1.8.3 | PID Output | | #,## | 23 | |

## 4.2 Monitor Values descriptions

### *4.2.1* Monitoring values 1

*V1.1* ***DC-link Voltage*** *V* ***ID 1108***

Filtered DC Link voltage in Volts.

*V1.2* ***DC Voltage Reference*** *%* ***ID 1200***

Used DC voltage reference. 100 % = 1,35 x Nominal AC Voltage.

*V1.3* ***Output Current*** *A* ***ID 1834***

Output current of the inverter coming out of the cabinet.

*V1.4* ***Reactive Current*** *%* ***ID 1157***

The reactive current of the regenerative drive in % of System Rated Current.

*V1.5* ***Output Power*** *kW* ***ID 1707***

Output Power in the drive's output terminals.

*V1.6* ***Supply Frequency*** *Hz* ***ID 1123***

The drive output frequency.

*V1.7* ***Supply Voltage*** *V* ***ID 1107***

The drive output voltage.

*V1.8* ***Grid Frequency*** *Hz* ***ID 1835***

Grid frequency in ##.## Hz. The sign indicates the phase order. Can be monitored only when UNIT is in RUN state.

*V1.9* ***Grid Voltage*** *V* ***ID 1709***

AC Voltage measured on the grid side of the main contactor by an external measurement circuit.

*V1.10* ***Total Energy kWh*** *kWh* ***ID 1837***

Total produced energy to the grid

*V1.11* ***Energy Today kWh*** *kWh* ***ID 1708***

Amount of energy produced today.

*V1.12* *Energy Yesterday* *kWh* *ID 1733*

Amount of energy produced yesterday.

*V1.13* *Run Time Total* *h* *ID 1836*

Total time the inverter has been running.

*V1.14* *Run Time Today* *h* *ID 1731*

The time the inverter has been running today.

*V1.15* *Run Time Yesterday* *h* *ID 1732*

The time the inverter was running yesterday.

*V1.16* *Grid Connections* *ID 1706*

Total number of times the inverter has closed the main contactor and connected to the grid.

*V1.17* *Int Fan Run Hours* *h* *ID 1511*

Total time internal fan has been running

*V1.18* *Ext Fan Run Hours* *h* *ID 1512*

Total time external fan has been running

*V1.19* *Standby Remaining* *s* *ID 1201*

Remaining time in standby mode, if standby mode is activated.

*4.2.2* Monitoring values 2

*V1.2.1* ***CosPhiiActual*** ***ID 1717***

The calculated Cos Phi.

*V1.2.2* ***Unit Temperature*** ***°C*** ***ID 1109***

The heatsink temperature of the drive.

*V1.2.3* ***Reactive Current Reference*** ***%*** ***ID1389***

The final reactive current reference.

*V1.2.4* ***Active Current*** ***%*** ***ID 1125***

The active current in % of System Rated Current.

A negative value means that the current is flowing to AC side from DC side.

### *V1.2.5 Inverter statusword 1 ID 1819*

Diagnostic statusword 1.

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Main Switch Open Fault | No Fault | Fault | See Fault list 64 |
| 1 | Main Switch Open Warning | No Alarm | Alarm | See Fault list 64 |
| 2 | AC Voltage Max Fault | No Fault | Fault | See Fault list 72 |
| 3 | AC Voltage Min Fault | No Fault | Fault | See Fault list 73 |
| 4 | AC Freg Max Fault | No Fault | Fault | See Fault list 74 |
| 5 | AC Freg Min Fault | No Fault | Fault | See Fault list 75 |
| 6 | DC Ground Warning | No Alarm | Alarm | See Fault list 76 |
| 7 | DC Ground Fault | No Fault | Fault | See Fault list 77 |
| 8 | Surge Alarm | No Alarm | Alarm | See Fault list 83 |
| 9 | FB Heardbeat timeout | No Fault | Fault | See Fault list 85 |
| 10 | Input Switch Alarm | No Alarm | Alarm | See Fault list 86 |
| 11 | Emergency Switch | No Fault | Fault | See Fault list 87 |
| 12 | UnBalance | No Alarm | Alarm | See Fault list 18 |
| 13 | Thermistor Fault | No Fault | Fault | See Fault list 29 |
| 14 | Safe Disable | No Fault | Fault | See Fault list 30 |
| 15 | *Reserved* | No Fault | Fault | |

### *V1.2.6 Inverter statusword 2 ID 1820*

Diagnostic statusword 2.

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Overvoltage | No Fault | Fault | See Fault list 2 |
| 1 | Earth Fault | No Fault | Fault | See Fault list 3 |
| 2 | Inverter Fault | No Fault | Fault | See Fault list 4 |
| 3 | Charge Switch Fault | No Fault | Fault | See Fault list 5 |
| 4 | Saturation | No Fault | Fault | See Fault list 7 |
| 5 | Unknown Fault | No Fault | Fault | See Fault list 8 |
| 6 | Undervoltage | No Fault | Fault | See Fault list 9 |
| 7 | Input Phase Fault | No Fault | Fault | See Fault list 10 |
| 8 | Input Phase Warning | No Alarm | Alarm | See Fault list 10 |
| 9 | Supply Phase Loss | No Fault | Fault | See Fault list 11 |
| 10 | Supply Phase Warning | No Alarm | Alarm | See Fault list 11 |
| 11 | Over Temperature | No Fault | Fault | See Fault list 14 |
| 12 | Over Temperature Warning | No Alarm | Alarm | See Fault list 14 |
| 13 | Undertemp | No Fault | Fault | See Fault list 13 |
| 14 | Temperature Power limit warning | No Alarm | Alarm | See Fault list 97 |
| 15 | OverCurrent | No Fault | Fault | See Fault list 1 |

### V1.2.7 Inverter statusword 3 ID 1821

Diagnostic statusword 3.

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Processor Watchdog | No Fault | Fault | See Fault list 25 |
| 1 | *Reserved* | | | |
| 2 | IGBT HW Temp | No Fault | Fault | See Fault list 31 |
| 3 | Cooling Fan | No Fault | Fault | See Fault list 32 |
| 4 | Application Fault | No Fault | Fault | See Fault list 35 |
| 5 | Control Unit Fault | No Fault | Fault | See Fault list 36 |
| 6 | Device Changed | No Fault | Fault | See Fault list 37 |
| 7 | Device Added | No Fault | Fault | See Fault list 38 |
| 8 | Device Moved | No Fault | Fault | See Fault list 39 |
| 9 | Device Unknown | No Fault | Fault | See Fault list 40 |
| 10 | Device Changed | No Fault | Fault | See Fault list 44 |
| 11 | Device Added | No Fault | Fault | See Fault list 45 |
| 12 | EEprom Checksum fault | No Fault | Fault | See Fault list 22 |
| 13 | Counter Fault | No Fault | Fault | See Fault list 24 |
| 14 | *Reserved* | No Fault | Fault | |
| 15 | *Reserved* | No Fault | Fault | |

### V1.2.8 Inverter statusword 4 ID 1822

Diagnostic statusword 4.

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | IGBT Temperature | No Fault | Fault | See Fault list 41 |
| 1 | EEPROM Fault | No Fault | Fault | See Fault list 48 |
| 2 | Zero Divice Fault | No Fault | Fault | See Fault list 49 |
| 3 | External Fault Active | No Fault | Fault | See Fault list 51 |
| 4 | External Warning Active | No Alarm | Alarm | See Fault list 51 |
| 5 | *Reserved* | | | |
| 6 | Fieldbus Communication | No Fault | Fault | See Fault list 53 |
| 7 | Slot Communication | No Fault | Fault | See Fault list 54 |
| 8 | System bus Master Heartbeat Trip active | No Fault | Fault | See Fault list 59 |
| 9 | System bus Communication Fault Trip Active | No Fault | Fault | See Fault list 55 |
| 10 | LCL OverTemp Fault Active | No Fault | Fault | See Fault list 70 |
| 11 | LCL OverTemp Warning Active | No Alarm | Alarm | See Fault list 70 |
| 12 | User Temp Alarm | No Alarm | Alarm | Fault code 99 |
| 13 | Analog Signal Too Low Fault active | No Fault | Fault | Fault code 50 |
| 14 | Analog Signal Too Low Warning active | No Alarm | Alarm | Fault code 50 |
| 15 | *Reserved* | | | |

### *V1.2.9 EEPROM Saving Status ID 1106*

Status of the nonvolatile memory (EEPROM) storing activated by the application

0 = IDLE

1 = ACTIVE

2 = RESOURCE ERROR

3 = WRITE ERROR

4 = NOT FOUND

5 = NOT SUPPORTED (e.g. NXP2)

### *V1.2.10 Status Word ID 43*

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

| | Application Status Word ID43 | |
|---|---|---|
| | FALSE | TRUE |
| b0 | | |
| b1 | Not in Ready state | Ready |
| b2 | Not Running | Running |
| b3 | No Fault | Fault |
| b4 | | |
| b5 | | |
| b6 | Run Disabled | Run Enable |
| b7 | No Warning | Warning |
| b8 | | Charging Switch closed (internal) |
| b9 | | MCB Control (DO Final) |
| b10 | | MCB Feedback |
| b11 | | DO Charging Active |
| b12 | No Run Request | Run Request |
| b13 | | |
| b14 | | PV Field OK |
| b15 | | |

### *V2.1.2.11 Used DC start level ID 1965*

Monitoring Value for the currently used DC Start Level value.

### *V2.1.2.12 Mindex ID 1874*

This value can be used to recognize low Dc-Link voltage when operating in island mode. If the value is above 90%, the drive is in limits to make correct voltage to the AC side.

### *V2.1.2.13 Calibrated DC Voltage ID 1839*

Calibrated DC Voltage is used in the parallel drives

*4.2.3* Fieldbus monitoring values

### *V1.3.1 FB Control Word ID 1478*

Control Word received from the Fieldbus Master.

| | FB Control Word | |
|---|---|---|
| | Signal | Comment |
| b0 | Start | **0** = Stop Command<br>**1** = Start Command |
| b1 | | |
| b2 | Reset | 0>1 Reset fault. |
| b3 | | |
| b4 | | |
| b5 | | |
| b6 | | |
| b7 | | |
| b8 | Master | Master command |
| b9 | | |
| b10 | | |
| b11 | | |
| b12 | | |
| b13 | ReactCurrOr CosPhiiRefSel | **0** = Reactive Current Control<br>**1** = CosPhii Control |
| b14 | FB Force start | **0** = Normal Start<br>**1** = Force Start regardless of DC voltage level |
| b15 | | |

### *V1.3.2 FB Status Word ID 1479*

Status Word sent to the upper system/PLC via Fieldbus.

| | FB Status Word | |
|---|---|---|
| | Signal | Comment |
| b0 | StartCriterions FullFilled | Not only if Inverter control is ready, but if all "Ready Criterions" are also fulfilled |
| b1 | Inverter Activated | When active, the inverter can be in either in Standby or Inverter Running mode. |
| b2 | | |
| b3 | Fault | |
| b4 | Warning | |
| b5 | Inverter Activated Standby | |
| b6 | | |
| b7 | Main contactor close command | |
| b8 | Master | Master command |
| b9 | Pulse 1s | Heartbeat bit. The inverter toggles this bit on and off. 1s on, 1s off. |
| b10 | ChargeSwState | 0 = Open<br>1 = Closed |
| b11 | | |
| b12 | | |
| b13 | | |
| b14 | | |
| b15 | | |

### *V1.3.3 FB GenPowerLim ID 1481*

Power limit sent by the fieldbus.

### *V1.3.4 FB Q/PF Ref ID 1480*

Reactive Current or Power Factor Reference received from Fieldbus. Control Word states which reverence is used.

### *V1.3.5 Day From PLC ID 1719*

Day index sent from the PLC.

*4.2.4* I/O monitoring values

*V1.4.1 DIN1, DIN2, DIN3 ID 15*

*V1.4.2 DIN4, DIN5, DIN6 ID 16*

| | DIN1/DIN2/DIN3 status | DIN4/DIN5/DIN6 status |
|---|---|---|
| b0 | DIN3 | DIN6 |
| b1 | DIN2 | DIN5 |
| b2 | DIN1 | DIN4 |

*V1.4.3 DIN Status 1 ID 56*

*V1.4.4 DIN Status 2 ID 57*

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

*V1.4.5 Analogue Input 1 % ID 13*

*V1.4.6 Analogue Input 2 % ID 14*

*V1.4.7 Custom AnOut 1 % ID 1240*

Customized analogue output

*4.2.5* MPPT

*V1.5.1 MPP Reference ID 1816*

The DC reference of the MPP tracker.

*V1.5.2 Actual Step Size ID 1815*

This value shows the actual momentary step size of the MPP tracker.

*V1.5.3 Actual Step Ratio ID 1825*

This value shows the actual step ratio. Power change divided by actual step size. The value is used for evaluating the size of the next step.

*V1.5.4 MPPT State ID 1817*

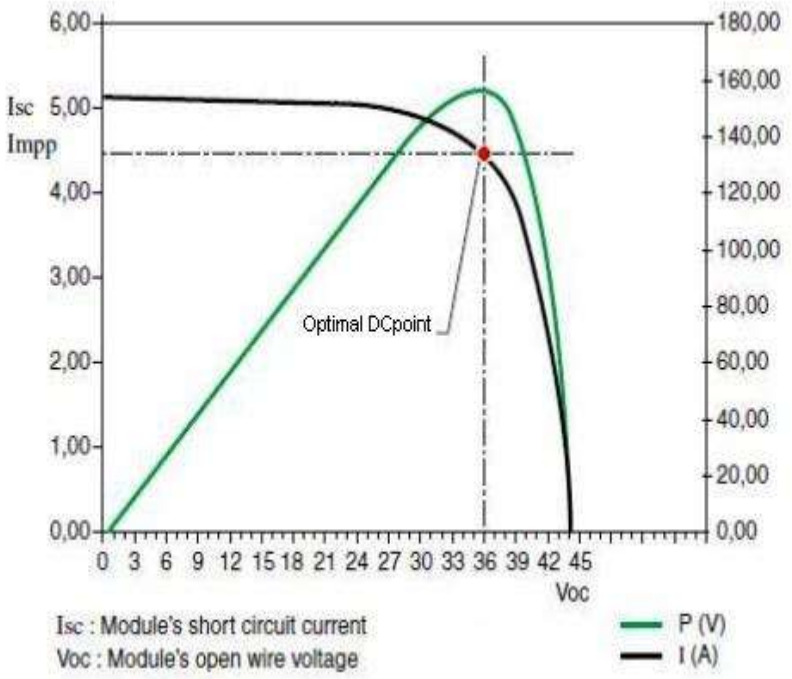
State of the MPP tracker. For debugging purposes only.

*P1.5.5 Power Window On*

When the MPP tracker takes a step in any direction, the power change has to be bigger than the Power Window for making a decision if the Power has increased or decreased. Otherwise it will take another step in the same direction until the limit is exceeded.

*V1.5.6 Simulated Optimal DC point ID 1724*

Estimated optimal DC Point is the DC Reference point which giving the best simulated power.




*Picture xx. Optimal DC point.*

*4.2.6* License key activation

*V1.6.1 Serial Number Key ID 1997*

Give this number to the technical support of the manufacturer when there is a problem in the activation of a function. The drive shows a licence fault.

*4.2.7* Gird code

*V1.7.1 Line State ID 2202*

Give this number to the technical support of the manufacturer when there is a problem in the activation of a function. The drive shows a licence fault.

| | Line State | |
|---|---|---|
| | Signal | |
| b0 | LineVoltageHighFast_Act | |
| b1 | LineVoltageHighSlow_Act | |
| b2 | LineVoltageLowSlow_Act | |
| b3 | LineVoltageLowFast_Act | |
| b4 | LineFreqHighFast_Act | |
| b5 | LineFreqHighSlow_Act | |
| b6 | LineFreqLowSlow_Act | |
| b7 | LineFreqLowFast_Act | |
| b8 | LVRTTimerStart | |
| b9 | LVRTBiTimerStart | |
| b10 | SeparateLimitOrForces | |
| b11 | LineFreqRate | |
| b12 | 10minAverageTrip | |
| b13 | FALSE | |
| b14 | FALSE | |
| b15 | FALSE | |

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

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

*V1.7.4 Line Voltage L1-L2 % #,## 2203*

*V1.7.5 Line Voltage L2-L3 % #,## 2204*

*V1.7.6 Line Voltage L3-L1 % #,## 2205*

*V1.7.7 Trip State 2206*

*4.2.8* PID Controller

Monitoring values for power controller

*V1.8.1 PID Reference ID 20*

Active Current reference

*V1.8.2 PID Actual Value ID 21*

Active current

*V1.8.3 PID Output ID 23*

PID controller output for DC Voltage reference, gives an offset for DC Voltage Reference.

# 5. PARAMETERS

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given in the chapter 6. Parameter description includes more than is available in this application see parameter list what is available.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
ID = ID number of the parameter

All parameters is possible to control from fieldbus by ID number

## 5.1 P2.1 Basic parameters

*Table 9. Basic parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.1.1 | Grid Nom Voltage | 200 | 1000 | Vac | 500V:400<br>690V:690 | 110 | Set the nominal voltage of the grid. |
| P2.1.2 | Grid Nom Frequency | -320,00 | 320,00 | Hz | 50,00 | 1532 | Initial start frequency |
| P2.1.3 | Unit nom Current | 0.0 | Ih | A | Il | 113 | Used to scale % values. |
| P2.1.4 | Parallel AFE | 0 | 1 | | 0 | 1501 | **0** = Single AFE<br>**1** = Parallel AFE |
| P2.1.5 | Transformer: Inverter Side | 0 | 3200 | Vac | 400 | 1850 | |
| P2.1.6 | Transformer: Grid Side | 0 | 3200 | Vac | 400 | 1851 | |
| P2.1.7 | Number Of Units | 0 | 8 | | 1 | 1604 | Number of units in array mode system. Needed e.g. for system bus communication |
| P2.1.8 | Configuration | -1 | 9 | | 0 | 1531 | Sets the inverter in a stand-alone or panel/array mode. In array mode the inverter has to be given a unique inverter number. Communication parameters for touchpad panel communication, systembus and CAN communication are set based on this value. |

### *5.1.1* DC Level Setup

*Table 10. DC Level Setup*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.1.9.1 | DC Start Lvl | 0 | 2000 | V | 570 | 1962 | If DC voltage is above this limit when the drive is stopped, DC is considered to be high enough to start-up.<br>If the the DC is below this level when the drive is stopped, the DC is considered to be too low to produce power and drive will not try to start-up. |
| P2.1.9.2 | DCStartLvlDelay | 1,00 | 320,00 | s | 10,00 | 1964 | Delay for when the DC rises above P2.1.7.2 before DC level is considered high enough for starting. |
| P2.1.9.3 | DCStartLvlSource | 0 | 1 | | 1 | 1966 | 0 = "Panel", if this is enabled the drive will always use the user-set value in P2.1.7.1 as the Start Level<br>1 = "ShutdownDC", if this is enabled the drive will use the open circuit DC voltage from the previous natural stop + offset from P2.1.7.5 as the new Start Level. |
| P2.1.9.4 | DCStartLvlOffset | 0 | 300 | V | 15 | 1967 | Offset value to be used when P2.1.7.4 is set to "ShutdownDC". |
| P2.1.9.5 | DCStartMaxLimit | 0 | 2000 | V | 590 | 1968 | Absolute maximum value for the Strt/Stp Level when P2.1.7.4 is set to "ShutdownDC" |

## 5.2 Reference Handling

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.2.1 | Cos phi ref | -1,0 | 1,0 | | 1,0 | 2304 | Cos phi reference |
| P2.2.2 | Reactive Current Reference | -300 | 300 | % | 0 | 1459 | Regenerative reactive current reference 100.0 = Nominal current.<br>Positive =Inductive<br>Negative = Capacitive |

### *5.2.1* DC Reference

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.2.3.1 | DC Drooping | 0,00 | 100,00 | % | 0,00 | 620 | DC Drooping for balancing current output. |
| P2.2.3.2 | DC Calibration | -5,00 | 5,00 | % | 0,00 | 1777 | DC calibration for balancing the outputs of parallel drives |
| P2.2.3.3 | Manual DC | 0 | 1 | | 0 | 1808 | 0 = Disable<br>1 = Enable |
| P2.2.3.4 | Manual DC Reference | 0,00 | 320.00 | % | 150,00 | 1809 | Reference for manual DC control |

### *5.2.2* Power/frequency reference

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.2.4.1 | Gen Power Ref. | 0 | 170.0 | % | 0.0 | 1533 | |
| P2.2.4.2 | ReferenceMode | 0 | 1 | | 0 | 1914 | 0 = Pure Iq ref<br>1 = Volt comp Iq |

#### *5.2.2.1 PID Power Controller*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| 2.2.4.3.1 | PID Power Activation | 0.1 | W.10 | DigIN | 0.1 | 1907 | |
| 2.2.4.3.2 | PID Kp | 0,00 | 1e6 | % | 100,00 | 1911 | |
| 2.2.4.3.3 | PID Ti | 0 | 1e5 | ms | 1000 | 1906 | |
| 2.2.4.3.4 | PID DC Low | -50,00 | 50,00 | % | -5,00 | 1903 | |
| 2.2.4.3.5 | PID DC High | -50,00 | 50,00 | % | 5,00 | 1904 | |
| 2.2.4.3.6 | Reference Down Rate | -1,00 | 100 | %/s | -1,00 | 1842 | |
| 2.2.4.3.7 | Reference Up Rate | -1,00 | 100 | %/s | -1,00 | 1843 | |

### *5.2.3* AC Voltage reference

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.2.5.1 | Capacitor Size | 0,0 | 100,0 | % | 5,4 | 1460 | Regen filter capacitor size in ###.# % |
| P2.2.5.2 | Inductor Size | 0,0 | 100,0 | % | 3,0 | 1461 | Regen total filter inductance in ###.# % |
| P2.2.5.3 | Capacitor Size 2nd | 0,0 | 100,0 | % | 0,0 | 3330 | |
| P2.2.5.4 | Capacitor Size 2nd Voltage | 0,0 | 1100,0 | % | 0,0 | 3331 | |

## 5.3 IO Signals

### *5.3.1* Digital Inputs

**Note!** Check also G2.3.1.13 Configuration parameters for inverted inputs!
**Note!** If Digital Input signal source is set to DigIn:F.1 or DigIn:F.2, the application uses "ANIN as DIGIN1" or "ANIN as DIGIN2" respectively as signal source.
**Note!** To disable certain function, set the signal source to DigIN:0.1 (always FALSE) or DigIN:0.2 (always TRUE).

*Table 12. Digital Input parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.1.1 | External Trip | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1214 | Select the digital input to activate External Trip. |
| P2.3.1.2 | Surge Alarm | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1806 | Select the digital input to Activate Surge Alarm. |
| P2.3.1.3 | Main Cont Ack | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1453 | This parameter defines if the inverter monitors the status of the main contactor of the unit. If the monitoring function is used, the unit monitors the status and will not start if the state of the contactor does not correspond to the required status, i.e. is open when it should be closed. If status of the main contactor is not monitored in the system the option DigIN:0.x must be chosen. |
| P2.3.1.4 | Fault Reset | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1208 | Select digital input used for fault reset. |
| P2.3.1.5 | DCSwitchFeedback | DigIN:0.1 | DigIN:F.10 | DigIN:0.2 | 1212 | This parameter defines which digital input is used for DC Switch Feedback signal. If this is used the inverter will not go to ready state unless the DCSwitchFeedback signal is TRUE. |
| P2.3.1.6 | FilterOverTemp | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1179 | Digital input for trigging a LCL filter over temperature fault. |
| P2.3.1.7 | DC Insulation | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1180 | Digital input for trigging DC Insulation. |
| P2.3.1.8 | Emergency Switch | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1181 | Digital input for trigging Emergency Switch. |
| P2.3.1.9 | Start Ok | DigIN:0.1 | DigIN:F.10 | DigIN:0.2 | 1974 | Digital input for giving external Start Ok signal. |
| P2.3.1.10 | Power Limit 1 | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1182 | Digital Input to activate DI Power Limit 1 (P2.3.1.13.11) |
| P2.3.1.11 | Power Limit 2 | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1183 | Digital Input to activate DI Power Limit 2 (P2.3.1.13.13) |
| P2.3.1.12 | Custom DIN 1 | DigIN:0.1 | DigIN:F.10 | DigIN:0.1 | 1184 | Digital input which can be used to control any other variable which has an ID. (Give ID to be controlled in P2.3.1.13.15) |

#### 5.3.1.1 Configuration

These signals are used to specify are the G2.3.1 Digital Inputs using Normal or Inverted Logic and with some input certain specialized parameters also.

**Note!** The Normal/Inverted Logic parameters have no effect on Digital Input which is set to DigIN:0.x

*Table 13. Digital Input configuration parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.3.1.13.1 | Input inversion | 0 | 65535 | - | 33 | 1091 | Inversion control of the input I/O signals.<br>B0: Invert external fault<br>B1: Invert surge protection<br>B2: Invert main contactor feedback<br>B3: Invert IO fault reset<br>B4: Invert DC switch closed<br>B5: Invert LCL over temp<br>B6: Invert DC insulation<br>B7: Invert emergency stop<br>B8: Invert IO start OK<br>B9: Invert power limit 1<br>B10: Invert power limit 2<br>B11: Invert custom DIN |
| P2.3.1.13.2 | PowerLim 1 Value | 0,0 | 110,0 | % | 110,0 | 767 | |
| P2.3.1.13.3 | PowerLim 2 Value | 0,0 | 110,0 | % | 110,0 | 769 | |
| P2.3.1.13.4 | CustomDIN1 ID | 0 | 65535 | - | 0 | 771 | |

#### 5.3.1.2 Analog Inputs

The Analog Inputs, like Digital Inputs, have been implemented using Terminal To Function (TTF) programming method, which means, user needs to specify which Analog Input is linked to certain function. To disable certain function, set the input to anything between AnIN:0.1 and AnIN:0.10.

#### 5.3.1.3 Power Limitation

*Table 14. Power Limitation Analog Input parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.2.1.1 | Power Lim Input | AnIN:0.1 | AnIN:E.10 | AnIN:0.1 | 1787 | This parameter specifies which Analog Input is used for Power Limitation. |
| P2.3.2.1.2 | Power Lim Max | Power Lim Min | 110,0 % | 110,0 % | 1788 | This parameter specifies what is the Power Limitation value at maximum input level. |
| P2.3.2.1.3 | Power Lim Min | 0,0 % | Power Lim Max | 0,0 % | 1789 | This parameter specifies what is the Power Limitation value at minimum input level. |
| P2.3.2.1.4 | PLimInput Filter | 0,00 s | 10,00 s | 0,2 s | 1791 | Filter Time for Power Limitation measurement. |
| P2.3.2.1.5 | AnPLimOnFault | 0,0 % | 110,0 % | 110,0 % | 1792 | Specifies what Power Limit value from Analog Input is given to the system when Analog Input Fault for this signal has been detected. |

### 5.3.1.4 Analog Input as Digital Input #1 & #2

With these parameter groups 2 analog inputs can be programmed to be used as Digital Inputs. Parameter group G2.3.2.2 has parameters for Digital Input #1 and G2.3.2.3 for #2.

If any signal in G2.3.1 is set as DigIN:F.1 it is then controlled by Analog Input specified in G2.3.2.2 (Digital Input #1), DigIN:F.2 corresponds to G2.3.2.3 (Digital Input #2).

The parameter groups and functionalities are identical, so only G2.2.2.3 is described here.

*Table 15. Parameters for using an Analog Input as Digital Input #1*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.2.2.1<br>P2.3.2.3.1 | AnalogDIN1 Input | AnIN:0.1 | AnIN:E.10 | AnIN:0.1 | #1: 1770<br>#2: 1766 | This parameter specifies which Analog Input is used as Digital Input. |
| P2.3.2.2.2<br>P2.3.2.3.2 | AnalogDIN1 Filt | 0,00 s | 10,00 s | 0,2 s | #1: 1771<br>#2: 1767 | Filter Time for Digital Input. |
| P2.3.2.2.3<br>P2.3.2.3.3 | AnalogDIN1 Hyst | 0,00 % | 20,00 % | 5,00 % | #1: 1772<br>#2: 1768 | Hysteresis for the input. |
| P2.3.2.2.4<br>P2.3.2.3.4 | AnDIGIN1FaultVal | False | True | False | #1: 1773<br>#2: 1769 | Specifies what this Digital Input is set to in Analog Input Fault situation |

### 5.3.1.5 DC Ground Measurement

*Table 16. DC Ground Analog Input parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.2.4.1 | DCGroundMonInput | AnIN:0.1 | AnIN:E.10 | AnIN:0.1 | 1763 | This parameter specifies which Analog Input is used for DC Ground Monitoring. |
| P2.3.2.4.2 | DCGrdInputFilter | 0,00 s | 10,00 s | 0,2 s | 1764 | Filter Time for DC Ground Monitoring. |
| P2.3.2.4.3 | AnDCGrndFaultVal | 0,00 % | 100,00 % | 100,00 % | 1765 | Specifies the DC Ground measurements value in Analog Input Fault situation. |

### 5.3.1.6 Customizable Analog Input

*Table 17. Customizable Analog Input's Parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.2.5.1 | CustomANINInput | AnIN:0.1 | AnIN:E.10 | AnIN:0.1 | 1757 | Used to select which analog input is used as Custom Analog Input |
| P2.3.2.5.2 | CustomANINFiltT | 0,00 s | 10,00 s | 0,05 s | 1758 | Filter Time setting for the analog input signal |
| P2.3.2.5.3 | CustomANINMax | P2.3.2.5.4 | 32767 | 10000 | 1759 | Defines the maximum value set to the variable defined by P2.3.2.5.6 when the Analog Input is feed with maximum signal |
| P2.3.2.5.4 | CustomANINMin | -32768 | P2.3.2.5.3 | 0 | 1760 | Defines the minimum value set to the variable defined by |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | P2.3.2.5.6 when the Analog Input is feed with minimum signal |
| P2.3.2.5.5 | CustomANINID | 0 | 1999 | 0 | 1761 | ID of the variable this analog input is controlling |
| P2.3.2.5.6 | CustomANINInv | 0 | 1 | 0 | 1762 | No = The stronger the input signal's strength, the bigger value is set to the selected variable<br>Yes = The stronger the input signal's strength, the smaller value is set to the selected variable |

### *5.3.2* Digital Outputs

*Table 18.Digital Output parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.3.3.1 | Ready | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 432 | Open: Drive is not ready<br>Closed: Drive is ready |
| P2.3.3.2 | Run | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 433 | Open: Drive is not running<br>Closed: Drive is running |
| P2.3.3.3 | Fault | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 434 | Open: Drive is not faulted<br>Closed: Drive is faulted |
| P2.3.3.4 | Fault, Inverted | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 435 | Open: Drive is faulted<br>Closed: Drive is not faulted |
| P2.3.3.5 | Warning | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 436 | Open: Drive has no warnings active<br>Closed: Drive has active warnings |
| P2.3.3.6 | MContControl | DigOUT:B.2 | DigOUT:B.2 | DigOUT:B.2 | 445 | Open: Drive commands the main contactor open<br>Closed: Drive commands the main contactor closed |
| P2.3.3.7 | DC Supply Ready | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 440 | Open: DC Supply not ready<br>Closed: DC Supply ready |
| P2.3.3.8 | DC Earth Fault | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 441 | Open: DC Grounding Ok<br>Closed: DC Grounding Faulted |
| P2.3.3.9 | Ready/WarnBlink | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 442 | Open: Drive is not ready<br>Blinking: Drive is ready but has active warning<br>Closed: Drive is ready |
| P2.3.3.10 | Ext Fan Control | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 443 | Open: Drive commands the external fan to stop<br>Closed: Drive commands the external fan to run |
| P2.3.3.11 | FollOpenMCont | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 444 | Closed: Drive is a multimaster follower and Grid disconnection is forced |
| P2.3.3.12 | PLimitationActive | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 446 | Closed: Selected Power Limit Reference (P2.3.3.19.1) is lower than the trigger level (P2.3.3.19.2) |
| P2.3.3.13 | PowerLimitTooLow | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 449 | External Power Limit Reference has been set and the Actual Power Limit value has ramped too low and the inverter has stopped. |

| | | | | | | |
|---|---|---|---|---|---|---|
| P2.3.3.14 | Drive Charged | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 450 | Closed: Drive is Charged<br>Open: Drive is not Charged |
| P2.3.3.15 | Drive Ok | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 451 | With power generation application, for the drive to go to the actual "Ready State" it also requires Start Command. This signal will be active even if the Start Command hasn't been activated, but all the other criterions application can see are fulfilled. |
| P2.3.3.16 | DrvOk/WarnBlink | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 452 | Same as "Drive Ok" but if also a warning is activated in the drive, this output will blink at frequency of 2 Hz. |
| P2.3.3.17 | Fault or GCStop | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 453 | The drive is stopped due to fault or Grid Code related issue. |
| P2.3.3.18 | Charging Pulse | DigOUT:0.1 | DigOUT:E.10 | DigOUT:0.1 | 454 | Charging Pulse for external devices. |

### *5.3.2.1 Configuration*

*Table 19. Digital Output configuration parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.3.3.19.1 | PLimActTrigLevel | 0,0 | 300,0 | % | 110,0 | 447 | Trigger level for Power Limitation Active Digital Output (P2.3.3.12) |
| P2.3.3.19.2 | PLimActTrigSel | 0 | 2 | | 0 | 448 | Monitored Power Limit Reference:<br>0 = External Power Limit Reference<br>1 = Grid Code Power Limit Value<br>2 = Both |
| P2.3.3.19.3 | ChargPulseLength | 10 | 100 | s | 15 | 455 | Length of the charging pulse from output specified by P2.3.3.18 |

### *5.3.3* Analog Outputs

*Table 20.Analog Output parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.3.4.1 | AnOut Sel | AnOUT:0.1 | AnOUT:E.10 | | AnOUT:0.1 | 1232 | Specify the port for analog output |
| P2.3.4.2 | AnOut ID | 0 | 2000 | | 0 | 1233 | Set the ID of the signal to be connected to the Analog Output specified by P2.3.4.1. To connect e.g. DC-link voltage to the analog output, enter 1839 as parameter value. |
| P2.3.4.3 | AnOut FilterTime | 0,00 | 10,00 | s | 0,10 | 1235 | Filter time for the selected signal in seconds. |
| P2.3.4.4 | AnOutputVarMax | P2.3.4.5 | 32767 | | 32767 | 1236 | Maximum value of a signal selected for Analog Output. |
| P2.3.4.5 | AnOutputVarMin | -32768 | P2.3.4.4 | | 0 | 1237 | Minimum value of a signal connected to the Analog Output. |
| P2.3.4.6 | AnOutOutpuMax | P2.3.4.7 | 100,00 | % | 100,00 | 1238 | The analog output's signal strength corresponding with P2.3.4.4 AnOutputVarMax |
| P2.3.4.7 | AnOutOutpuMin | 0,00 | P2.3.4.6 | % | 0,00 | 1234 | The analog output's signal strength corresponding with P2.3.4.5 AnOutputVarMin |
| P2.3.4.8 | AnOut Inverted | 0 | 1 | | 0 | 1239 | If this is enabled, the analog output's signal strength is at maximum, when the linked variable's value is at its minimum and vice versa. |

## 5.4 Limit Settings

### *5.4.1* Current Limit

*Table 21. Current limit*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.4.1.1 | Current Limit | 0 | Varies | A | Varies | 107 | Total current limit |
| P2.4.1.2 | LCL OvertTempFact | 40 | 100 | % | 70 | 1748 | Factor multiplied to current limit when LCL Over Temp input is active. |

### *5.4.2* Generator Power Limit

*Table 22. Generator power limit*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.4.2.1 | Power Lim Gen | 0,1 | 130,0 | % | 110,0 | 1290 | Power limit for the generator side operation. |
| P2.4.2.2 | GenLimRampStart | -0,1 | 110,0 | % | -0,1 | 1786 | Generator limit starting ramp rate %/s. |
| P2.4.2.3 | GenLimRampStop | -0,1 | 110,0 | % | 10,0 | 1785 | Generator limit stopping ramp rate %/s. |
| P2.4.2.4 | MinGenPowerLimit | 0 | 300,0 | % | 4,0 | 1938 | Minimum Power limit for generator side power limitter |
| P2.4.2.5 | PowLimStartLevel | P2.4.2.6 | 20,0 | % | 6,0 | 1983 | Drive can start to generate power when power limit over this parameter. |
| P2.4.2.6 | PowLimStopLevel | -1,0 | P2.4.2.5 | % | 4,0 | 1977 | Drive stop to generate power when power limit below this parameter. |
| P2.4.2.7 | Disable TempLimit | 0 | 1 | | 0 | 1756 | Disabled temperature power limit |

## 5.5 Inverter Control

### *5.5.1* Standby Control

*Table 23 Standby control*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.5.1.1 | PwrStandbyLevel | -0,1 | 1000,0 | % | 4,0 | 1540 | The Inverter will stop if power is below this level for a time longer than "PwrStandbyDelay". When level is negative then standby is not used |
| P2.5.1.2 | PwrStandbyDelay | 0 | 32000 | s | 120 | 1541 | Delay before stopping when power is below "PwrStandbyLevel" |
| P2.5.1.3 | PwrQuickStandby | -0.1 | 10.0 | % | 0 | 1549 | Inverter will stop without any ramps after delay stated in P2.5.1.4, if power is below this value and go to standby mode. Value should be tuned so that inverter stops e.g. if DC breaker is opened. When level is negative then standby is not used |
| P2.5.1.4 | PwrQuickStdbyDel | 0.00 | 10.00 | s | 3,00 | 1560 | Delay time for the quick standby functionality. |
| P2.5.1.5 | QuickStandbyDC | 0 | 1 | | 0 | 1905 | Use quick standby DC level in the DC start level |
| P2.3.1.6 | Standby Interval | 1 | 3600 | s | 300 | 1754 | How long to wait before trying to start again after the inverter has gone into standby mode. Reasons for standby mode might be a failed test of the photovoltaic field or inverter going into standby because of low power. |

### *5.5.2* MPP Tracker

*Table 24. MPP Tracker parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.5.2.1 | MinStepSize | 0,05 | P2.3.2.2 | % | 0,60 | 1810 | Minimum step size for the maximum power point tracker. MinStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) is below MinStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively. |
| P2.5.2.2 | MaxStepSize | P2.5.2.1 | 20,00 | % | 0,80 | 1811 | Maximum step size for the maximum power point tracker. MaxStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) (step ratio) is above MaxStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | ratio is between MinStepRatio and MaxStepRatio respectively. |
| P2.5.2.3 | MinStepRatio | 0,05 | 20,00 | dPdU | 10,00 | 1814 | Minimum step size for the maximum power point tracker. MinStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) is below MinStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively. |
| P2.5.2.4 | MaxStepRatio | 0,05 | 20,00 | dPdU | 15,00 | 1813 | Maximum step size for the maximum power point tracker. MaxStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1))<br>(step ratio) is above MaxStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively. |
| P2.5.2.5 | Min DC Reference | 80,00 | 300,00 | % | 109,00 | 1818 | Minimum DC Reference to which the MPP tracker will limit itself and not go below. 109,00% is close to the theoretical minimum value if nominal AC voltage is 230-280V. |
| P2.5.2.6 | Step Time | 10 | 10000 | ms | 2500 | 1812 | This parameter defines how often the MPP tracker will take a step in any direction. Default varies depending on the inverter size class. |
| P2.5.2.7 | PowerFilterTime | 0,00 | 320,00 | s | 0,00 | 1827 | The MPP tracker compares the power value before and after a step to see if it has increased or decreased. Hence, if it's going in the right or wrong direction respectively. This parameter adds a low pass filter to the compared signal. |
| P2.5.2.8 | UseAveragedPMeas | 0 | 1 | | 1 | 1831 | This parameter enables or disables the 10 sample averaging of the output power figure to filter out noise from the measurement. |
| P2.5.2.9 | ReferenceWindow | 0,8 | 20,00 | % | 3,00 | 1838 | In some cases the MPP tracker might not get the requested DC reference. E.g. if the inverter is running at the current limit. In this case it will show up as a deviation between the DC reference and actual. This parameter states the maximum allowed deviation. If bigger, the MPP tracker freezes and forces |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | its value towards the actual value. Should the deviation decrease to the allowed range, then it starts tracking again. |
| P2.5.2.10 | Ramped DC Ref. | 0 | 1 | | 1 | 1826 | This parameter will activate ramping of the DC reference step changes. The reference will be ramped to its new value in one third of the step time (StepTime/3). This calms the DC link and power output down a little bit if step changes are big. If the inverter is in array configuration it's advised to always enable Ramped DC Ref. The slave inverters will get the reference with a little delay, but if the refs are ramped, the deviation in reference between master and slaves is very small. (If no ramping is used, then the deviation can be MaxStepSize for 10-20ms.) |
| P2.5.2.11 | Actual DC Following Power Limit | 0 | 100 | % | 70 | 1755 | Fine tuning parameter, used in situations when starting ramp-up is very fast. DC Reference will follow Actual DC level when produced power is over this limit and Actual DC level is not following DC Reference. |
| P2.5.2.12 | DC Reference at Start | 50 | 100 | % | 100 | 1595 | Percentage of start moments open circuit DC Voltage, which is going to be used as DC Reference at start up. |
| P2.5.2.13 | DCRampT%StepT | 0 | 100 | % | 33 | 1829 | DC Reference Ramp rate compared to the Step Time P2.5.2.6. |
| P2.5.2.14 | PowerWindow(Dec) | 0 | 100,00 | % | 0,12 | 1842 | When the MPP tracker takes a step in any direction. Then the power change has to be bigger than the Power Window for making a decision if the Power has increased or decreased. Otherwise it will take another step in the same direction until the limit is exceeded.<br><br>Power Window size when decreasing DC reference. |
| P2.5.2.15 | PowerWindow(Inc) | 0 | 100,00 | % | 0,05 | 1843 | Power Window size when increasing DC reference. |
| P2.5.2.16 | FastCondTreshold | 0,0 | 100,0 | % | 2,0 | 1946 | Fine tuning |
| P2.5.2.17 | PDiffGIncTresh | -100,0 | 100,0 | % | 0,0 | 1944 | Fine tuning |
| P2.5.2.18 | PDiffGDecTresh | -100,0 | 100,0 | % | 0,2 | 1943 | Fine tuning |

### *5.5.3* Bypass Control

*Table 25. Bypass Control parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.5.3.1 | PC Control Mode | 0 | 3 | | 1 | 1807 | 0 = Disable<br>1 = Start<br>2 = Reference<br>3 = Start/Ref |

### *5.5.4* Multimaster Follower Control

*Table 26. Multimaster follower Control parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.5.4.1 | Foll Start Lvl | P2.5.4.3 | 100,0 | % | 70,0 | 1984 | Follower start level |
| P2.5.4.2 | Foll Start Delay | 0,00 | 300 | s | 5 | 1985 | Follower start delay |
| P2.5.4.3 | Foll Stop Lvl | -1,0 | P2.5.4.1 | % | 27,0 | 1986 | Follower stop level |
| P2.5.4.4 | Foll Stop Delay | 0,00 | 300 | s | 300 | 1987 | Follower stop delay |

### *5.5.5* Power Adjust

*Table 27. Field Adjustable Power Scaling Parameter*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.5.5.1 | a*Power^2 | -5,0000 | 5,0000 | 0 | 1523 | Power calculation fine tuning |
| P2.5.5.2 | b*Power | -50,000 | 50,000 | 1,000 | 1524 | Power calculation fine tuning |
| P2.5.5.3 | c | -50,000 | 50,000 | 0 | 1525 | Power calculation fine tuning |

## 5.6 Drive Control

*Table 28. Drive control*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P 2.6.1 | Switching Freq | 2 | 6 | kHz | 3.6 | 601 | |
| P 2.6.2 | AFE Options 1 | 0 | 65535 | | 32 | 1463 | |
| P 2.6.3 | AFE Options 2 | 0 | 65535 | | 0 | 1464 | |
| P 2.6.4 | AFE Options 3 | 0 | 65535 | | 0 | 1466 | |
| P 2.6.5 | Start Delay | 0 | 320 | s | 0 | 1500 | |
| P 2.6.6 | Modulator Type | 0 | 4 | | 1 | 1516 | |
| P 2.6.7 | App Controlword1 | 0 | 65535 | | 0 | 1900 | |

### *5.6.1* Control

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P 2.6.8.1 | Active Current Kp | 0 | 4000 | | 400 | 1455 | |
| P2.6.8.2 | Active Current Ti | 0 | 1000 | ms | 1,5 | 1456 | |
| P2.6.8.3 | Sync Kp | 0 | 32000 | | 2000 | 1457 | |
| P2.6.8.4 | Sync Ti | 0 | 1000 | | 50 | 1458 | |

## 5.7 Protections

### *5.7.1* General

*Table 29.Protections, General parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.1.1 | External Trip | 0 | 2 | | 2 | 701 | This parameter defines a response to external trip. If the inverter monitors the state of external trip input and a fault occurs the inverter can be set to respond to the fault.<br>0 = No response<br>1 = Warning<br>2 = Fault |
| P2.7.1.2 | Input Ph. Superv | 0 | 2 | | 2 | 1518 | The input phase supervision ensures that the input phases of the Inverter have an approximately equal current.<br>0 = No response<br>1 = Warning<br>2 = Fault |
| P2.7.1.3 | InputFilter Temp | 0 | 2 | | 2 | 1505 | This parameter defines a response to Input filter over temperature fault. The fault is monitored through digital input<br>0 = No response<br>1 = Warning<br>2 = Fault |
| P2.7.1.4 | UserTempWarnLimit | 40 | 100 | °C | 78 | 1853 | Limit for giving the temperature rising warning. |
| P2.7.1.5 | DCSwitchNOKDelay | 0,00 | 100,00 | s | 0,20 | 1971 | Delay for dropping DC Switch digital input signal to FALSE. |
| P2.7.1.6 | StartNOKDelay | 0,00 | 100,00 | s | 0,20 | 1973 | Delay for dropping Start Ok digital input signal to FALSE. |

### *5.7.2* DC Earth Fault

*Table 30.DC Earth Fault parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.2.1 | DCGround Source | 0 | 2 | | 2 | 1801 | Analog input source to take the DC Earth Fault measurement from.<br>0 = Not Used<br>1 = Analog Input<br>2 = Digital Input |
| P2.7.2.2 | DCGroundFaultLev | 0,00 | 100,00 | % | 13,00 | 1715 | Fault level of analog input. |
| P2.7.2.3 | DCGoundWarnLevel | 0,00 | 100,00 | % | 8,00 | 1716 | Warning level of analog input. |
| P2.7.2.4 | DCGroundHysteres | 0,00 | 2,00 | % | 0,00 | 1714 | Hysteresis for warning and fault levels. |
| P2.7.2.5 | DCGround Delay | 0,00 | 100,00 | s | 60,00 | 1782 | Delay for warning and fault. |
| P2.7.2.6 | DCGroundRstDelay | 1 | 3600 | s | 180 | 1750 | Reset delay of fault, if fault conditions no longer active. |

### *5.7.3* AC Earth Fault

*Table 31.AC Earth Fault parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P2.7.3.1 | Earth fault | 0 | 1 | | 1 | 1332 | Action in case of Earth Fault.<br>0 = No response<br>1 = Fault |
| P2.7.3.2 | Earth Fault Curr | 0,0 | 100,0 | % | 50,0 | 1333 | Max level of Earth current in % of unit current. |

### *5.7.4* Main Contactor

*Table 32.Main Contactor parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.4.1 | MCont FaultDelay | 0,00 | 10,00 | s | 0,50 | 1521 | Delay for Main contactor fault. Delay between main contactor control relay close command and main contactor acknowledge signal. If acknowledge signal is not received within this time, then fault 64 is trigged. |
| P2.7.4.2 | Start Delay | 0,00 | 10,00 | s | 0,40 | 1519 | Main contactor ON delay. Delay from Main contactor acknowledge to modulation start. |

### *5.7.5* Fieldbus

*Table 33. Field bus fault parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.5.1 | HeartbeatTimeout | 0,000 | 65,000 | s | 3,000 | 1840 | The inverter should receive a heartbeat signal from the external control panel once every second. If the signals are not received and inverter is controlled by external panel, then the inverter will trip after the set delay with this parameter. |
| P2.7.5.2 | TimeoutRstDelay | 0 | 65000 | s | 30 | 1841 | The heartbeat timeout fault will be reset automatically after this time if the heartbeat signal re-appears. |

### *5.7.6* System bus

*Table 34.System bus fault parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.6.1 | HeartbtFltDelay | 0,000 | 65,00 | s | 3,000 | 1600 | If a slave does not receive a heartbeat signal from the master, it will lock to its current DC reference and trip after this delay. |
| P2.7.6.2 | CommFaultDelay | 0,00 | 65,00 | s | 3,000 | 1601 | Trip delay from communication problems with systembus option board. |

### *5.7.7* Auto reset

*Table 35.Automatic reset parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.7.1 | Wait Time | 0,10 | 10,00 | s | 0,50 | 717 | This parameter defines the time to wait after a fault trigger has disappeared. When the time has elapsed, the Inverter tries to automatically restart modulation. |
| P2.7.7.2 | Trial Time | 0,00 | 60,00 | s | 30,00 | 718 | If the fault trigger appears more often than defined by parameters P2.7.7.3 to P2.7.7.7 inside the trial time |
| P2.7.7.3 | Overvolt. Tries | 0 | 10 | | 10 | 721 | This parameter determines how many automatic restarts can be made during the trial time set by parameter P2.7.7.2. after an overvoltage trip.<br>0 = No automatic restart after overvoltage fault trip.<br>>0 = Number of automatic restarts after overvoltage fault trip. The fault is reset and the inverter is started automatically after the DC-link voltage has returned to the normal level. |
| P2.7.7.4 | Overcurr. Tries | 0 | 3 | | 3 | 722 | NOTE! IGBT temp fault also included.<br>This parameter determines how many automatics restarts can be made during the trial time set by P2.7.7.2.<br>0 = No automatic restart after overcurrent fault trip<br>>0 = Number of automatic restarts after overcurrent trip and IGBT temperature faults. |
| P2.7.7.5 | Ext.Trip Tries | 0 | 10 | | 0 | 725 | This parameter determines how many automatics restarts can be made during the trial time set by P2.7.7.2.<br>0 = No automatic restart after External fault trip<br>>0 = Number of automatic restarts after External trip. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P2.7.7.6 | Input Ph. Tries | 0 | 10 | | 10 | 726 | This parameter determines how many automatics restarts can be made during the time set by P2.7.7.2. |

### *5.7.8* Analog Inputs

*Table 36. Analog Input Supervision Parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.8.1 | AnInputFaultMode | 0 | 2 | - | 1 | 1947 | Analog Input Fault Mode:<br>0 = No Action<br>1 = Warning<br>2 = Fault |
| P2.7.8.2 | AnInFaultDelay | 0,000 | 10,000 | s | 1,000 | 1941 | The Analog Input fault will be triggered after this delay when faulty operation has been detected. |

### *5.7.9* AC Voltage Protections

**Note!** This is only visible when Grid code functionality is turned OFF

*Table 37. AC Voltage Protection Parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.9.1 | AC Voltage Max | 0 | 200 | % | 110 | 1710 | Max AC Voltage Limit. |
| P2.7.9.2 | AC Voltage Min | 0 | 200 | % | 70 | 1711 | Min AC Voltage Limit. |
| P2.7.9.3 | AC Max TripDelay | 0 | 300 | s | 0 | 1796 | Trip delay if voltage above max limit. |
| P2.7.9.4 | AC Min TripDelay | 0 | 300 | s | 0 | 1797 | Trip delay if voltage below min limit. |
| P2.7.9.5 | AC Volt RstDelay | 1 | 3600 | s | 185 | 1703 | Reset delay of fault if fault conditions no longer active. |

### *5.7.10* AC Frequency Protections

**Note!** This is only visible when Grid code functionality is turned OFF

*Table 38. AC Frequency Protection Parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.7.10.1 | AC Freq Max | 0 | 200 | % | 103 | 1752 | Max AC Frequency Limit. |
| P2.7.10.2 | AC Freq Min | 0 | 200 | % | 98 | 1753 | Min AC Frequency Limit. |
| P2.7.10.3 | AC Freq TripDelay | 0 | 300 | s | 0 | 1805 | Trip delay if frequency is above or below limits. |
| P2.7.10.4 | AC Freqt RstDelay | 1 | 3600 | s | 185 | 1751 | Reset delay of fault, if fault conditions no longer active. |

## 5.8 Fieldbus

*Table 39. Fieldbus*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.8.1 | FB Data Out1 Sel | 0 | 10000 | | 1650 | 852 | |
| P2.8.2 | FB Data Out2 Sel | 0 | 10000 | | 1651 | 853 | |
| P2.8.3 | FB Data Out3 Sel | 0 | 10000 | | 1652 | 854 | |
| P2.8.4 | FB Data Out4 Sel | 0 | 10000 | | 1653 | 855 | |
| P2.8.5 | FB Data Out5 Sel | 0 | 10000 | | 1654 | 856 | |
| P2.8.6 | FB Data Out6 Sel | 0 | 10000 | | 1655 | 857 | |
| P2.8.7 | FB Data Out7 Sel | 0 | 10000 | | 1656 | 858 | |
| P2.8.8 | FB Data Out8 Sel | 0 | 10000 | | 1657 | 859 | |
| P2.8.9 | FB Data In 1 Sel | 0 | 10000 | | 1481 | 876 | |
| P2.8.10 | FB Data In 2 Sel | 0 | 10000 | | 1480 | 877 | |
| P2.8.11 | FB Data In 3 Sel | 0 | 10000 | | 0 | 878 | |
| P2.8.12 | FB Data In 4 Sel | 0 | 10000 | | 0 | 879 | |
| P2.8.13 | FB Data In 5 Sel | 0 | 10000 | | 0 | 880 | |
| P2.8.14 | FB Data In 6 Sel | 0 | 10000 | | 0 | 881 | |
| P2.8.15 | FB Data In 7 Sel | 0 | 10000 | | 0 | 882 | |
| P2.8.16 | FB Data In 8 Sel | 0 | 10000 | | 0 | 883 | |
| P2.8.17 | FB Control Slot | 0 | 4 | | 0 | 1979 | 0 = Slots D & E<br>1 = Slot D<br>2 = Slot E<br>3 = Slot D + Fast PB<br>4 = Slot E + Fast PB |

## 5.9 System Tests

### *5.9.1* Power Simulation

*Table 40.System test Power simulation parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.9.1.1 | Simulation Mode | 0 | 2 | | 0 | 1720 | 0 = Disable<br>1 = Enable<br>2 =SimModSimDC |
| P2.9.1.2 | BreakDownPoint | 0,00 | 320,00 | V | 190,00 | 1721 | |
| P29.1.3 | BreakDownPower | 0,0 | 3200,0 | % | 70,0 | 1722 | |
| P2.9.1.4 | BreakDownRatio | 0,00 | 320,00 | % | 1,35 | 1723 | |
| P2.9.1.5 | Simulation DC | 400 | 1500 | V | 600 | 1577 | Simulation without DC works with this Value |

### *5.9.2* System bus

*Table 41.System test, System bus parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.9.2.1 | SystemBus Test | 0 | 1 | | 0 | 1780 | Parameter for testing if system bus configuration is ok.<br>0 = Disable<br>1 = Enable |

### *5.9.3* Simulated Grid

*Table 42.Simulated grid parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.9.3.1 | SimGridFreq | 0,00 | 100,00 | Hz | 50,00 | 1725 | Simulated Grid Frequency |
| P2.9.3.2 | SimGridVoltage | 0 | 1000 | V | 400 | 1726 | Simulated Grid Voltage, default value varies between power sizes. |
| P2.9.3.3 | UseSimulatedFreq | 0 | 1 | | 1 | 1728 | Enable or disable the use of simulated frequency in simulation mode. |
| P2.9.3.4 | UseSimulatedVolt | 0 | 1 | | 1 | 1729 | Enable or disable the use of simulated voltage in simulation mode. |

## 5.10 Counters

*Table 43.Countes parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.10.1 | LoadSaveCountVal | 0 | 2 | | 0 | 1861 | Counters Values Load or Save Functionality<br>0 = Idle Do nothing<br>1 = Load Values; Load inverter counters values to parameters P2.10.2-6<br>2 = Save Values; Save parameters P2.10.2-6 values to the inverter counters values. |
| P2.10.2 | TotalEnergyPrese | 0,0 | 42949 6729,5 | kWh | 0 | 1858 | Value to save to Total Energy counter when "LoadSaveCountVal" parameter is set to 2/Save. |
| P2.10.3 | GridConnPreset | 0 | 42949 67295 | | 0 | 1730 | Value to load into GridConnection counter when "LoadSaveCountVal" parameter is set to 2/Save. |
| P2.10.4 | TotalRuntimPrese | 0 | 42949 67295 | h | 0 | 1859 | Value to load into Runtime total counter when "LoadSaveCountVal" parameter is set to 2/Save. |
| P2.10.5 | IntFanRuntPresVa | 0 | 42949 67295 | h | 0 | 1894 | Value to load into Internal Fan Runtime counter when "LoadSaveCountVal" parameter is set to 2/Save. |
| P2.10.6 | ExtFanRuntPresVa | 0 | 42949 67295 | h | 0 | 1896 | Value to load into External Fan Runtime total counter when "LoadSaveCountVal" parameter is set to 2/Save. |
| P2.10.7 | EnergyProdIntegT | 0,200 | 1,000 | s | 0,200 | 1856 | Energy Counter algorithm's integration interval |

## 5.11 Admin Parameters

### *5.11.1* Ext Fan Control

*Table 54. External fan control parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P2.11.1.1 | Start temp | 30 | 60 | °C | 45 | 1727 | The temperature level of the inverter unit, at which the external fan control signal will be activated. The external fan signal can be selected for any digital/relay output. |
| P2.11.1.2 | Stop temp | 25 | 45 | °C | 40 | 1734 | The temperature level of the inverter unit, at which the external fan control signal will be deactivated. Notice! The deactivation can also be delayed with the "Stop Delay" parameters. (If the inverter stops the unit temperature might decrease much faster than e.g. the LCL's, then a delay to get some more cooling time might be appropriate.)The external fan signal can be selected for any digital/relay output. |
| P2.11.1.3 | Stop delay | 1 | 3600 | s | 120 | 1857 | The deactivation of the external fan control signal after unit temperature has decreased below "Stop Temp" can be delayed with this parameter. (If the inverter stops the unit temperature might decrease much faster than e.g. the LCL's, then a delay to get some more cooling time might be appropriate.)The external fan signal can be selected for any digital/relay output. |

### *5.11.2* Datalogger

#### *5.11.2.1 Trigger*

*Table 55. Datalogger trigger parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.11.2.1.1 | Trigger signal | 0 | 65535 | 0 | 2704 | Trigger signal definition (ID or index). If set to 0 and DL_TriggerOptions B0 is 0, then MCStatus.B3 (fault bit) is used as trigger signal / value. |
| P2.11.2.1.2 | Trigger value low | 0 | 65535 | 0 | 2705 | Trigger value as level or bitmask depending on trigger options |
| P2.11.2.1.3 | Trigger value high | 0 | 65535 | 0 | 2706 | High word of trigger value, in case trigger variable is of DINT/UDINT type |
| P2.11.2.1.4 | Trig on fault | 0 | 1 | 1 | 2712 | 0 = no fault trig<br>1 = trig on fault |
| P2.11.2.1.5 | Trigger is | 0 | 1 | 1 | 2713 | 0 = trigger value is level<br>1 = trigger value is bitmask |

| | | | | | | |
|---|---|---|---|---|---|---|
| P2.11.2.1.6 | Trigger level is | 0 | 1 | 1 | 2711 | 0 = trigger level is negative<br>1 = trigger level is positive |
| P2.11.2.1.7 | Trigger on | 0 | 1 | 1 | 2710 | 0 = trig on rising edge<br>1 = trig on falling edge |
| P2.11.2.1.8 | Pre-trig | 0 | 3 | 3 | 2707 | pre-trig %: 00 = 70%, 01 = 50%, 10 = 25%, 11 = 10% |
| P2.11.2.1.9 | Trigger mode | 0 | 1 | 0 | 2708 | 0 = continuous mode<br>1 = single mode |
| P2.11.2.1.10 | Store settings | 0 | 1 | 1 | 2709 | 0 = don't store settings (reset at power down)<br>1 = store settings. |

### *5.11.2.2 Settings*

*Table 56. Datalogger setting parameters*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P2.11.2.2.1 | Sample period | 0 | 65535 | 1 | 2703 | Sample period in ms. If 0, then set to default (1 ms). |
| P2.11.2.2.2 | Max samples | 0 | 65535 | 0 | 2702 | Number of samples in DataLogger. Set to nonzero value to limit size of log. DataLogger must be set again for change to take effect. |
| P2.11.2.2.3 | DL signal 1 | 0 | 65535 | 14589 | 2714 | Signal definition (ID or index):<br>1 - 9999 = variable ID 10001 - 19999 = fw interface variable index (10001 = index 1)<br>20001 - 29999 = application variable index (20001 = index 1) |
| P2.11.2.2.4 | DL signal 2 | 0 | 65535 | 14367 | 2715 | Signal definition (ID or index) |
| P2.11.2.2.5 | DL signal 3 | 0 | 65535 | 14544 | 2716 | Signal definition (ID or index) |
| P2.11.2.2.6 | DL signal 4 | 0 | 65535 | 14508 | 2717 | Signal definition (ID or index) |
| P2.11.2.2.7 | DL signal 5 | 0 | 65535 | 14509 | 2718 | Signal definition (ID or index) |
| P2.11.2.2.8 | DL signal 6 | 0 | 65535 | 14592 | 2719 | Signal definition (ID or index) |
| P2.11.2.2.9 | DL signal 7 | 0 | 65535 | 10401 | 2720 | Signal definition (ID or index) |
| P2.11.2.2.10 | DL signal 8 | 0 | 65535 | 10463 | 2721 | Signal definition (ID or index) |
| P2.11.2.2.11 | DL signal 9 | 0 | 65535 | 14590 | 2722 | Signal definition (ID or index) |
| P2.11.2.2.12 | DL signal 10 | 0 | 65535 | 14591 | 2723 | Signal definition (ID or index) |
| P2.11.2.2.13 | DL signal 11 | 0 | 65535 | 14547 | 2724 | Signal definition (ID or index) |
| P2.11.2.2.14 | DL signal 12 | 0 | 65535 | 14548 | 2725 | Signal definition (ID or index) |
| P2.11.2.2.15 | DL signal 13 | 0 | 65535 | 11095 | 2726 | Signal definition (ID or index) |
| P2.11.2.2.16 | DL signal 14 | 0 | 65535 | 43 | 2727 | Signal definition (ID or index) |
| P2.11.2.2.17 | DL signal 15 | 0 | 65535 | 14837 | 2728 | Signal definition (ID or index) |
| P2.11.2.2.18 | DL signal 16 | 0 | 65535 | 14362 | 2729 | Signal definition (ID or index) |
| P2.11.2.2.19 | DL Controlword | 0 | 65535 | 0 | 2730 | DataLogger control word.<br>bit 0 = external trigger<br>bit 1 = restart<br>bit 2 = PC trigger (don't set in application code)<br>bit 3 = Reserved (disable flash store)<br>bit 4 = pause logging after RUN state trigs<br>bit 5 = set datalogger to system software de |

## 5.12 Grid Codes

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.1 | GGC License | 0 | 65535 | | 0 | | 3201 | |
| P2.17.2 | EnableGridCode | 0 | 2 | | 0 | | 3254 | 0 = Disabled<br>1 = Enabled; No Trip.<br>2 = Enabled |
| P2.17.3 | Anti-islanding | 0 | 2 | | 0 / Disabled | | 3250 | |
| P2.17.4 | Power RampUp Rate | -1,00 | 320,00 | %/s | 50 | | 3324 | Negative value means no limitation in power increase. |

### *5.12.1* FRT

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.5.1 | FRT Function | 0 | 4 | | 0 / No | | 3251 | 0 = Disabled; Both<br>1 = Enabled; Limits<br>2 = Enabled; Curve<br>3 = Enabled; Neither<br>4 = Enabled; Both |
| P2.17.5.2 | ReactivInjection | 0 | 2 | | 0 / Tri:N, Bi:N | | 3252 | |
| P2.17.5.3 | Symmetrical Reactive | 0 | 1 | | 0 / No | | 3323 | |

### *5.12.2* Reconnection

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.6.1 | ReConnectTime | 1,1 | 1000 | s | 2 | | 3253 | |
| P2.17.6.2 | ReConnTimeStop | 1,1 | 1000 | s | 2 | | 3255 | |
| P2.17.6.3 | ReConRampUpRate | -1 | 320 | %/s | 20 | | 3297 | |

### *5.12.3* Line Voltage

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.7.1 | Voltage Monitor | 0 | 1 | | 1 | | 3364 | 0 = Average<br>1 = Phase Min Max |
| P2.17.7.2 | LV High 1 | 0 | 200 | % | 115 | | 3256 | |
| P2.17.7.3 | LV High 1 Delay | 0 | 60000 | ms | 0 | | 3257 | |
| P2.17.7.4 | LV High 2 | 0 | 200 | % | 0 | | 3258 | |
| P2.17.7.5 | LV High 2 Delay | 0 | 120000 | ms | 0 | | 3259 | |
| P2.17.7.6 | LV High 3 | 0 | 200 | % | 0 | | 3361 | |
| P2.17.7.7 | LV High 3 Delay | 0 | 120000 | ms | 0 | | 3362 | |
| P2.17.7.8 | LV High 3 PLim | 0 | 300 | % | 300,0 | | 3363 | |
| P2.17.7.9 | LV Low 1 | 0 | 200 | % | 0 | | 3260 | |
| P2.17.7.10 | LV Low 1 Delay | 0 | 120000 | ms | 0 | | 3261 | |
| P2.17.7.11 | LV Low 2 | 0 | 200 | % | 80 | | 3262 | |
| P2.17.7.12 | LV Low 2 Delay | 0 | 120000 | ms | 0 | | 3263 | |
| P2.17.7.13 | LV Low 3 | 0 | 200 | % | 0 | | 3365 | |
| P2.17.7.14 | LV Low 3 Delay | 0 | 120000 | ms | 0 | | 3366 | |
| P2.17.7.15 | LV Low 3 PLim | 0 | 300 | % | 300,0 | | 3367 | |
| P2.17.7.16 | 10 Min Average High Voltage | 0 | 200 | % | 0 | | 3353 | |
| P2.17.7.17 | 10 min Average trip delay | 0 | 10000 | ms | 50 | | 3376 | |
| P2.17.7.18 | 10 Min Average Trip Act | 0.1 | E.10 | | 0.1 | | 3375 | |

### *5.12.4* Line Frequency

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.8.1 | LF High 1 | 0 | 200 | % | 103 | | 3264 | |
| P2.17.8.2 | LF High 1 Delay | 0 | 120000 | ms | 0 | | 3265 | |
| P2.17.8.3 | LF High 2 | 0 | 200 | % | 0 | | 3266 | |
| P2.17.8.4 | LF High 2 Delay | 0 | 120000 | ms | 0 | | 3267 | |
| P2.17.8.5 | LF High 3 | 0 | 200 | % | 0 | | 3368 | |
| P2.17.8.6 | LF High 3 Delay | 0 | 12000 | ms | 0 | | 3369 | |
| P2.17.8.7 | LF Low 1 | 0 | 200 | % | 0 | | 3268 | |
| P2.17.8.8 | LF Low 1 Delay | 0 | 120000 | ms | 0 | | 3269 | |
| P2.17.8.9 | LF Low 2 | 0 | 200 | % | 95 | | 3270 | |
| P2.17.8.10 | LF Low 2 Delay | 0 | 120000 | ms | 0 | | 3271 | |
| P2.17.8.11 | LF Low 3 | 0 | 200 | % | 0 | | 3370 | |
| P2.17.8.12 | LF Low 3 Delay | 0 | 120000 | ms | 0 | | 3371 | |
| P2.17.8.13 | LF MaxChangeRate | 0 | 20 | Hz/s | 0 | | 3322 | |

### *5.12.5* Voltage Time Trip

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.9.1 | Voltage X0 | 0 | 110 | % | 0 | | 3272 | |
| P2.17.9.2 | Time Y0 | 0 | 20000 | ms | 0 | | 3273 | |
| P2.17.9.3 | Voltage X1 | 0 | 110 | % | 0 | | 3274 | |
| P2.17.9.4 | Time Y1 | 0 | 20000 | ms | 0 | | 3275 | |
| P2.17.9.5 | Voltage X2 | 0 | 110 | % | 0 | | 3276 | |
| P2.17.9.6 | Time Y2 | 0 | 20000 | ms | 0 | | 3277 | |
| P2.17.9.7 | Voltage X3 | 0 | 110 | % | 0 | | 2278 | |
| P2.17.9.8 | Time Y3 | 0 | 20000 | ms | 0 | | 3279 | |
| P2.17.9.9 | Voltage X4 | 0 | 110 | % | 0 | | 3280 | |
| P2.17.9.10 | Time Y4 | 0 | 20000 | ms | 0 | | 3281 | |
| P2.17.9.11 | Voltage X5 | 0 | 110 | % | 30 | | 3282 | |
| P2.17.9.12 | Time Y5 | 0 | 20000 | ms | 400 | | 3283 | |
| P2.17.9.13 | Voltage X6 | 0 | 110 | % | 80 | | 3284 | |
| P2.17.9.14 | Time Y6 | 0 | 20000 | ms | 2500 | | 3285 | |

### *5.12.6* Line OK Limits

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.10.1 | LF OK High | 0 | 200 | % | 0 | | 3287 | |
| P2.17.10.2 | LF OK Low | 0 | 110 | % | 0 | | 3286 | |
| P2.17.10.3 | LV OK High | 0 | 200 | % | 0 | | 3289 | |
| P2.17.10.4 | LV OK Low | 0 | 110 | % | 0 | | 3288 | |
| P2.17.10.5 | Line OK Delay | 0 | 20000 | ms | 0 | | 3290 | |

### *5.12.7* Reactive Injection

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.1 | UV Reactive Mode | 0 | 1 | | 0 / Linear | | 3314 | |
| P2.17.11.2 | OV Reactive Mode | 0 | 1 | | 0 / Linear | | 3377 | |

#### *5.12.7.1 Linear UV*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.3.1 | UV High Corner | 0 | 200 | % | 0 | | 3291 | |
| P2.17.11.3.2 | UV Low Corner | 0 | 200 | % | 0 | | 3292 | |
| P2.17.11.3.3 | UV Reac. Ref | 0 | 150 | % | 0 | | 3293 | |
| P2.17.11.3.4 | UV Bi Reac. Ref | 0 | 150 | % | 0 | | 3294 | |

#### *5.12.7.2 Linear OV*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.4.1 | OV Low Corner | 0 | 150 | % | 0 | | 3300 | |
| P2.17.11.4.2 | OV Max Reactiv | 0 | 150 | % | 0 | | 3301 | |
| P2.17.11.4.3 | OV React Slope | 0 | 150 | % | 0 | | 3302 | |
| P2.17.11.4.4 | OV React PLim In | 0 | 150 | % | 0 | | 3303 | |
| P2.17.11.4.5 | OV React PLim Out | 0 | 150 | % | 0 | | 3329 | |

#### *5.12.7.3 Power Lock UV*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.5.1 | PowerLockIn | 0 | 200 | % | 0 | | 3315 | |
| P2.17.11.5.2 | PowerLockOut | 0 | 200 | % | 0 | | 3316 | |
| P2.17.11.5.3 | Power Log In Mode | 0 | 1 | | 0 | | 3372 | |
| P2.17.11.5.4 | UV High Corner | 0 | 200 | % | 0 | | 3291 | |
| P2.17.11.5.5 | UV Low Corner | 0 | 200 | % | 0 | | 3292 | |
| P2.17.11.5.6 | UV LockOut Voltag | 0 | 200 | % | 0 | | 3317 | |
| P2.17.11.5.7 | UVReacRefHighCor | 0 | 200 | % | 0 | | 3318 | |
| P2.17.11.5.8 | UV Reac. Ref | 0 | 150 | % | 0 | | 3293 | |
| P2.17.11.5.9 | UV Bi Reac. Ref | 0 | 150 | % | 0 | | 3294 | |

#### *5.12.7.4 Power Lock OV*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.6.1 | OV Low Corner | 0 | 150 | % | 0 | | 3300 | |
| P2.17.11.6.2 | OV High Corner | 0 | 200 | % | 0 | | 3320 | |
| P2.17.11.6.3 | OVReacRefLowCorn | 0 | 200 | % | 0 | | 3321 | |
| P2.17.11.6.4 | OV Max Reactiv | 0 | 150 | % | 0 | | 3301 | |
| P2.17.11.6.5 | OV LockOut Voltag | 0 | 200 | % | 0 | | 3319 | |

### *5.12.7.5 Q(U) Power*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.11.7.1 | High Max Q Power | -300 | 300 | % | 0,0 | | 3341 | |
| P2.17.11.7.2 | High Max Voltage | 0 | 200 | % | 105,00 | | 3340 | |
| P2.17.11.7.3 | High Min Voltage | 0 | 200 | % | 100,00 | | 3339 | |
| P2.17.11.7.4 | Low Max Q Power | -300 | 300 | % | 0,0 | | 3344 | |
| P2.17.11.7.5 | Low Max Voltage | 0 | 200 | % | 100,00 | | 3343 | |
| P2.17.11.7.6 | Low Min Voltage | 0 | 200 | % | 95,00 | | 3342 | |

## *5.12.8* Power Limit

### *5.12.8.1 High Frequency*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.12.1.1 | HighFreqModes | 0 | 1 | | 0 | | 3307 | 0 = High Limit<br>1 = Minimum |
| P2.17.12.1.2 | HighFreqLowCornr | 0 | 200 | % | 0,00 | | 3295 | |
| P2.17.12.1.3 | HighFreqPLimSlop | -1 | 300 | %/Hz | 50,0 | | 3239 | End corner mode activated by setting this to zero -><br>- P2.17.12.1.7<br>- P2.17.12.1.8 |
| P2.17.12.1.4 | HighFreqLockOut | 0 | 150 | % | 0,00 | | 3308 | |
| P2.17.12.1.5 | HighFreqPLimRamp | -1 | 320 | %/s | -1,00 | | 3298 | |
| P2.17.12.1.6 | HighFreqPReleDel | 0 | 1000000 | ms | 50 | | 3299 | |
| P2.17.12.1.7 | HighLFFullPRelDe | 0 | 400000 | ms | 0 | | 3374 | |
| P2.17.12.1.8 | HighFreqHigCornr | 0 | 200 | % | 0,00 | | 3296 | |
| P2.17.12.1.9 | HighFreqPowRatio | 0 | 100 | % | 0,0 | | 3309 | |

### *5.12.8.2 High Voltage*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.12.2.1 | Log In Voltage | 0,00 | 320,00 | % | 0 | | 3325 | |
| P2.17.12.2.2 | Log Out Voltage | 0,00 | 320,00 | % | 0 | | 3326 | |
| P2.17.12.2.3 | Limit Slope | -1,0 | 3200,0 | %/% | 0,0 | | 3327 | |
| P2.17.12.2.4 | PowerLm VoltMode | 0 | 1 | | 0 | | 3360 | |

### *5.12.8.3 Low Frequency Power*

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.12.5.1 | Power Increase High Frequency | 0,00 | 150,00 | % | 0,00 | | 3334 | |
| P2.17.12.5.2 | Power Increase Slope | 0,0 | 200,0 | %/% | 15,0 | | 3335 | |
| P2.17.12.5.3 | Power Increase Max | 0,0 | 200,0 | % | 200,0 | | 3336 | |

### 5.12.8.4 Cos Phii Control

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.13.1 | CosPhiiMode | 0 | 3 | | 0 | | 3345 | **0** = Direct Reference<br>**1** = Volt LogIn LogOut<br>**2** = Act. Current |
| P2.17.13.2 | CosPhiiRef | -1 | 1 | | 0 | | 3304 | |
| **Code** | **Parameter** | **Min** | **Max** | **Unit** | **Default** | **Cust** | **ID** | **Description** |
| P2.17.13.3.1 | Lock In Voltage | 0 | 150 | % | 0 | | 3305 | |
| P2.17.13.3.2 | Lock Out Voltage | 0 | 150 | % | 0 | | 3306 | |
| P2.17.13.3.3 | Max Cos Ref | -1 | 1 | | 1,000 | | 3346 | |
| **Code** | **Parameter** | **Min** | **Max** | **Unit** | **Default** | **Cust** | **ID** | **Description** |
| P2.17.13.4.1 | Min Cos Ref Min Power | -150 | 150 | % | 15,0 | | 3357 | |
| P2.17.13.4.2 | Min Cos Ref | -1 | 1 | | 1,000 | | 3356 | |
| P2.17.13.4.3 | CosRefMidPower | -150 | 150 | % | 50,0 | | 3358 | |
| P2.17.13.4.4 | Max Cos Ref Max Power | -150 | 150 | % | 150,0 | | 3359 | |
| P2.17.13.4.5 | Max Cos Ref | -1 | 1 | | 1,000 | | 3346 | |

### 5.12.8.5 External Input

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.14.1 | Ext GC Trip In | 0.1 | E.10 | DI | 0.1 | | 3310 | |
| P2.17.14.2 | SeparateFLimMon | 0.1 | E.10 | DI | 0.1 | | 3311 | |
| P2.17.14.3 | SepFreqHighLim | 0 | 150 | % | 0 | | 3312 | |
| P2.17.14.4 | SepFreqLowLim | 0 | 150 | % | 0 | | 3313 | |

### 5.12.8.6 Options

| Code | Parameter | Min | Max | Unit | Default | Cust | ID | Description |
|---|---|---|---|---|---|---|---|---|
| P2.17.15.1 | GC Options 1 | 0 | 65535 | | 0 | | 3328 | |
| P2.17.15.2 | Voltage Filt. TC | 0 | 10000 | ms | 20 | | 3332 | |
| P2.17.15.3 | Frequency Filt. TC | 0 | 10000 | ms | 35 | | 3333 | |
| P2.17.15.4 | FRT Options | 0 | 65535 | | 0 | | 3400 | |
| P2.17.15.5 | Vac Stop Offset | -10,00 | 10,00 | % | 0,00 | | 3337 | |
| P2.17.15.6 | Vac Run Offset | -10,00 | 10,00 | % | 0,00 | | 3338 | |
| P2.17.15.7 | Power Follower Hysteresis | 0,0 | 100,0 | % | 3,0 | | 1529 | |
| P2.17.15.8 | Line Voltage High Filter TC | 0 | 10000 | ms | 100 | | 3373 | |

## 5.13 Control

*Table 57.Control parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P 3.1 | Control Source | 0 | 1 | | Varies | 1403 | 0=Keypad Cntrl<br>1=External PLC<br>2=Systembus |

## 5.14 System menu

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

## 5.15 Expander boards (Control keypad: Menu M7)

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

**Note!** These parameters are set automatically when parameter Configuration is set

# 6. PARAMETERS AND DESCRIPTIONS

## 6.1 Basic Parameters

### *P2.1.1 Grid Nominal Voltage ID 110*

This parameter sets the incoming line voltage for the regenerative drive. Set this parameter to the nominal line voltage at the installation site. Used also as a reference point for grid voltage protection functions.

### *P2.1.2 Grid Nominal Frequency ID 1532*

Grid Nominal frequency. Used for frequency protection functions and initial guess for synchronization frequency.

### *P2.1.3 Unit Nominal Current ID 113*

The rated current capacity of the supply or the transformer. It can be necessary to set it if AFE is overdesigned compared to the supply or feeding transformer capacity.

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

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

### *P2.1.4 Parallel AFE ID 1501*

Set this to 1 if more than one unit is connected to same DC bus.

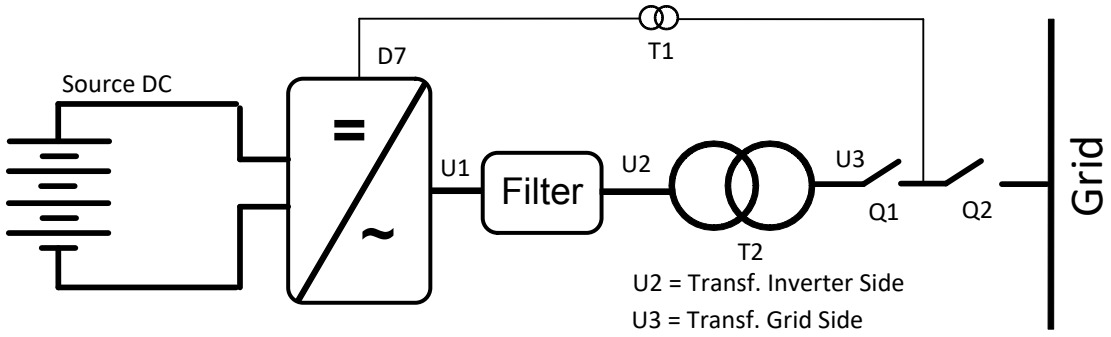
0 = Single AFE

1 = Parallel AFE

Parallel AFE parameter is used for reducing the circulating current between the parallel connected AFEs. If the AFEs are fed from the isolated transformers then there is no need parallel AFE activation. That means parallel AFE is required to be enabled in all AFEs only when DC links of more than one AFE are connected together and AFEs are fed from the same incoming source without the isolation transformer. Each AFE must have its own LCL filter. The drooping parameter (P2.3.1.7) is set to 5 % also in all AFEs when parallel AFE is enabled.

*6.1.1* Transformer Parameters

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




*Picture 5. D7 measurements.*

| | | |
|---|---|---|
| *P2.1.5* | *Transformer inverter side* | *ID 1850* |

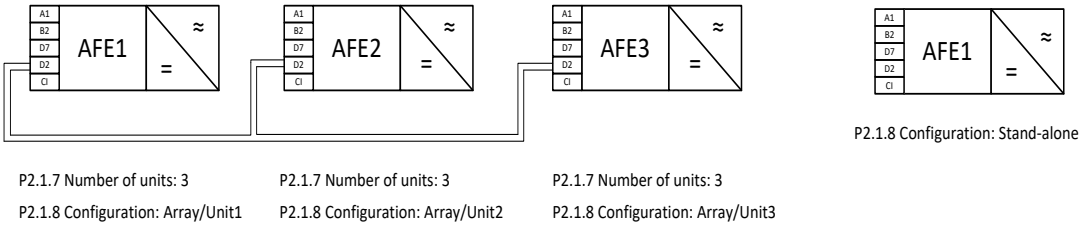
Set the transformer nominal voltage on inverter side (U2).

| | | |
|---|---|---|
| *P2.1.6* | *Transformer grid side* | *ID 1851* |

Set the transformer nominal voltage on grid side (U3).

*6.1.2* Configuration Parameters

These parameters are used to define stand-alone and multi master system.




*Picture 6. Multimaster and stand-alone configurations.*

### *P2.1.7 Number of units ID 1604*

Number of units in the multi master system, defines how many inverter units are connected to system. This information is needed for system bus communication.

### *P2.1.8 Configuration ID 1531*

Sets the inverter in a stand-alone or multi master mode (Array/Unit x). In multimaster mode the inverter has to be given a unique inverter number. This number is used in communication and system identification.

-1 = SB Master

0 = Undefined

1 = Stand-alone

2 = Array/Unit 1

3 = Array/Unit 2

4 = Array/Unit 3

5 = Array/Unit 4

6 = Array/Unit 5

7 = Array/Unit 6

8 = Array/Unit 7

9 = Array/Unit 8

*6.1.3* DC Level Setup

Using these parameters it is possible to modify the awakening level of the drive.

*P2.1.9.1 DC start level* *ID 1962*

When DC rises above this limit when the drive is stopped, DC is considered to be high enough to start-up. If the the DC falls below this level when the drive is stopped, the DC is considered to be too low to produce power and drive will not try to start-up.

*P2.1.9.2 DC start level delay* *ID 1964*

Delay for when the DC rises above used DC start level before DC level is considered high enough for starting.

*P2.1.9.3 DC start level source* *ID 1966*

0 = "Panel", if this is enabled the drive will always use the user-set value in P2.1.9.1 as the Start/Stp Level

1 = "ShutdownDC", if this is enabled the drive will use the open circuit DC voltage from the previous natural stop + offset from P2.1.9.5 as the new Start Level. The new level is shown in V2.1.9.2

*P2.1.9.4 DC start level offset* *ID 1967*

Offset value to be used when P2.1.9.4 is set to "ShutdownDC". This value is always added to the open circuit voltage of the DC bus after a stop due to low power production.

*P2.1.9.5 DC start max limit* *ID 1968*

Absolute maximum limit for the Start Level when P2.1.9.4 is set to "ShutdownDC". This is to make sure adding the offset value after an unsuccessful start-up won't raise the Start Level too high which would make the start-up impossible or to use unreasonable high DC level as start limit.

## 6.2 Reference Handling

### *P2.2.1 Cosphii reference* *ID 2304*

Direct cosphii reference. If P2.11.13.1 lock in and P2.11.13.2 out is used this function is not active.

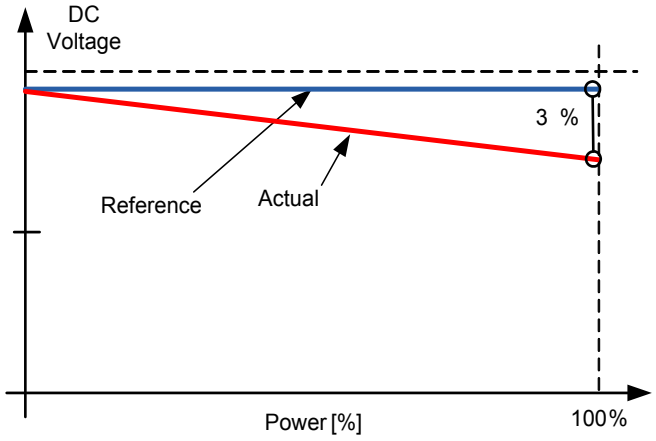
### *P2.2.2 Reactive current reference* *ID 1459*

This parameter sets the reference for the reactive current in % of the nominal current. This can be used for power factor correction of AFE system or reactive power compensation. Positive value gives inductive compensation whereas negative value gives capacitive compensation.

### *6.2.1* DC Reference

### *P2.2.3.1 DC drooping* *ID 620*

When inverters are used in array mode, drooping can be used for current balancing. The DC voltage reference drooping is set as % of active current reference. E.g. if drooping is 3.00% and active current is 50% then DC voltage reference is reduced 1,5%. With drooping paralleled units can be balanced by adjusting the DCVoltReference to slightly different values.




*Picture 7. DC drooping.*

### *P2.2.3.2 DC calibration* *ID 1777*

In multi master system inverters are connected to same DC-bus. There can be some small errors in the measurements of DC voltage between the inverters and as they are trying to maintain a slightly different DC Voltage because of this error, it will result in the output power not being equally shared between the inverters in the system. With this parameter the DC Voltage can be calibrated to show same values on all inverters.

#### *P2.2.3.3 Manual DC* *ID 1808*

This parameter disables the Maximum Power Point Tracker and the drive uses a manual DC Reference.

0 = Disable
1 = Enable

#### *P2.2.3.4 Manual DC Reference* *ID 1809*

If MPP Tracker is disabled then you must set DC Voltage reference in percentage to the drive.

$$DC_{Ref\%} = \frac{V_{DC\ Ref}}{V_{AC} \times 1{,}35} \cdot 100\%$$

### *6.2.2* Power/ Frequency reference

#### *P2.2.4.1 Generator Power Reference* *ID 1533*

Power reference for PID controller.

#### *P2.2.4.2 Reference Mode* *ID 1533*

0 = Pure Iq Ref

1 = Voltage Compensated Iq

### *6.2.2.1 PID Power Controller*

PID Controller is forced to zero when DI: PID Power Activation is low or drive is in stop state or drive is not operating in AFE mode. PID Controller will adjust power flow by giving offset to given DC Voltage Reference. It's recommended to use some drooping to make controller smoother.

#### *2.2.4.3.1 PID Power Activation* *ID1907*

Select digital input to activate PID Power control function.

#### *2.2.4.3.2 PID Kp* *ID1911*

Gain for PID controller.

#### *2.2.4.3.3 PID Ti* *ID1906*

Integration time for PID controller.

#### *2.2.4.3.4 PID DC Low* *ID1903*

This parameter defined how low PID controller can adjust DC Voltage Reference from P2.2.3.4 Manual DC Voltage Ref.

#### *2.2.4.3.5 PID DC High* *ID1904*

This parameter defined how high PID controller can adjust DC Voltage Reference from P2.2.3.4 Manual DC Voltage Ref.

#### *2.2.4.3.6 Reference Down Rate %/s* *ID1842*

Power reference ramp rate when increasing the reference

#### *2.2.4.3.7 Reference Up Rate %/s* *ID1843*

Power reference ramp rate when decreasing the reference

*6.2.3* AC Voltage reference

### *P2.2.5.1 Capacitor size* *ID 1460*

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

$$I_{CAP} = \left(\frac{V_{Grid}}{\sqrt{3}}\right)(2\pi f C_Y)$$

$Where\ C_Y = Filter\ capacitance$

$$Capacitor\ size\ [\%] = \frac{I_{CAP} * [CurrenScale]}{System\ Rated\ Current} * 100$$

CurrentScale; if no decimals in current value then current scale is 1. If one decimal in current value then current scale is 10. If two decimals in current value, then current scale is 100.

### *P2.2.5.2 Inductor size* *ID 1461*

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

$$Inductor\ size\ [\%] = \frac{2\pi f L * 100}{\left(\frac{\frac{V_{Grid}}{\sqrt{3}} * [CurrenScale]}{System\ Rated\ Current}\right)}$$

### *P2.2.5.3 Capacitor Size 2nd* *ID3330*

Capacitor size can be adjusted based on voltage level. Set here the capacitor size at voltage level defined by ID3331

### *P2.2.5.4 Capacitor Size 2nd Voltage* *ID3331*

Set here the voltage level where Capacitor Size 2nd is used ID3330

## 6.3 IO signals

### *6.3.1* Digital inputs

**Note!** Check also G2.3.1.13 Configuration parameters for inverted inputs!

**Note!** If Digital Input signal source is set to DigIn:F.1 or DigIn:F.2, the application uses "ANIN as DIGIN1" or "ANIN as DIGIN2" respectively as signal source.

**Note!** To disable certain function, set the signal source to DigIN:0.1 (always FALSE) or DigIN:0.2 (always TRUE).

*P2.3.1.1 External trip* *ID 1214*

Select the digital input to activate External Trip fault.

*P2.3.1.2 Surge Alarm Input* *ID 1806*

Select the digital input to trigging Activate Surge Alarm.

*P2.3.1.3 Main Contactor Feedback* *ID 1453*

This Digital Input is used for feedback signal of the main contactor, if the feedback and drive's main contactor control signal are different for too long the drive gives F64 MCC Fault. If this parameter is set to DigIN:0.x the F64 is disabled.

*P2.3.1.4 Fault Reset Input* *ID 1208*

Select digital input used for fault reset

*P2.3.1.5 DC Switch Feedback* *ID 1212*

This parameter defines which digital input is used for external DC Switch Feedback signal. If DC Switch Feedback is used the inverter will not go to ready state unless the signal is high.

*P2.3.1.6 Filter over Temperature* *ID 1179*

Digital input for trigging a LCL filter over temperature fault

*P2.3.1.7 DC Insulation fault input* *ID 1180*

Digital input for trigging DC Insulation fault.

*P2.3.1.8 Emergency Switch Input* *ID 1181*

Digital input for trigging Emergency Switch fault.

*P2.3.1.9 Start Ok* *ID 1974*

External signal for Start permission.

*P2.3.1.10 DI Power Limit 1 Activation* *ID 1182*

Digital input for activating Power Limit 1. Limitation can be adjusted using P2.3.11.13.2.

*P2.3.1.11 DI Power Limit 2 Activation* *ID 1183*

Digital input for activating Power Limit 2. Limitation can be adjusted using P2.3.11.13.3.

*P2.3.1.12 DI signal for controlling custom variable* *ID 1184*

Digital input which can be used to control any other variable which has an ID. Give ID to be controlled in P2.3.11.13.4.

#### 6.3.1.1 Configuration

These signals are used to specify are the G2.3.1 Digital Inputs using Normal or Inverted Logic and with some input certain specialized parameters also.

**Note!** The Normal/Inverted Logic parameters have no effect on Digital Input which is set to DigIN:0.x

*P2.3.1.13.1 Input inversion* *ID 1091*

Bit selection to invert input signal logic.

E.g. If you need to invert external fault and surge protection you need to set value 3.

**B0** (+1): Invert external fault
**B1** (+2): Invert surge protection
**B2** (+4): Invert main contactor feedback
**B3** (+8): Invert IO fault reset
**B4** (+16): Invert DC switch closed
**B5** (+32): Invert LCL over temp
**B6** (+64): Invert DC insulation
**B7** (+128): Invert emergency stop
**B8** (+256): Invert IO start OK
**B9** (+512): Invert power limit 1
**B10** (+1024): Invert power limit 2
**B11** (+2048): Invert custom DIN
**B12** (+4096): Reserved
**B13** (+8192): Reserved
**B14** (+16384): Reserved
**B15** (+32768): Reserved

*P2.3.1.13.2 Power limit value 1* *ID 767*

Power limit value when DI power limit 1 activate

*P2.3.1.13.3 Power limit value 2* *ID 769*

Power limit value when DI power limit 2 activate

*P2.3.1.13.4 Custom DIN 1 ID* *ID 771*

ID number when Custom DIN 1 activate

### *6.3.2* Analog inputs

The Analog Inputs, like Digital Inputs, have been implemented using Terminal To Function (TTF) programming method, which means, user needs to specify which Analog Input is linked to certain function. To disable certain function, set the input to anything between AnIN:0.1 and AnIN:0.10.

#### *6.3.2.1 Power limitation*

***P2.3.2.1.1 Power Limitation Input*** ***ID 1787***

This parameter can be used to select which input is used for Power Limitation functionality.

***P2.3.2.1.2 Maximum Power Limitation Value*** ***ID 1788***

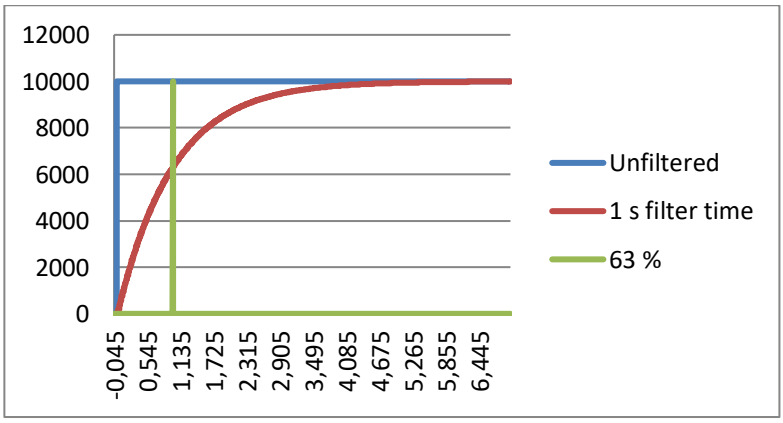
Specifies the Power Limit setting at maximum input.

***P2.3.2.1.3 Minimum Power Limitation Value*** ***ID 1789***

Specifies the Power Limit setting at minimum input.

***P2.3.2.1.4 Power Limit Input's Filter Time*** ***ID 1791***

Filter time in seconds for Power Limitation Input. The range of the time can be selected from 0.01 sec to 10.00 sec.




*Picture 5. Analog input filter.*

***P2.3.2.1.5 Power Limit value from Analog Input Fault situation*** ***ID 1792***

Specifies what Power Limit value from Analog Input is given to the system when Analog Input Fault for this signal has been detected. The system uses always the smallest Power Limit value given by any means.

### *6.3.2.2 Analog Input as Digital Input #1 & #2*

With these parameter groups 2 analog inputs can be programmed to be used as Digital Inputs. Parameter group G2.3.2.2 has parameters for Digital Input #1 and G2.3.2.3 for #2.

If any signal in G2.3.1 is set as DigIN:F.1 it is then controlled by Analog Input specified in G2.3.2.2 (Digital Input #1), DigIN:F.2 corresponds to G2.3.2.3 (Digital Input #2).

***P2.3.2.2.1 Analog DIN 1 input*** ***ID 1770***

This parameter can be used to select which Analog Input is used Digital Input #1.

***P2.3.2.2.2 Filter Time*** ***ID 1771***

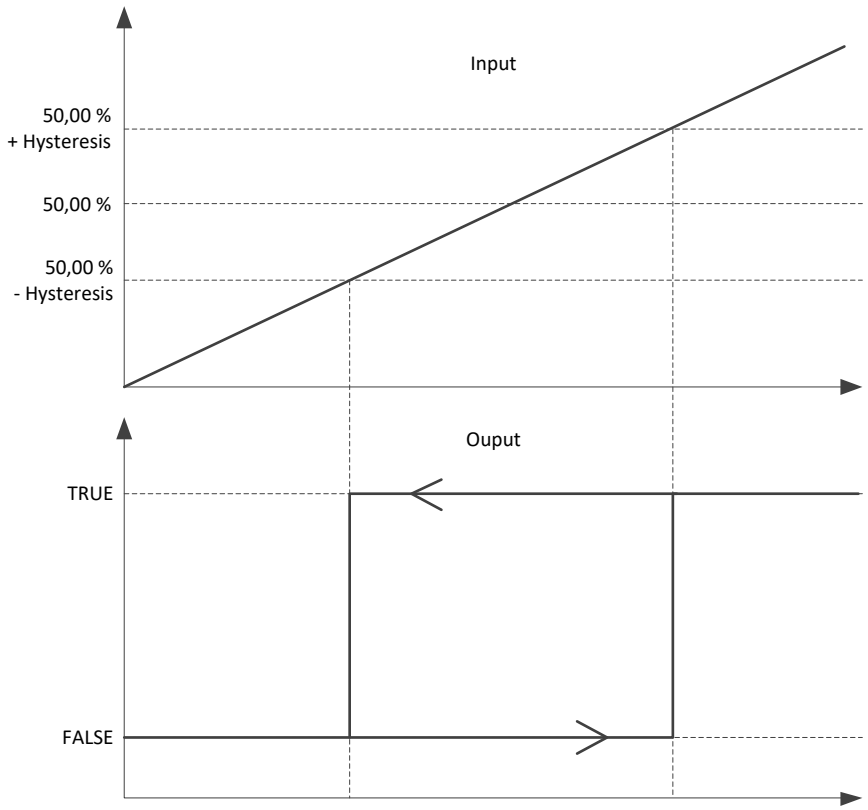
Filter time in seconds for the Analog Input. The range of the time can be selected from 0.01 sec to 10.00 sec.

***P2.3.2.2.3 Hysteresis*** ***ID 1772***

Hysteresis value for the Analog Input. The range can be selected from 0.01 to 20.00 %.

***P2.3.2.2.4 Digital Input's state in Analog Input Fault situation*** ***ID 1773***

Specifies what this Digital Input is set to in Analog Input Fault situation




*Picture 6. Operation principle of the Analog Input usage as Digital Input.*

*P2.3.2.3.1 Analog DIN 2 input* *ID 1766*

This parameter can be used to select which Analog Input is used Digital Input #2.

*P2.3.2.3.2 Filter Time* *ID 1767*

Filter time in seconds for the Analog Input. The range of the time can be selected from 0.01 sec to 10.00 sec.

*P2.3.2.3.3 Hysteresis* *ID 1768*

Hysteresis value for the Analog Input. The range can be selected from 0.01 to 20.00 %.

*P2.3.2.3.4 Digital Input's state in Analog Input Fault situation* *ID 1769*

Specifies what this Digital Input is set to in Analog Input Fault situation

*6.3.2.3 DC ground measurement*

*P2.3.2.4.1 DC Ground Monitoring Input* *ID 1763*

This parameter can be used to select which input is used for DC Ground Monitoring.

*P2.3.2.4.2 DC Ground Monitoring Filter Time* *ID 1764*

Filter time in seconds for DC Ground Monitoring. The range of the time can be selected from 0.01 sec to 10.00 sec.

*P2.3.2.4.3 DC Ground input in Analog Input Fault Situation* *ID 1765*

Specifies the DC Ground measurements value in Analog Input Fault situation.

*6.3.2.4 Custom analog input*

***P2.3.2.5.1 Custom Analog Input's Signal Selection*** ***ID 1757***

Used to select which analog input is used as Custom Analog Input.

***P2.3.2.5.2 Custom Analog Input's Filter Time*** ***s*** ***ID 1758***

Filter Time setting for the analog input signal. The range of the time can be selected from 0.01 sec to 10.00 sec.

***P2.3.2.5.3 Custom maximum value*** ***ID 1759***

Defines the maximum value set to the variable defined by P2.3.2.5.5 when the Analog Input is feed with maximum signal

***P2.3.2.5.4 Custom minimum value*** ***ID 1760***

Defines the minimum value set to the variable defined by P2.3.2.5.5 when the Analog Input is feed with minimum signal.

***P2.3.2.5.5 Custom Analog Input ID*** ***ID 1761***

ID of the variable this analog input is controlling.

***P2.3.2.5.6 Custom Analog Signal's Inversion*** ***ID 1762***

No = The stronger the input signal's strength, the bigger value is set to the selected variable

Yes = The stronger the input signal's strength, the smaller value is set to the selected variable

*6.3.3* Digital outputs

| | | |
|---|---|---|
| *P2.3.3.1* | *Ready Signal DO Selection* | *ID 432* |
| *P2.3.3.2* | *Run Signal DO Selection* | *ID 433* |
| *P2.3.3.3* | *Fault Signal DO Selection* | *ID 434* |
| *P2.3.3.4* | *"No Fault" Signal DO Selection* | *ID 435* |
| *P2.3.3.5* | *Warning Signal DO Selection* | *ID 436* |
| *P2.3.3.6* | *Main Contactor Control Signal DO Selection* | *ID 445* |
| *P2.3.3.7* | *"DC Supply Ready" Signal DO Selection* | *ID 440* |
| *P2.3.3.8* | *DC Earth Fault Signal DO Selection* | *ID 441* |
| *P2.3.3.9* | *Ready/Warning Blink Signal DO Selection* | *ID 442* |
| *P2.3.3.10* | *External Fan Control Signal DO Selection* | *ID 443* |
| *P2.3.3.11* | *Follower's Main Contactor Open Command Signal* | *ID 444* |

This signal gives "Open Main Contactor" command from multimaster followers, when they have to be disconnected from the grid, due to Grid Code requirement or fault, but the master drive is not wanted to be disconnected.

*P2.3.3.12 Power Limitation Active Signal DO Selection* *ID 446*

This signal indicates if selected Power Limit Reference (P2.3.3.19.2) is lower than trigger level (P2.3.3.19.1).

*P2.3.3.13 Power Limit Reference Too Low DO Selection* *ID 449*

External Power Limit Reference (Panel, Fieldbus, Digital or Analog Input) has been set and the Actual Power Limit value has ramped too low and the inverter has stopped.

| | | |
|---|---|---|
| *P2.3.3.14* | *Drive Charged Signal DO Selection* | *ID 450* |
| *P2.3.3.15* | *Drive Ok Signal DO Selection* | *ID 451* |
| *P2.3.3.16* | *Drive Ok/Warning Blink Signal DO Selection* | *ID 452* |
| *P2.3.3.17* | *Fault or Grid Code related stop* | *ID 453* |
| *P2.3.3.18* | *Charging Pulse for External Devices* | *ID 454* |

The length of the this pulse can be set by P2.3.3.19.3

*6.3.3.1 Configuration*

***P2.3.3.19.1 Power Limit Active Signal's Trigger Level*** ***ID 447***

Sets the trigger level when the "Power Limit Active" Digital Output signal closes.

***P2.3.3.19.2 Power Limit Level Selection*** ***ID 448***

Selects which Power Limit Reference value is used as trigger.

0 = External Power Limit Reference

1 = Grid Code Power Limit Value (signal active also during ramps)

2 = Both

***P2.3.3.19.3 Charging Pulse's Length*** ***ID 455***

Length of the charging pulse from output specified by P2.3.3.18.

*6.3.4* Analog outputs

*P2.3.4.1 Analog Output Selection ID 1232*

Select's the used Analog Output terminal.

*P2.3.4.2 Analog Output Signal ID ID 1233*

Set the ID of a signal to be connected to the Analog Output.

To connect e.g. DC-link voltage to Analog terminal, use 1839 as parameter value.

*P2.3.4.3 Analog Output Filter Time ID 1235*

Filter Time for the Analog Output.

*P2.3.4.4 Variable's value which will correspond to the output signal's maximum strength ID 1236*

Maximum value of a signal selected for Analog Output.

*P2.3.4.5 Variable's value which will correspond to the output signal's minimum strength ID 1237*

Minimum value of a signal connected to the Analog Output.

*P2.3.4.6 Signal strength corresponding with variable's maximum value ID 1238*

The analog output's signal strength corresponding with P2.3.4.4 AnOutputVarMax

*P2.3.4.7 Signal strength corresponding with variable's minimum value ID 1234*

The analog output's signal strength corresponding with P2.3.4.5 AnOutputVarMin

*P2.3.4.8 Analog Output Inversion ID 1239*

If this is enabled, the analog output's signal strength is at maximum, when the linked variable's value is at its minimum and vice versa.

## 6.4 Limit settings

### *6.4.1* Current limit

**P2.4.1.1 *Current Limit*** **ID 107**

Sets the current limit for the regenerative supply unit. Set this to correspond to the maximum required load or peak overload for the unit, bearing in mind that the load might consist of several motor drive units.

Maximum value 2 * IH depends on the unit size.

**P2.4.1.2 *LCL Over temperature factor*** **ID 1748**

Factor multiplied to current limit when LCL Over Temp input is active.

### *6.4.2* Generator power limit

**P2.4.2.1 *Generator power limit*** **ID 1290**

Power limit for the generator side operation.

**P2.4.2.2 *Generator limit ramp start*** **ID 1786**

Generator starting ramp rate %/s.

**P2.4.2.3 *Generator limit ramp stop*** **ID 1785**

Generator stop ramp time sets by %/s.

**P2.4.2.4 *Minimum generator power limit*** **ID 1938**

Minimum Power limit for generator side power limitter,1000 equals 100.0% of Nominal power

**P2.4.2.5 *Power limit start level*** **ID 1983**

Drive can start to generate power when power limit over this parameter.

**P2.4.2.6 *Power limit stop level*** **ID 1977**

Drive stop to generate power when power limit below this parameter.

**P2.4.2.7 *Disable temp limit*** **ID 1756**

Disabled temperature power limit

## 6.5 Inverter Control

### *6.5.1* Standby settings

***P2.5.1.1 Power standby level*** ***ID 1540***

The Inverter will stop if power is below this level for a time longer than standby delay.

When standby level is negative then standby is not used

***P2.5.1.2 Power standby delay*** ***ID 1541***

Delay before stopping, when power is below standby level

***P2.5.1.3 Power quick standby*** ***ID 154***

Inverter will stop within the time specified in power quick standby delay if power is below this value and go to standby mode. Value should be tuned so that inverter stops e.g. if DC breaker is opened. When quick standby level is negative then quick standby is not used

***P2.5.1.4 Power quick standby delay*** ***ID 1560***

Delay for power quick standby.

***P2.5.1.5 Power quick standby DC-level*** ***ID 1905***

Quick standby DC-level is used in the wake up DC-level calculation.

***P2.5.1.6 Standby interval*** ***ID 1754***

Time, how long to wait before trying to start again after the inverter has gone into standby mode. Reasons for standby mode might be a failed test of the photovoltaic field or inverter going into standby because of low power.

*6.5.2* MPP tracker

MPPT idea is to find maximum power point in any conditions. This MPPT tracker recognizes when there are stable or fast moving conditions.

*P2.5.2.1 Minimum Step Size* *ID 1810*

Minimum step size for the maximum power point tracker. MinStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) is below MinStepRatio. Scaled linearly between MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively.

*P2.5.2.2 Maximum Step Size* *ID 1811*

Maximum step size for the maximum power point tracker. MaxStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1))(step ratio) is above MaxStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively.

*P2.5.2.3 Minimum Step Ratio* *ID 1814*

Minimum step size for the maximum power point tracker. MinStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) is below MinStepRatio. Scaled linearly between MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively.

*P2.5.2.4 Maximum Step Ratio* *ID 1813*

Maximum step size for the maximum power point tracker. MaxStepSize is used when (P(k)-P(k-1))/(U(k)-U(k-1)) (step ratio) is above MaxStepRatio. Scaled linearly betwen MinStepSize and MaxStepSize when step ratio is between MinStepRatio and MaxStepRatio respectively.

*P2.5.2.5 Min DC Reference* *ID 1818*

Minimum DC Reference to which the MPP tracker will limit itself and not go below. 109,00% is close to the theoretical minimum value if nominal AC voltage is 230-280V.

*P2.5.2.6 Step Time* *ID 1812*

This parameter defines how often the MPP tracker will take a step in any direction.

*P2.5.2.7 Power Filter Time* *ID 1827*

The MPP tracker compares the power value before and after a step to see if it has increased or decreased. Hence, if it's going in the right or wrong direction respectively. This parameter adds a low pass filter to the compared signal.

*P2.5.2.8 Use Averaged Power Measurement* *ID 1831*

This parameter enables or disables the 10 sample averaging of the output power figure to filter out noise from the measurement.

*P2.5.2.9 Reference Window* *ID 1838*

In some cases the MPP tracker might not get the requested DC reference, e.g. if the inverter is running at the current limit. In this case it will show up as a deviation between the DC reference and actual voltage. This parameter states the maximum allowed deviation. If bigger, the MPP tracker freezes and forces its reference towards the actual value. Should the deviation decrease to the allowed range, then it starts tracking again.

*P2.5.2.10 Ramped DC Reference* *ID 1826*

This parameter will activate ramping of the DC reference step changes. The ramp time is specified by P2.3.2.18 as percentage of Step Time. This calms the DC link and power output down a little bit if step changes are big. If the inverter is in array configuration it's advised to always enable Ramped DC Ref. The slave inverters will get the reference with a little delay, but if the refs are ramped, the deviation in reference between master and slaves is very small. (If no ramping is used, then the deviation can be MaxStepSize for 10-20ms.)

*P2.5.2.11 Actual DC Following Power Limit* *ID 1755*

Fine tuning parameter, used in situations when starting ramp-up is very fast. DC Reference will follow Actual DC level when produced power is over this limit and Actual DC level is not following DC Reference.

*P2.5.2.12 DC Reference at Start* *ID 1595*

Percentage from current DC Voltage, that is going to be used as DC Reference at start up.

*P2.5.2.13 DC Reference Ramp Time as % of Step Time* *ID 1829*

DC Reference Ramp rate compared to the Step Time. When the DC Reference is changed that changes the voltage of the capacitors and depending if the voltage is lowered or raised the output of the capacitors cause momentarily either raise or fall of output power. The DC Reference Ramp is used to make that disturbance smaller.

NOTE: The MPPT makes a power measurement at half point of Step Time period, so power output has to be stabilized before Step Time / 2 time period has elapsed, otherwise the MPPT will not work properly.

*P2.5.2.14 Power Window (Dec)* *ID 1945*

Power Window size when decreasing DC reference.

*P2.5.2.15 Power Window (Inc)* *ID 1939*

Power Window size when increasing DC reference.

*P2.5.2.16 Fast condition threshold* *ID 1946*

Fast moving condition threshold limit.

*P2.5.2.17 Fast condition intensity increase threshold* *ID 1944*

Limit when no changes are made to DC reference in the fast moving conditions

*P2.5.2.18 Fast condition intensity decrease threshold* *ID 1943*

Limit when no changes are made to DC reference in the fast moving conditions

*6.5.3* Bypass control

*P2.5.3.1 PC Control Mode* *ID 1807*

With PC control mode can choose is the possible run Units with the NCDrive program.

0 = Disable
1 = Can Start/Stop unit with NCDrive
2 = Can set Reference to unit with NCDrive
3 = Can Start/Stop and set Reference

*6.5.4* Multimaster follower control

The master can be programmed to start the followers according to the power production using application control word B2. The master unit can be any of the units, but the master has to be changed manually if/when needed.

*P2.5.4.1 Follower start level* *ID 1984*

*P2.5.4.2 Follower start delay* *ID 1985*

*P2.5.4.3 Follower stop level* *ID 1986*

*P2.5.4.4 Follower stop delay* *ID 1987*

*6.5.5* Power adjust

These parameters can be used to calculate more precise power figures. These parameters are the arguments a quadratic equation:

$$P_{adjusted} = aP^2 + bP + c,$$

where *P* equals measured power and $P_{adjusted}$ is shown as monitor value output power. The same scaling works also output current figures and the adjusted current can be seen in monitor value output current

*P2.5.5.1 a*Power^2* *ID 1523*

*P2.5.5.2 b*Power* *ID 1524*

*P2.5.5.3 c* *ID 152*

6.6 Drive Control

*P2.6.1 Switching Frequency* *ID 601*

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

*P2.6.2 AFE Options* *ID 1463*

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

**B5** = Disable all harmonic elimination compensation.

This is active by default. When activated, this function will reduce little $5^{th}$ and $7^{th}$ harmonics. This will not reduce harmonics of the grid, only the harmonics of the drive.

**B13** = Enable use of D7 board for start synchronisation.

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

*P2.6.3 AFE Options 2* *ID 1464*

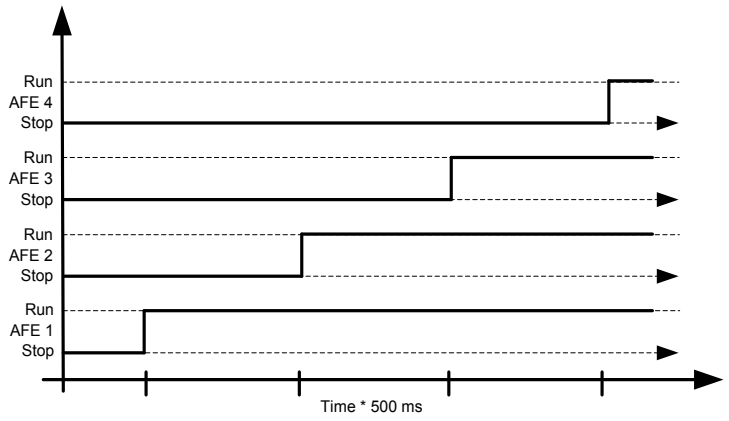
This packed bit word is made for enabling/disabling different control options for the regeneration control.

*P2.6.4 AFE Options 3* *ID 1466*

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

*P2.6.5 Start Delay* *ID 1500*

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




*Picture 10. Start delay.*

*P2.6.6 Modulator Type* *ID 1516*

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

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

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

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

3 = Software modulator 3: An unsymmetric BusClamb, in which one switch always conducts 120 degrees to a negative DC-rail to reduce switching losses. The upper and lower switches are unevenly loaded and the spectrum is wide. Not recommended for parallel units.

4 = Software modulator 4: A pure sine wave, sinusoidal modulator without harmonic injection. It is dedicated to be used, for example, in back-to-back test benches to avoid a circulating third harmonic current. The required DC voltage is 15% higher compared to other modulator types.

*P2.6.7 Application control word* *ID 1900*

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

E.g. If you need to activate B0 and B1 then you need to set value 3.

B0 (+1): Calculate total capacitor size. This must be active when there is LC-filter connected in multi master system

B1 (+2): Enable Dynamic Active Current Limit Handling

B2 (+4): SB master acts like normal multi master

B3 (+8): Reserved

B4 (+16): Reserved

B5 (+32): Use Normal AFE Charging levels

B6 (+64): Activate Double sampling when Grid Code is not active

B7 (+128): Use simulated energy production

B8 (+256): Reserved

B9 (+512): Reserved

B10 (+1024): Reserved

B11 (+2048): Reserved

B12 (+4096): Reserved

B13 (+8192): Reserved

B14 (+16384): Reserved

B15 (+32768): Reserved

*6.6.1* Control

*P2.6.8.1 Active current Kp* *ID 1455*

Regen active current controller gain.

*P.2.6.8.2 Active current Ti* *ID 1456*

Regen active current controller integral time.

*P2.6.8.3 Sync Kp* *ID 1457*

Regen synchronization gain.

*P2.6.8.4 Sync Ti* *ID 1458*

Regen synchronization integral time.

## 6.7 Protections

### *6.7.1* General

#### *P2.7.1.1 External Trip* *ID 701*

This parameter defines a response to external trip. If the inverter monitors the state of external trip input and a fault occurs the inverter can be set to respond to the fault.

0 = No response
1 = Warning
2 = Fault

#### *P2.7.1.2 Input Phase Supervisor* *ID 1518*

The input phase supervision ensures that the input phases of the Inverter have an approximately equal current.

0 = No response
1 = Warning
2 = Fault

#### *P2.7.1.3 Input Filter Temp* *ID 1505*

This parameter defines a response to Input filter over temperature fault. The fault is monitored through digital input.

0 = No response
1 = Warning
2 = Fault

#### *P2.7.1.4 UserTempWarnLimit* *ID 1853*

Limit for giving the temperature rising warning

#### *P2.7.1.5 DCSwitchNOKDelay* *ID 1603*

Delay for dropping DC Switch digital input signal to FALSE.

#### *P2.7.1.6 StartNOKDelay* *ID 1602*

Delay forpping Start Ok digal input signal to FALSE.

*6.7.2* DC Earth fault

*P2.7.2.1 DC Ground Source* *ID 1801*

Used to select the input method for DC Ground Fault.

*P2.7.2.2 DC Ground Fault Level* *ID 1715*

Fault level of analog input.

*P2.7.2.3 DC Ground Warning Level* *ID 1716*

Warning level of analog input.

*P2.7.2.4 DC Ground Hysteresis* *ID 1714*

Hysteresis for warning and fault levels.

*P2.7.2.5 DC Ground Delay* *ID 1782*

Delay for warning and fault.

*P2.7.2.6 DC Ground Reset Delay* *ID 1750*

Reset delay of fault, if fault conditions no longer active.

*6.7.3* AC Earth Fault

*P2.7.3.1 Earth fault* *ID 1332*

Action in case of Earth Fault.

0 = No response
1= Fault

*P2.7.3.2 Earth Fault Current* *ID 1333*

Max level of Earth current in % of unit current.

*6.7.4* Main Contactor

*P2.7.4.1 Main Contactor Fault Delay* *ID 1521*

Delay for Main contactor fault. Delay between main contactor control relay close/open command and main contactor acknowledge signal. If acknowledge signal is not received within this time, then fault 64 is trigged.

*P2.7.4.2 Start Delay* *ID 1519*

Main contactor ON delay. Delay from Main contactor acknowledge to modulation start.

*6.7.5* Control Panel

*P2.7.5.1 Heartbeat Timeout ID 1840*

The inverter should receive a heartbeat signal from the external control panel once every second. If the signals are not received and inverter is controlled by external panel, then the inverter will trip after the set delay with this parameter.

*P2.7.5.2 Timeout Reset Delay ID 1841*

The heartbeat timeout fault will be reset automatically after this time if the heartbeat signal re-appears.

*6.7.6* Systembus

*P2.7.6.1 Heartbeat Filter Delay ID 1600*

If a slave does not receive a heartbeat signal from the master, it will lock to its current DC reference and trip after this delay.

*P2.7.6.2 Communication Fault Delay ID 1601*

Trip delay from communication problems with systembus option board.

*6.7.7* Auto reset

*P2.7.7.1 Automatic reset Wait Time ID 717*

This parameter defines the time to wait after a fault trigger has disappeared. When the time has elapsed, the Inverter tries to automatically restart modulation.

*P2.7.7.2 Automatic reset Trial Time ID 718*

If the fault trigger appears more often than defined by parameters P2.7.7.3 to P2.7.7.6 inside the trial time

*P2.7.7.3 Over voltage Autoreset tries ID 721*

This parameter determines how many automatic restarts can be made during the trial time set by parameter P2.7.7.2. "Trial Time" After an over voltage trip.

0 = No automatic restart after overvoltage fault trip.
>0 = Number of automatic restarts after overvoltage fault trip. The fault is reset and the inverter is started automatically after the DC-link voltage has returned to the normal level.

*P2.7.7.4 Over current Autoreset tries ID 722*

NOTE! IGBT temp fault also included. This parameter determines how many automatics restarts can be made during the trial time set by P2.7.7.2. "Trial Time"

0 = No automatic restart after over current fault trip
>0 = Number of automatic restarts after over current trip and IGBT temperature faults.

*P2.7.7.5 External Trip Autoreset tries ID 725*

This parameter determines how many automatics restarts can be made during the trial time set by P2.7.7.2. "Trial Time"

0 = No automatic restart after External fault trip
>0 = Number of automatic restarts after External trip.

*P2.7.7.6 Input Phase Autoreset Tries ID 726*

This parameter determines how many automatics restarts can be made during the time set by P2.7.7.2. "Trial Time"

*6.7.8* Analog Inputs

*P2.7.8.1 Response for Analog Input Malfunction ID 1947*

How the inverter responses to Analog Input malfunction:

0 = No Action

1 = Warning

2 = Fault

*P2.7.5.2 Reaction Time for Analog Input Malfunction ID 1941*

If P2.7.8.1 is set to "Warning" or "Fault", this parameter sets the response time.

*6.7.9* AC Voltage Protection

*P2.7.9.1 AC Voltage Maximum ID 1710*

Max AC Voltage Limit.

*P2.7.9.2 AC Voltage Minimum ID 1711*

Min AC Voltage Limit.

*P2.7.9.3 AC Maximum Trip Delay ID 1796*

Trip delay if voltage above max limit.

*P2.7.9.4 AC Minimum Trip Delay ID 1797*

Trip delay if voltage below min limit.

*P2.7.9.5 AC Voltage Reset Delay ID 1703*

Reset delay of fault if fault conditions no longer active.

*6.7.10* AC Frequency Protection

*P2.7.10.1 AC Frequency Maximum ID 1752*

Max AC Frequency Limit.

*P2.7.10.2 AC Frequency Minimum ID 1753*

Min AC Frequency Limit.

*P2.7.10.3 AC Frequency Trip Delay ID 1805*

Trip delay if frequency is above or below limits.

*P2.7.10.4 AC Frequency Reset Delay ID 1751*

Reset delay of fault, if fault conditions no longer active.

6.8 Fieldbus

| | | |
|---|---|---|
| *P2.8.1* | *FB Data Out1 Sel* | *ID 852* |
| *P2.8.2* | *FB Data Out2 Sel* | *ID 853* |
| *P2.8.3* | *FB Data Out3 Sel* | *ID 854* |
| *P2.8.4* | *FB Data Out4 Sel* | *ID 855* |
| *P2.8.5* | *FB Data Out5 Sel* | *ID 856* |
| *P2.8.6* | *FB Data Out6 Sel* | *ID 857* |
| *P2.8.7* | *FB Data Out7 Sel* | *ID 858* |
| *P2.8.8* | *FB Data Out8 Sel* | *ID 859* |

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

| | | |
|---|---|---|
| *P2.8.9* | *FB Data In 1 Sel* | *ID 876* |
| *P2.8.10* | *FB Data In 2 Sel* | *ID 877* |
| *P2.8.11* | *FB Data In 3 Sel* | *ID 878* |
| *P2.8.12* | *FB Data In 4 Sel* | *ID 879* |
| *P2.8.13* | *FB Data In 5 Sel* | *ID 880* |
| *P2.8.14* | *FB Data In 6 Sel* | *ID 881* |
| *P2.8.15* | *FB Data In 7 Sel* | *ID 882* |
| *P2.8.16* | *FB Data In 8 Sel* | *ID 883* |

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

*P2.8.17 FB Control Slot* *ID 1979*

This parameter defines which slot is used as the main control place when two fieldbus boards have been installed in the drive.

0 = Slots D & E

1 = Slot D

2 = Slot E

3 = Slot D + Fast PB

4 = Slot E + Fast PB

## 6.9 System Tests

There is possibly to put the application in a power unit simulation mode. This mode is meant for testing the inverter without actually starting the power unit, hence generating any real power. This feature is useful during the commissioning phase and gives the possibility to test application logic, I/Os and fieldbus communication.

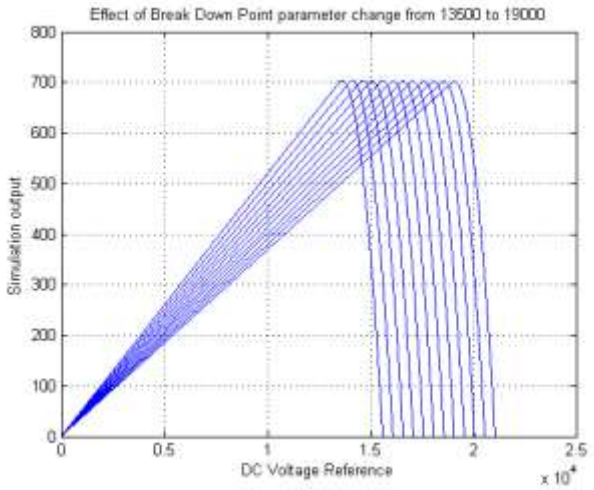
### *6.9.1* Power Simulation

***P2.9.1.1 Simulation mode*** ***ID1720***

0 = Simulation Mode Disabled *"Disable"*
1 = Simulation Mode with Real DC Voltage *"Enable"*
2 = Simulation Mode with Simulated DC Voltage (P2.9.1.6) *"SimModSimDC"*

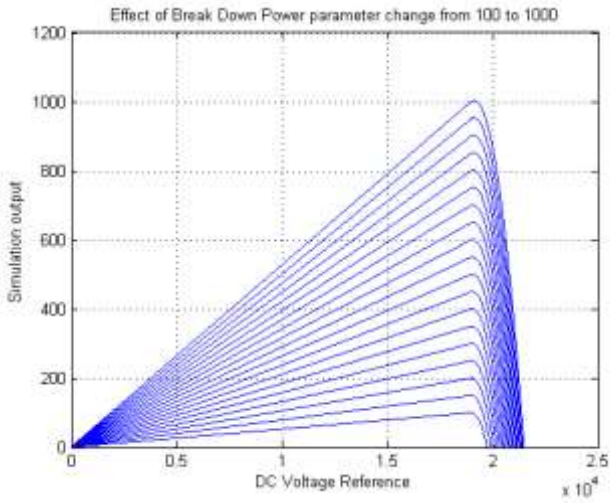
***P2.9.1.2 Break down point*** ***ID 1721***

This parameter defines break down point voltage.




*Picture 11. Break down point.*

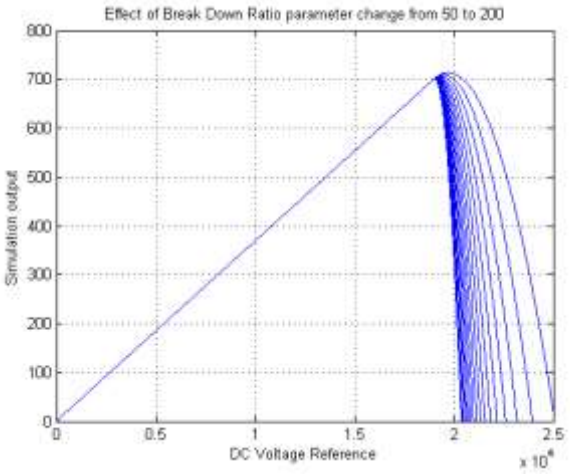
***P2.9.1.3 Break down power*** ***ID 1722***




*Picture 12. Break down power.*

### *P2.9.1.4 Break down ratio* *ID 1723*

This parameter defines break down ratio.




*Picture 13. Break down ratio.*

### *P2.9.1.6 Simulation DC* *ID 1577*

There is possibly to give simulation DC-link value to the system without connection to power unit by using this feature.

*6.9.2* Systembus test

### *P2.9.2.1 Systembus test* *ID 1780*

Parameter for testing if systembus configuration and connections are ok. The test can be started from any inverter in multimaster system. The inverter where test is started sends test pulses first to itself and after 5 seconds, to the next and so on, until all inverters have been tested. When the pulse is received in the inverter, the LEDs in the NX panel are flashing, so if the LEDs in all of the inverter flash during the test, the test is successful.

0 = Disable
1 = Enable

*6.9.3* Simulated grid

*P2.9.3.1 Simulated Grid Frequency ID 1725*

This parameter specifies the simulated grid frequency if the application is tested without actual AC grid present.

*P2.9.3.2 Simulated Grid Voltage ID 1726*

This parameter specifies the simulated grid voltage if the application is tested without actual AC grid present.

*P2.9.3.3 Use Simulated Grid Frequency ID 1728*

Enable or disable the use of simulated frequency in simulation mode.

*P2.9.3.4 Use Simulated Grid Voltage ID 1729*

Enable or disable the use of simulated Voltage in simulation mode.

## 6.10 Counters

*P2.10.1 Load or Save Counters Value ID 1861*

Counters Values Load or Save Functionaly:

0 = Idle; "Do nothing"

1 = Load Values; Counter current values to parameters P2.10.2-6

2 = Save Values; Save values in parameters P2.10.2-6 as the inverter's counters values.

*P2.10.2 Total Energy Preset value ID 1858*

Value to save to Total Energy counter when "LoadSaveCountVal" parameter save is activated.

*P2.10.3 Grid Connection Preset value ID 1730*

Value to save to Grid Connection counter when "LoadSaveCountVal" parameter save is activated

*P2.10.4 Total Runtime Preset value ID 1859*

Value to save to Runtime total counter when "LoadSaveCountVal" parameter save is activated

*P2.10.5 Internal Fan Runtime Preset Value ID 1894*

Value to save to Internal Fan Runtime (Internal) counter when" LoadSaveCountVal " parameter save is activated

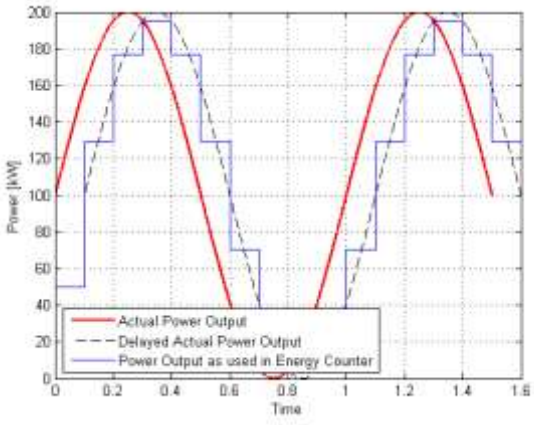
*P2.10.6 External Fan Runtime Preset Value ID1896*

Value to save to External Fan Runtime (Internal) total counter when "LoadSaveCountVal " parameter save is activated

*P2.10.7 Integration interval for energy counter ID 1856*

This parameter defines how often the current power output is added to the energy counters.

$$E = \int_0^{\infty} P_{real}(t)\mathrm{d}t \approx \sum_{i=0}^{\infty}\left[\left(P_{measured}(i-1) + \frac{P_{measured}(i) - P_{measured}(i-1)}{2}\right)\cdot t_{int}\right]$$




*Picture 15. Energy production counter principle.*

## 6.11 Admin parameters

### *6.11.1* External fan control

*P2.11.1.1 Start temp ID 1727*

The temperature level of the inverter unit, at which the external fan control signal will be activated. The external fan signal can be selected for any digital/relay output.

*P2.11.1.2 Stop temp ID 1734*

The temperature level of the inverter unit, at which the external fan control signal will be deactivated.

Notice! The deactivation can also be delayed with the "Stop Delay" parameters. (If the inverter stops the unit temperature might decrease much faster than e.g. the LCL's, then a delay to get some more cooling time might be appropriate.)The external fan signal can be selected for any digital/relay output.

*P2.11.1.3 Stop delay ID 1857*

The deactivation of the external fan control signal after unit temperature has decreased below "Stop Temp" can be delayed with this parameter. (If the inverter stops the unit temperature might decrease much faster than e.g. the LCL's, then a delay to get some more cooling time might be appropriate.)The external fan signal can be selected for any digital/relay output.

### *6.11.2* Datalogger

#### *6.11.2.1 Datalogger trigger*

***P2.11.2.1.1 Trigger signal*** ***ID 2704***

Trigger signal definition (ID or index). If set to 0 and DL_TriggerOptions B0 is 0, then MCStatus.B3 (fault bit) is used as trigger signal / value.

***P2.11.2.1.2 Trigger value low*** ***ID 2705***

Trigger value as level or bitmask depending on trigger options

***P2.11.2.1.3 Trigger value high*** ***ID 2706***

High word of trigger value, in case trigger variable is of DINT/UDINT type

***P2.11.2.1.4 Trig on fault*** ***ID 2712***

0 = no fault trig

1 = trig on fault

***P2.11.2.1.5 Trigger is*** ***ID 2713***

0 = trigger value is level

1 = trigger value is bitmask

***P2.11.2.1.6 Trigger level is*** ***ID 2711***

0 = trigger level is negative

1 = trigger level is positive

***P2.11.2.1.7 Trigger on*** ***ID 2710***

0 = trig on rising edge

1 = trig on falling edge

***P2.11.2.1.8 Pre-trig*** ***ID 2707***

pre-trig %: 00 = 70%, 01 = 50%, 10 = 25%, 11 = 10%

***P2.11.2.1.9 Trigger mode*** ***ID 2708***

0 = continuous mode

1 = single mode

*P2.11.2.1.10 Store settings* *ID 2709*

0 = don't store settings (reset at power down)

1 = store settings.

*6.11.2.2 Datalogger settings*

*P2.11.2.2.1 Sample period* *ID 2703*

Sample period in ms. If 0, then set to default (1 ms).

*P2.11.2.2.2 Max samples* *ID 2702*

Number of samples in DataLogger. Set to nonzero value to limit size of log. DataLogger must be set again for change to take effect.

*P2.11.2.2.3-18 Datalogger signals 1-16* *IDs 2714 - 2729*

Signal definition (ID or index):

1 - 9999 = variable ID

10001 - 19999 = fw interface variable index (10001 = index 1)

20001 - 29999 = application variable index (20001 = index 1)

*P2.11.2.2.19 Datalogger controlword* *ID 2701*

DataLogger control word.

bit 0 = external trigger

bit 1 = restart

bit 2 = PC trigger (don't set in application code)

bit 3 = Reserved (disable flash store)

bit 4 = pause logging after RUN state trigs

bit 5 = set datalogger to system software de

## 6.12 Grid Code parameters

*P 2.17.1 GGC License ID 3201*

Enter here license code to activate General Grid Code functionality.

*P 2.17.2 EnableGridCode ID 3254*

Parameter to enable Grid Codes if correct license is given.

**0 = Disabled**

Grid Code functions are disabled.

**1 = Enabled; No Trip.**

Grid Code functions are active but do not cause drive to trip.

**2 = Enabled**

Grid Code functions are active and drive will stop modulating if trip limit is reached.

*P 2.17.3 Anti-islanding ID 3250*

Enables or disables anti-islanding functions.

**0 = Disabled**

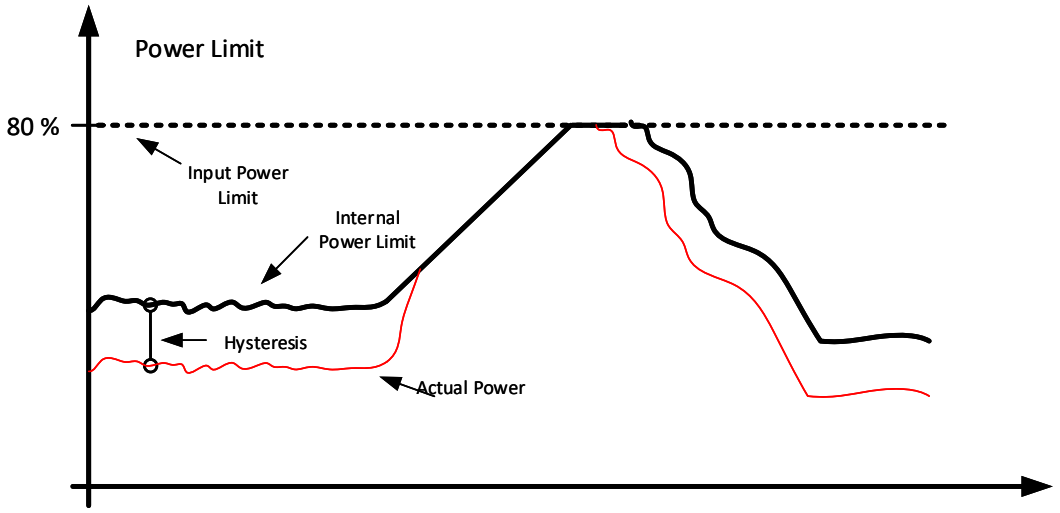
In islanding situation frequency may stay inside acceptable operation.

**1 = Active**

In islanding situation frequency will change rapidly and frequency limit will trip the drive.

*P 2.17.4 Power Ramp Up Rate ID3324*

Limit power increase rated when using positive values. Negative value will disable power increase rate limiter.



*6.12.1* FRT

*P2.17.5.1 FRT Function ID 3251*

Enables FRT functionality.

**0 = Disabled; Both**

FRT is disabled but voltage level and curve are active at the same time.

**1 = Enabled; Limits**

FRT is enabled, voltage levels makes the trip but not curve.

**2 = Enabled; Curve**

FRT is enabled, curve makes the trip but not voltage levels.

**3 = Enabled; Neither**

FRT is enabled, but neither curve or voltage levels are not making trip.

**4 = Enabled; Both**

FRT is enabled, Both curve and levels make trip

*P2.17.5.2 ReactivInjection ID 3252*

Select the grid fault types when reactive current is injected.

**0 = Tri:N, Bi:N**

Reactive current is not injected.

**1 = Tri:Y, Bi:Y**

Reactive current is injected

**2 = Tri:Y, Bi:N**

Reactive current is injected to three phase fault but not bi-phase faults.

*P2.17.5.3 Symmetrical Reactive ID3323*

Select if unsymmetrical fault will be few by symmetrical current.

*6.12.2* Reconnection

*P 2.17.6.1 ReConnectTime s ID 3253*

Reconnection time when fault happens on run state.

*P 2.17.6.2 ReConnTimeStop s ID 3255*

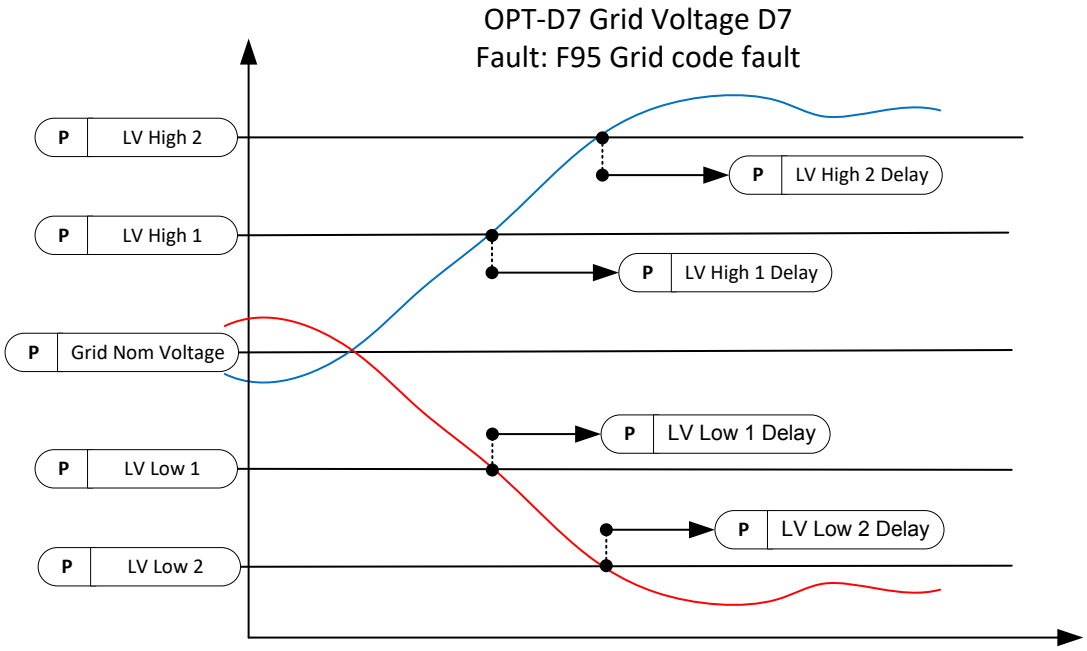
Reconnection time when fault happens in stop state.

*P 2.17.6.3 ReConRampUpRate %/s ID 3297*

Power ramp up rate on reconnection.

### *6.12.3* Line Voltage

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




| | | | | |
|---|---|---|---|---|
| *P 2.17.7.1* | *Voltage Monitor* | *%* | *ID* | *3364* |

Line Voltage monitoring type
0 = Average voltage from phase voltages
1 = Minimum and Maximum from phase voltages.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.2* | *LV High 1* | *%* | *ID* | *3256* |

Line Voltage High Limit 1 [%] of Grid Nominal Voltage. Trip after delay defined by ID3257.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.3* | *LV High 1 Delay* | *ms* | *ID* | *3257* |

Delay to trip when voltage above ID3256.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.4* | *LV High 2* | *%* | *ID* | *3258* |
| *P 2.17.7.5* | *LV High 2 Delay* | *ms* | *ID* | *3259* |

This parameter defines 10-minute average voltage trip limit.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.6* | *LV High 3* | *%* | *ID* | *3258* |
| *P 2.17.7.7* | *LV High 3 Delay* | *ms* | *ID* | *3259* |
| *P 2.17.7.7* | *LV High 3 PLim* | *%* | *ID* | *3363* |

Active Current limit activated when voltage goes above LV High 3

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.9* | *LV Low 1* | *%* | *ID* | *3260* |

Line Voltage Low Limit 1 [%] of Grid Nominal Voltage. Trip after delay defined by ID3261.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.10* | *LV Low 1 Delay* | *ms* | *ID* | *3261* |

Delay to trip when voltage below ID3260.

| | | | | |
|---|---|---|---|---|
| *P 2.17.7.11* | *LV Low 2* | *%* | *ID* | *3262* |
| *P 2.17.7.12* | *LV Low 2 Delay* | *ms* | *ID* | *3263* |
| *P2.17.7.13* | *LV Low 3* | *ID3365* | | |
| *P2.17.7.14* | *LV Low 3 Delay* | *ID3366* | | |
| *P2.17.7.15* | *LV Low 3 PLim* | *ID3367* | | |

Low voltage 3 has option to activate power limit when the limit is exceeded.

| | | | |
|---|---|---|---|
| *P 2.17.7.16* | *10 Min average voltage trip level* | *%* | *ID3353* |

This parameter defines 10-minute average voltage trip limit.

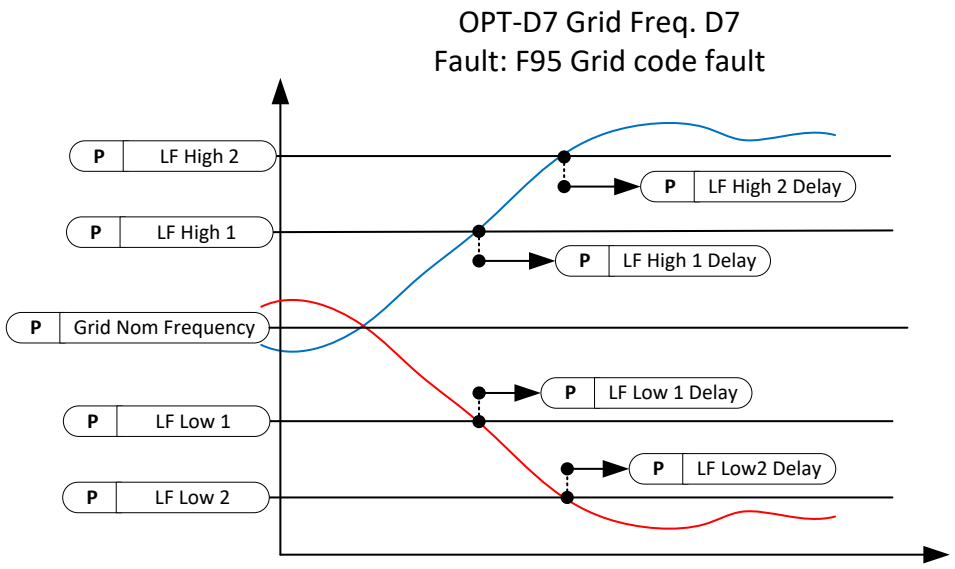
| | | |
|---|---|---|
| *P 2.17.7.17* | *10 Min Average Voltage Trip Delay* | *ID3376* |

Defines delay for 10 min average voltage monitoring.

| | | |
|---|---|---|
| *P 2.17.7.18* | *10 Min Average Voltage Trip Act DO selection* | *ID3375* |

### *6.12.4* Line Frequency

Line frequency trip levels and times to tripping. Times defines delay when drive sees that frequency has exceed set limit. Monitored signal may have hardware and/or software filtering function that will need to be considered when estimating total tripping time.
Reference frequency is P2.1.2 Grid Nom Freq.




*P 2.17.8.1 LF High 1 % ID 3264*

Line Frequency High Limit 1 [%] of Grid Nominal Frequency.

*P 2.17.8.2 LF High 1 Delay ms ID 3265*

Delay to trip when frequency above ID3264.

*P 2.17.8.3 LF High 2 % ID 3266*

*P 2.17.8.4 LF High 2 Delay ms ID 3267*

*P 2.17.8.5 LF High 3 % ID 3368*

*P 2.17.8.6 LF High 3 Delay ms ID 3369*

*P 2.17.8.7 LF Low 1 % ID 3268*

Line Frequency Low Limit 1 [%] of Grid Nominal Frequency.

*P 2.17.8.8 LF Low 1 Delay ms ID 3269*

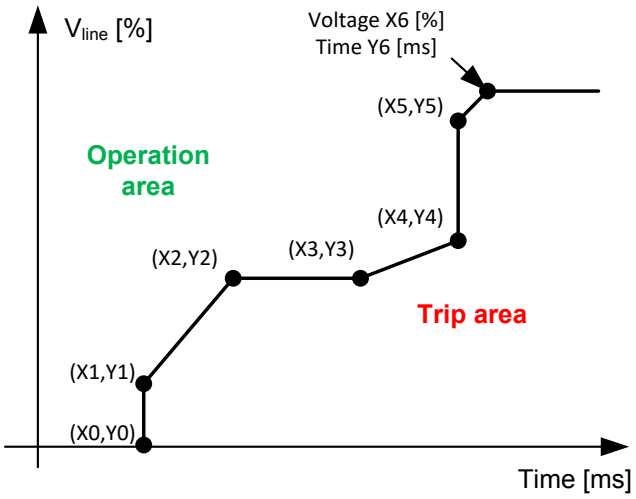
Delay to trip when frequency below ID3268.

| | | | | |
|---|---|---|---|---|
| *P 2.17.8.9* | *LF Low 2* | *%* | *ID* | *3270* |
| *P 2.17.8.10* | *LF Low 2 Delay* | *ms* | *ID* | *3271* |
| *P 2.17.8.11* | *LF Low 3* | *%* | *ID* | *3370* |
| *P 2.17.8.12* | *LF Low 3 Delay* | *ms* | *ID* | *3371* |
| *P 2.17.8.9* | *LF MaxChangeRate* | *Hz/s* | *ID* | *3322* |

Tripping if line frequency has changed more than set value inside one (1) second.

### *6.12.5* Voltage Time Trip

Define voltage drop curve, drive will trip if curve is exceeded. All values needs to be fill. Timer start when Voltage is below Voltage X6 point.




| | | | | |
|---|---|---|---|---|
| *P 2.17.9.1* | *Voltage X0* | *%* | *ID* | *3272* |

Lowest voltage level.

| | | | | |
|---|---|---|---|---|
| *P 2.17.9.2* | *Time Y0* | *ms* | *ID* | *3273* |
| *P 2.17.9.3* | *Voltage X1* | *%* | *ID* | *3274* |
| *P 2.17.9.4* | *Time Y1* | *ms* | *ID* | *3275* |
| *P 2.17.9.5* | *Voltage X2* | *%* | *ID* | *3276* |
| *P 2.17.9.6* | *Time Y2* | *ms* | *ID* | *2277* |
| *P 2.17.9.7* | *Voltage X3* | *%* | *ID* | *3278* |
| *P 2.17.9.8* | *Time Y3* | *ms* | *ID* | *3279* |
| *P 2.17.9.9* | *Voltage X4* | *%* | *ID* | *3280* |
| *P 2.17.9.10* | *Time Y4* | *ms* | *ID* | *3281* |
| *P 2.17.9.11* | *Voltage X5* | *%* | *ID* | *3282* |
| *P 2.17.9.12* | *Time Y5* | *ms* | *ID* | *3283* |
| *P 2.17.9.13* | *Voltage X6* | *%* | *ID* | *3284* |

Highest voltage level. Below this level timer is started.

| | | | | |
|---|---|---|---|---|
| *P 2.17.9.14* | *Time Y6* | *ms* | *ID* | *3285* |

Time to trip when voltage is below X6 point and above X5 point.

Trip time is scaled between X6 and X5 points.

### *6.12.6* Line OK Limits

Grid OK levels when reconnection is allowed. If zero values from Line Voltage and Line frequency are used.

| | | | | |
|---|---|---|---|---|
| *P 2.17.10.1* | *LF OK High* | *%* | *ID* | *3287* |
| *P 2.17.10.2* | *LF OK Low* | *%* | *ID* | *3286* |
| *P 2.17.10.3* | *LV OK High* | *%* | *ID* | *3289* |
| *P 2.17.10.4* | *LV OK Low* | *%* | *ID* | *3288* |
| *P 2.17.10.5* | *Line OK Delay* | *ms* | *ID* | *3290* |

Minimum time that line needs to be inside acceptable limits before reconnection counter is started.

### *6.12.7* Reactive Injection

Reactive current injection is activated by ID3252.

***P 2.17.11.1 UV Reactive Mode ID 3314***

Select the operation mode for reactive reference handling for under voltage.

1. Linear
2. Power Lock In and Lock Out.

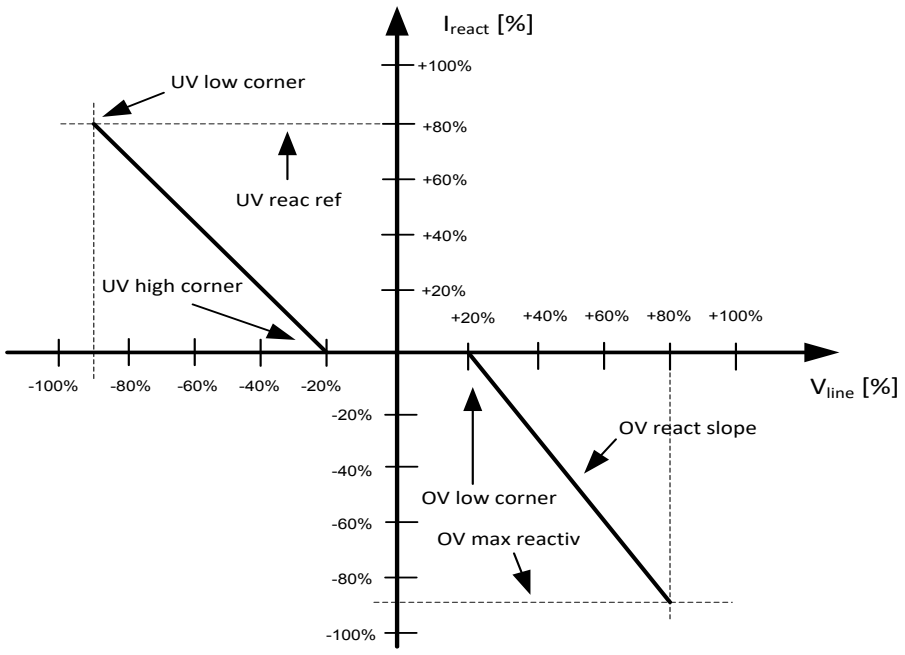
***P 2.17.11.1 OV Reactive Mode ID 3377***

Select the operation mode for reactive reference handling for over voltage.

1. Linear
2. Power Lock In and Lock Out.

### *6.12.7.1 Linear reference under voltage*

Injected reactive current is changing linearly between high and low voltage corners.




*P 2.17.11.3.1 UV High Corner % ID 3291*

Defines voltage level where reactive current injection is started.

*P 2.17.11.3.2 UV Low Corner % ID 3292*

Defines voltage level where full Reactive Current, specified in ID3293, is injected to the grid.

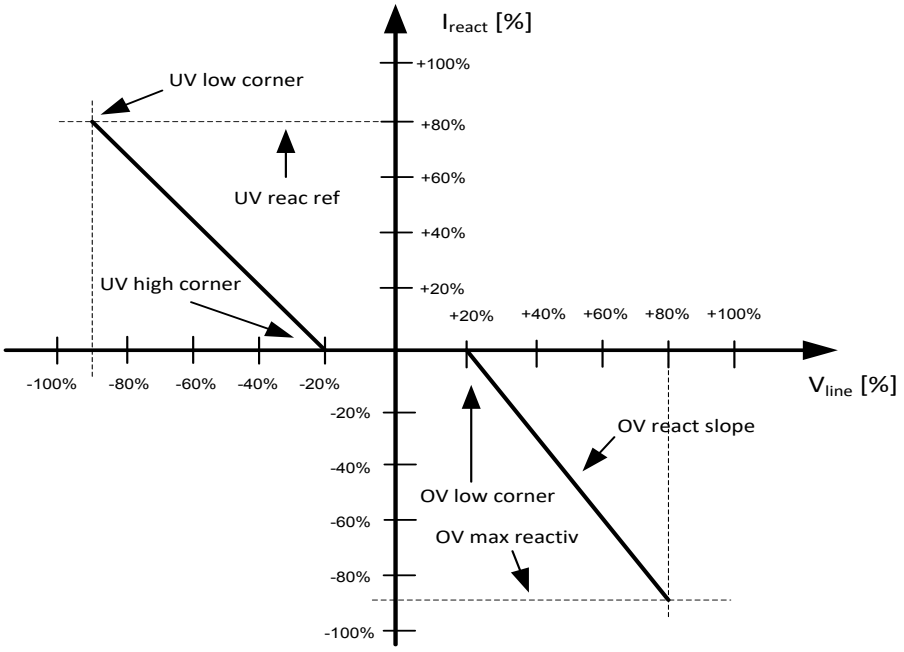
*P 2.17.11.3.3 UV Reac. Ref % ID 3293*

Reactive current reference at low voltage corner.

*P 2.17.11.3.4 UV Bi Reac. Ref % ID 3294*

Reactive current reference at low voltage corner on bi phase fault situation.

*6.12.7.2 Linear reference over voltage*




*P 2.17.11.4.1 OV Low Corner % ID 3300*

Voltage corner where reactive current injection is started on line over voltage situation.

*P 2.17.11.4.2 OV Max Reactiv % ID 3301*

Maximum reactive current reference on over voltage situation.

*P 2.17.11.4.3 OV React Slope %/% ID 3302*

Slope for reactive current reference, started at ID2300.
100 %/% means that reactive current is increase 100 % by 1 % voltage increase.

*P 2.17.11.4.4 OV React PLim In % ID 3303*

If drive output power is below this reactive current injection is not started on over voltage.

*P 2.17.11.4.5 OV React PLim Out % ID 3329*

When drive output power falls below this level reactive injection is stopped.

*6.12.7.3 Power Lock In and Out Reference under voltage.*

*P 2.17.11.5.1 Under Voltage PowerLockIn % ID 3315*

Power level where reactive current injection is started if Line Voltage is below ID3291.

*P 2.17.11.5.2 Under Voltage PowerLockOut % ID 3316*

Reactive current injection is stopped if power is below this value.

*P 2.17.11.5.3 Under Voltage PowerLogInMode ID 3372*

0 = Voltage Level Trip
1 = Linear

*P 2.17.11.5.4 UV High Corner % ID 3291*

If power is above ID3315 and voltage below this value but above ID3292 reactive current set by ID3318 is injected to grid.

*P 2.17.11.5.5 UV Low Corner % ID 3292*

If power is above ID3315 and voltage below this value, reactive current set by ID3293 is injected to grid.

*P 2.17.11.5.6 UV LockOutVoltag % ID 3317*

Voltage limit for disabling the reactive current injection in overvoltage situation

*P 2.17.11.5.7 UV Reac RefHighCor % ID 3318*

Reactive current injected to grid when power is above ID3315 and Line voltage below ID3291 but above ID3292.

*P 2.17.11.5.8 UV Reac. Ref % ID 3293*

Reactive current injected to grid when power is above ID3315 and voltage below ID3292. This level is kept until voltage is above ID3311.

*P 2.17.11.5.9 UV Bi Reac. Ref % ID 3294*

Reactive reference used when Bi-phase fault, in both voltage levels.

*6.12.7.4 Power Lock In and Out Reference over voltage.*

*P 2.17.11.6.1 Over Voltage PowerLockIn % ID 3378*

Power level where reactive current injection is started if Line Voltage is above ID3300.

*P 2.17.11.6.2 Over Voltage PowerLockOut% ID 3379*

Reactive current injection is stopped if power is below this value.

*P 2.17.11.5.3 Over Voltage PowerLogInMode ID 3380*

0 = Voltage Level Trip
1 = Linear

*P 2.17.11.6.4 OV Low Corner % ID 3300*

If power is above ID3315 and voltage above this value but below ID3320 reactive current set by ID3321 is injected to grid.

*P 2.17.11.6.5 OV High Corner % ID 3320*

If power is above ID3315 and voltage above this value, reactive current set by ID3301 is injected to grid.

*P 2.17.11.6.6 OV LockOut Voltag % ID 3319*

Reactive current injection is stopped if voltage is below this value.

*P 2.17.11.6.7 OVReacRefLowCorn % ID 3321*

Reactive current injected to grid when power is above ID3315 and Line voltage above ID3300 but below ID3320.

*P 2.17.11.6.8 OV Max Reactiv % ID 3301*

Reactive current injected to grid when power is above ID3315 and voltage above ID3320. This level is kept until voltage is below ID3319.

*6.12.7.5 Q(U) Power*

Reactive power reference based on grid voltage

***P2.17.11.4.1 High Max Q Power ID3341***

Maximum reactive power when over voltage is at Max.

***P2.17.11.4.2 High Max Voltage ID3340***

Over voltage level when maximum reactive power is injected to grid.

***P2.17.11.4.3 High Min Voltage ID3339***

Over voltage level when reactive power is started to inject to grid.

***P2.17.11.4.4 Low Max Q Power ID3344***

Maximum reactive power when under voltage is at min.

***P2.17.11.4.5 Low Max Voltage ID3343***

Under voltage level when reactive power is started to inject to grid.

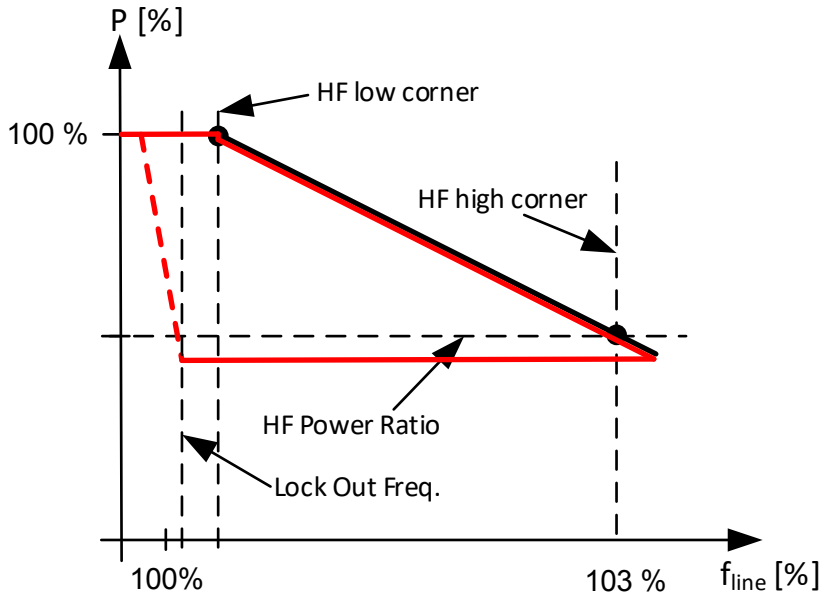
***P2.17.11.4.6 Low Min Voltage ID3342***

Under voltage level when maximum reactive power is injected to grid.

## *6.12.8* Power Limit

### *6.12.8.1 High Frequency Power Limit*

Select power limit behavior on high line frequency.




*P2.17.12.1.1* *HighFreqModes* *ID* *3307*

Parameter select how minimum power limit is handled.

**0 = High Limit**

Power limit will fallow set scaled line.

**1 = Minimum**

Power limit is kept at minum level set by scaled line.

*P2.17.12.1.2* *HighFreqLowCornr* *%* *ID* *3295*

Corner where power limiting is started on high line frequency. There is a 100 ms delay before limiting is started.

*P2.17.12.1.3* *HighFreqPLim Slope* *%/Hz* *ID* *3239*

Slope for power limit. If set to zero, function will use P2.17.12.1.7 High Freq High Corner and P2.17.12.1.8 High Freq Power Ratio. Use this parameter when power is needed to reduced with certain slope. Use P2.17.12.1.7 High Freq High Corner and P2.17.12.1.8 High Freq Power Ratio when power limits needs to be in certain value at certain frequency.

*P2.17.12.1.4* *HighFreqLockOut* *%* *ID* *3308*

Below this limit power limitation is stopped. P2.17.12.1.6 can be used to define delay before power limit is released.

*P2.17.12.1.5 HighFreqPLimRamp %/s ID 3298*

Power limit increase ramp rate.

*P2.17.12.1.6 HighFreqPReleDel ms ID 3299*

Delay how long limit is kept after frequency is below ID3308.

*P2.17.12.1.7 High Line Frequency Full Power Release delay ms ID3374*

When this is activated power is limited for this time to level where power was when High Frequency Low corner was exceeded.

*P2.17.12.1.8 HighFreqHigCornr % ID 3296*

Frequency corner where minimum power limit is used. If power limitation is defiend with slope use P2.17.1.1.3 paramter to define slope.

*P2.17.12.1.9 HighFreqPowRatio % ID 3309*

Power level in relation to actual power when ID3295 was exceeded to be used at ID3296 corner.

*6.12.8.2 High Voltage Power Limit*

***P2.17.12.2.1 Limit Mode ID3360***

Parameter select how minimum power limit is handled.

**0 = High Limit**

Power limit will fallow set scaled line.

**1 = Minimum**

Power limit is kept at minim level set by scaled line.

***P2.17.12.2.2 Log In Voltage [%] ID3325***

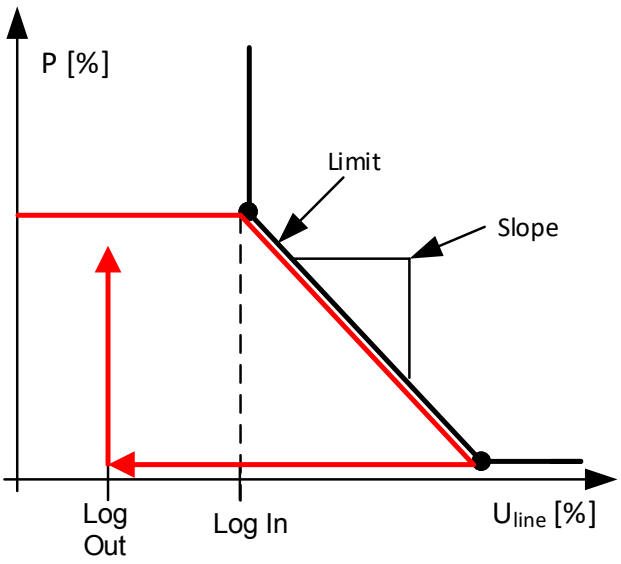
High voltage level when power will be started to limit by the defined slope. Power limit will not increase until voltage has gone below Log Out Voltage Level.

***P2.17.12.2.3 Log Out Voltage [%] ID3326***

Low Voltage Level where power limit is released if line voltage has increased above Log In Voltage Level

***P2.17.12.2.4 Limit Slope [%/%] ID3327***

Defines slope for the power limit when voltage goes above Log In Voltage. Function is disabled when this parameter is zero.



*6.12.8.3 Low Freq Power*

Power increase function when frequency decreases. When activated and frequency goes low, drive will activate Power PI controller and start to increase power.

*P2.17.12.5.1 Power Increase High Frequency ID3334*

Frequency when power is started to increase.

*P2.17.12.5.2 Power Increase Slope ID3335*

Slope how steeply power is increased.

*P2.17.12.5.3 Power Increase Max ID3336*

Limit for increased power.

*6.12.9* Cos Phii Control

***P 2.17.13.1 CosPhiiMode ID3345***

0 = Direct Reference

1 = Volt LogIn LogOut

2 = Act. Current

***P 2.17.13.2 CosPhiiRef ID 3304***

Direct Cos Phii reference. If Lock In and Out is used this function is not active.
1000=unity, 100=min, neg=capacitive

*6.12.9.1 Lock in and out control*

Cos Phii control is used at over voltage situations. Controller is activated when voltage is above Lock In Voltage and Active Current is more than 50 %. 1,0 ref at 50 % power and 0,9 ref at 100 % power.

***P 2.17.13.3.1 LockInVoltage % ID 3305***

Voltage level when Cos Phii control is started.

***P 2.17.13.3.2 LockOutVoltage % ID 3306***

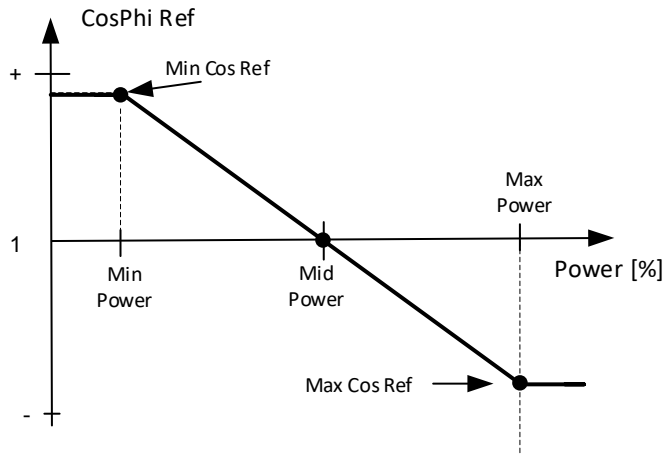
Voltage level when Cos Phii control is stopped.

***P 2.17.13.3.3 Max Cos Ref ID3346***

Cos Phii reference used when power is at 100 %.

### *6.12.9.2 Cos Phii Active Current Control*

Cos Phii reference is started to adjust above 50 % power and reach value set by ID3346 at 100 % Power.




***P2.17.13.4.1 Min Cos Ref Min Power ID3357***
Minimum power where Min Cos Ref is used

***P2.17.13.4.2 Min Cos Ref ID3356***
Cos Phii Reference at Min Power point.

***P2.17.13.4.3 Cos Ref Mid Power ID3358***
Middle power point where Cos Phii Ref is 1,000

***P2.17.13.4.4 Max Cos Ref Max Power ID3359***
Maximum power where Max Cos Ref is used

***P2.17.13.4.5 Max Cos Ref ID3346***
Cos Phii Reference at maximum power point.

### *6.12.10* External Input

External input to make a trip and/or to activate separate frequency limits for tripping.

***P 2.17.14.1 Ext GC Trip In ID 3310***

Direct digital input to activate Grid Code trip function.

***P 2.17.14.2 SeparateFLimMon ID 3311***

Digital input to active more strict frequency trip limits.

***P 2.17.14.3 SepFreqHighLim % ID 3313***

Frequency high limit used to Grid Code trip when digital input defined by ID3311 is active.

***P 2.17.14.4 SepFreqLowLim % ID 3313***

Frequency low limit used to Grid Code trip when digital input defined by ID3311 is active.

### *6.12.11* Grid Code Options

***P 2.17.15.1 Grid Code Options ID 3328***

**B00** = +1 = Activate this bit for Grid Code: GB/T 19964-2012.

**B01** = +2 = For voltage level trips minimum of phase voltages is used.

***P2.17.15.2 Voltage Filt. TC ms 3332***

Filtering time constant for voltage that is used Grid Code monitoring.

***P2.17.15.3 Frequency Filt. TC ms 3333***

Filtering time constant for frequency that is used Grid Code monitoring.

***P2.17.15.4 FRT Options 3400***

***P2.17.15.5 Vac Stop Offset % 3337***

With this is possible to give offset for Grid Code voltage in stop state.

***P2.17.15.6 Vac Run Offset % 3338***

With this is possible to give offset for Grid Code voltage in run state.

***P2.17.15.7 Power Follower Hysteresis ID1529***

Power follower hysteresis.

***P2.17.15.8 Line Voltage High Filt. TC ms 3373***

Filtering time constant for voltage that is used Grid Code monitoring.

## 7. CONTROL

Unlike the parameters listed above, these parameters are located in the **M3** menu of the control panel. The reference parameters do not have an ID number.

*Table 58.Control parameters*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P 3.1 | Control Source | 0 | 1 | | Varies | 1403 | 0=Keypad Cntrl<br>1=External PLC<br>2=Systembus |

Parameters and descriptions

***P 3.1 Control Source*** ***ID 1403***

0=Keypad Cntrl

1=External PLC
2=SystemBus

# 8. FIELDBUS INTERFACE

## IDs for 32bit Monitoring Values

Some monitoring values are 32bit in length and as such their fieldbus monitoring may not work properly. Here is a list of High and Low Words of these 32bit monitoring values so that external system can read them as 2 16bit words.

*Table 59. High & Low Words of 32bit Monitoring Values*

| Values | Unit | ID | Description |
|---|---|---|---|
| Total Energy Produced | kWh | High: 1803<br>Low: 1804 | Total energy of inverter fed into the grid. |
| Total Run Time | h | High: 1862<br>Low: 1863 | Total time the inverter has been running. |
| Grid Connections | | High: 1864<br>Low: 1865 | Total number of times the inverter has closed the main contactor and connected to the grid. |
| Day Energy Produced | kwh | High: 1866<br>Low: 1867 | Day energy of inverter fed into the grid. |
| Last Day Energy Produced | kwh | High: 1868<br>Low: 1869 | Last day energy of inverter fed into the grid. |

## 8.1 Control Word

*Table 60. Fieldbus interface Control data*

| Name | Type | Unit | Address | Description |
|---|---|---|---|---|
| Control Word | WORD | | 2001 | Check the next table |

*Control Word*

*Table 61. Fieldbus Control word bits*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Start Command | | Start | Permission for the inverter to start, if all other criteria are ok. |
| 1 | Reserved | | | |
| 2 | Fault Reset | - | Fault Reset | |
| 3 | Reserved | | | |
| 4 | Reserved | | | |
| 5 | Reserved | | | |
| 6 | Reserved | | | |
| 7 | Reserved | | | |
| 8 | Master | | Master | |
| 9 | Reserved | | | |
| 10 | Reserved | | | |
| 11 | Reserved | | | |
| 12 | Reserved | | | |
| 13 | Reactive Current / PF Reference selection | Process Data In which target ID is 1480 is used as Reactive Current Reference | Process Data In which target ID is 1480 is used as Power Factor Reference | Selection bit to indicate is the data from Fieldbus meant to be Reactive Current Reference or Power Factor Reference |
| 14 | Force Start | - | Forces the start of the inverter regardless of DC Voltage Level | Can be used in Commissioning and Maintenance when the inverter is wanted to start regardless the DC Voltage Level |
| 15 | Reserved | | | |

## 8.2 Status Words

*Table 62. Fieldbus interface status data*

| Name | Type | Unit | Address | Description |
|---|---|---|---|---|
| Status Word | WORD | | 2102 | Check the next table. |

*Status Word*

*Table 63. Fieldbus status word bits*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Ready Status | Not Ready | Ready | Not only if Inverter control is ready, but if all "Ready Criterions" are also fulfilled |
| 1 | Activation Status | Stopped | Activated | See Chapter 9.1<br>When active, the inverter can be in either in Standby or Inverter Running mode. |
| 2 | Reserved | | | |
| 3 | Fault Status | No Fault | Fault | Fault(s) active |
| 4 | Alarm Status | No Alarm | Alarm | Warning(s) active |
| 5 | Standby Status | | Standby | See Chapter 9.1 |
| 6 | Reserved | | | |
| 7 | Inverter Running Status | - | Inverter Running | See Chapter 9.1 |
| 8 | Master | | Master | |
| 9 | Heartbeat bit | | | The inverter toggles this bit on and off. 1s on, 1s off. |
| 10 | ChargeSwState | | Charged | |
| 11 | Reserved | | | |
| 12 | Reserved | | | |
| 13 | Reserved | | | |
| 14 | Reserved | | | |
| 15 | Reserved | | | |

## 8.3 Warning Status words

*Statusword 1, ID1819*

*Table 64. Warnings status word 1*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Main Switch Open Fault | No Fault | Fault | See Fault list 64 |
| 1 | Main Switch Open Warning | No Alarm | Alarm | See Fault list 64 |
| 2 | AC Voltage Max Fault | No Fault | Fault | See Fault list 72 |
| 3 | AC Voltage Min Fault | No Fault | Fault | See Fault list 73 |
| 4 | AC Freg Max Fault | No Fault | Fault | See Fault list 74 |
| 5 | AC Freg Min Fault | No Fault | Fault | See Fault list 75 |
| 6 | DC Ground Warning | No Alarm | Alarm | See Fault list 76 |
| 7 | DC Ground Fault | No Fault | Fault | See Fault list 77 |
| 8 | Surge Alarm | No Alarm | Alarm | See Fault list 83 |
| 9 | FB Heardbeat timeout | No Fault | Fault | See Fault list 85 |
| 10 | Input Switch Alarm | No Alarm | Alarm | See Fault list 86 |
| 11 | Emergency Switch | No Fault | Fault | See Fault list 95 |
| 12 | UnBalance | No Fault | Fault | See Fault list 18 |
| 13 | Thermistor Fault | No Fault | Fault | See Fault list 29 |
| 14 | Safe Disable | No Fault | Fault | |
| 15 | Reserved | | | |

*Statusword 2, ID1820*

*Table 65. Warnings status word 2*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Overvoltage | No Fault | Fault | See Fault list 2 |
| 1 | Earth Fault | No Fault | Fault | See Fault list 3 |
| 2 | Inverter Fault | No Fault | Fault | See Fault list 4 |
| 3 | Charge Switch Fault | No Fault | Fault | See Fault list 5 |
| 4 | Saturation | No Fault | Fault | See Fault list 7 |
| 5 | Unknown Fault | No Fault | Fault | See Fault list 8 |
| 6 | Undervoltage | No Fault | Fault | See Fault list 9 |
| 7 | Input Phase Fault | No Fault | Fault | See Fault list 10 |
| 8 | Input Phase Warning | No Alarm | Alarm | See Fault list 10 |
| 9 | Supply Phase Loss | No Fault | Fault | See Fault list 11 |
| 10 | Supply Phase Warning | No Alarm | Alarm | See Fault list 11 |
| 11 | Over Temperature | No Fault | Fault | See Fault list 14 |
| 12 | Over Temperature Warning | No Alarm | Alarm | See Fault list 14 |
| 13 | Undertemp | No Fault | Fault | See Fault list 13 |
| 14 | Temperature Power limit warning | No Alarm | Alarm | See Fault list 97 |
| 15 | OverCurrent | No Fault | Fault | See Fault list 1 |

*Statusword 3, ID1821*

*Table 66. Warnings status word 3*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | Processor Watchdog | No Fault | Fault | See Fault list 25 |
| 1 | Reserved | | | |
| 2 | IGBT HW Temp | No Fault | Fault | See Fault list 31 |
| 3 | Cooling Fan | No Fault | Fault | See Fault list 32 |
| 4 | Application Fault | No Fault | Fault | See Fault list 35 |
| 5 | Control Unit Fault | No Fault | Fault | See Fault list 36 |
| 6 | Device Changed | No Fault | Fault | See Fault list 37 |
| 7 | Device Added | No Fault | Fault | See Fault list 38 |
| 8 | Device Moved | No Fault | Fault | See Fault list 39 |
| 9 | Device Unknown | No Fault | Fault | See Fault list 40 |
| 10 | Device Changed | No Fault | Fault | See Fault list 44 |
| 11 | Device Added | No Fault | Fault | See Fault list 45 |
| 12 | EEprom Checksum fault | No Fault | Fault | See Fault list 22 |
| 13 | Counter Fault | No Fault | Fault | See Fault list 24 |
| 14 | Reserved | | | |
| 15 | Reserved | | | |

*Statusword 4, ID1822*

*Table 67. Warnings status word 4*

| Bit | Name | Value = 0 | Value = 1 | Description |
|---|---|---|---|---|
| 0 | IGBT Temperature | No Fault | Fault | See Fault list 41 |
| 1 | EEPROM Fault | No Fault | Fault | See Fault list 48 |
| 2 | Zero Divice Fault | No Fault | Fault | See Fault list 49 |
| 3 | External Fault Active | No Fault | Fault | See Fault list 51 |
| 4 | External Warning Active | No Alarm | Alarm | See Fault list 51 |
| 5 | Reserved | | | |
| 6 | Fieldbus Communication | No Fault | Fault | See Fault list 53 |
| 7 | Slot Communication | No Fault | Fault | See Fault list 54 |
| 8 | System bus Master Heartbeat Trip active | No Fault | Fault | See Fault list 59 |
| 9 | System bus Communication Fault Trip Active | No Fault | Fault | See Fault list 55 |
| 10 | LCL OverTemp Fault Active | No Fault | Fault | See Fault list 70 |
| 11 | LCL OverTemp Warning Active | No Alarm | Alarm | See Fault list 70 |
| 12 | User Defined Temperature Limit Exceeded | No Alarm | Alarm | See Fault list 99 |
| 13 | Analog Input <4mA Fault | No Fault | Fault | See Fault list 50 |
| 14 | Analog Input <4mA Alarm | No Alarm | Alarm | See Fault list 50 |
| 15 | Reserved | | | |

## 8.4 Monitoring values for Fieldbus use

*Table 68. Monitoring values for Fieldbus use*

| Values | Min | Max | Unit | ID | Description |
|---|---|---|---|---|---|
| Energy yesterday (high word) | | | | 1640 | |
| Energy yesterday (low word) | | | | 1641 | |
| DC Start Level | | | V | 1642 | |
| Run Time Yesterday | | | h | 1643 | |
| Grid Connections (High Word) | | | - | 1644 | |
| Grid Connections (Low Word) | | | - | 1645 | |
| Unit temperature | | | °C | 1646 | |
| Runtime Today | | | h | 1647 | |
| Total Runtime (High Word) | | | h | 1648 | |
| Total Runtime (Low Word) | | | h | 1649 | |
| Calibrated DC Voltage | | | V | 1650 | |
| AC Voltage | | | V | 1651 | |
| AC Frequency | | | Hz | 1652 | |
| Output Power | | | kW | 1653 | |
| Output Power | | | % | 1654 | |
| Output Current | | | A | 1655 | |
| Used Q/Cos Phi reference | | | %/- | 1656 | |
| Fault Code + Subcode | | | - | 1657 | |
| Energy today (high word) | | | kWh | 1658 | |
| Energy today (low word) | | | kWh | 1659 | |
| Total Energy (High word) | | | kWh | 1660 | |
| Total Energy (Low word) | | | kWh | 1661 | |
| Status Word 1 | | | - | 1662 | |
| Status Word 2 | | | - | 1663 | |
| Status Word 3 | | | - | 1664 | |
| Status Word 4 | | | - | 1665 | |

# 9. PROBLEM SOLVING

While proper information is needed form the problem, it is also recommended to try with latest application- and system software versions available. Software is continuously developed and default settings are improved.

| Type | Signal Name | Actual | Unit |
|---|---|---|---|
| Value | Supply Frequency | 0 | Hz |
| Value | Supply Voltage | 0 | V |
| Value | DC-link Voltage | 564 | V |
| Value | Active Current | 0 | % |
| Value | Reactive Current | 0 | % |
| Value | Line State | 32972 | |
| Value | Status Word | 1283 | |
| Value | DINStatusWord 1 | 0 | |

*Picture 19. The recommended signals for NCDrive*

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

For the CAN communication, use a 1 Mbit communication speed and a 10 ms update interval for signals.

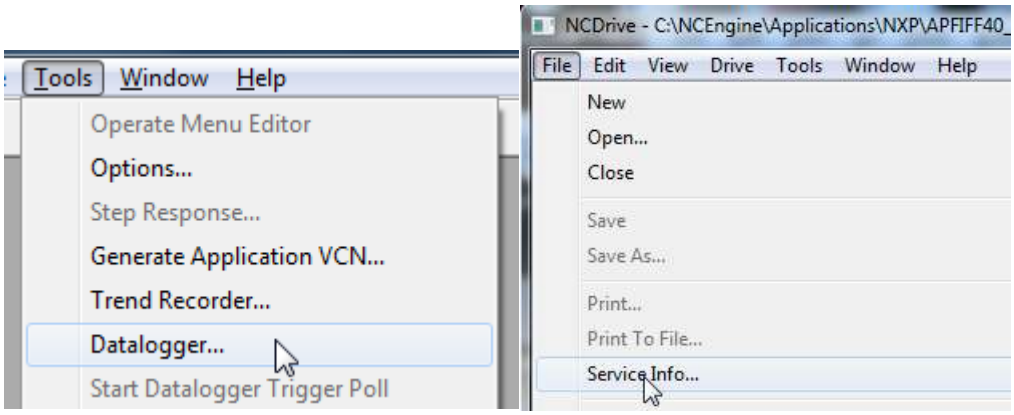
Use original vcn-file instead of generic vcn-file when uploading parameters. Then every application values will update correct to monitor window.

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

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

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

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




*Picture 20. Datalogger window opening and Service Info upload.*

# 10. APPLICATION FAULT CODES

Fault tables and descriptions of faults. Main reasons what possible causes fault

| Fault code | Fault | Possible cause | Correcting measures | Auto Reset |
|---|---|---|---|---|
| 1 | Overcurrent | AFE has detected too high a current (>4* $I_H$) in the cables: | | X |
| 2 | Overvoltage | The DC-link voltage has exceeded the inverter limit. See User manual.<br>- high overvoltage spikes in supply | - Check DC voltage | X |
| 3 | Earth fault | Current measurement has detected that the sum of phase currents is not zero.<br>- insulation failure in cables | - Check cables. | --- |
| 4 | Inverter fault | | | --- |
| 5 | Charging switch | The charging switch is open, when the START command has been given.<br>– faulty operation<br>– component failure | - Reset the fault and restart.<br>- Should the fault re-occur, contact your local distributor. | --- |
| 7 | Saturation trip | Various causes:<br>– defective component | - Cannot be reset from the keypad.<br>- Switch off power.<br>- DO NOT RE-CONNECT POWER!<br>- Contact your local distributor. | --- |
| 8 | System fault | - component failure<br>- faulty operation<br>Note exceptional fault data record Subcode in **T.14:**<br>S1 = Reserved<br>S2 = Reserved<br>S3 = Reserved<br>S4 = Reserved<br>S5 = Reserved<br>S6 = Reserved<br>S7 = Charging switch<br>S8 = No power to driver card<br>S9 = Power unit communication (TX)<br>S10 = Power unit communication (Trip)<br>S11 = Power unit comm. (Measurement) | Reset the fault and restart.<br>Should the fault re-occur, contact your local distributor. | --- |
| 9 | Undervoltage | DC-link voltage is under the inverter fault voltage limit. See user manual.<br>– most probable cause: too low a supply voltage<br>– Inverter internal fault<br>– One of input fuse is broken. | - In case of temporary supply voltage break, reset the fault and restart the inverter<br>- Check the supply voltage.<br>- If it is adequate, an internal failure has occurred.<br>- Check input fuses<br>- Check DC charge function | --- |

| Fault code | Fault | Possible cause | Correcting measures | Auto Reset |
|---|---|---|---|---|
| 10 | *Line Sync Fail* | Output line phase is missing.<br>Subcode in **T.14:**<br>S1 = Phase supervision diode supply | Check supply voltage, fuses and cable. | X |

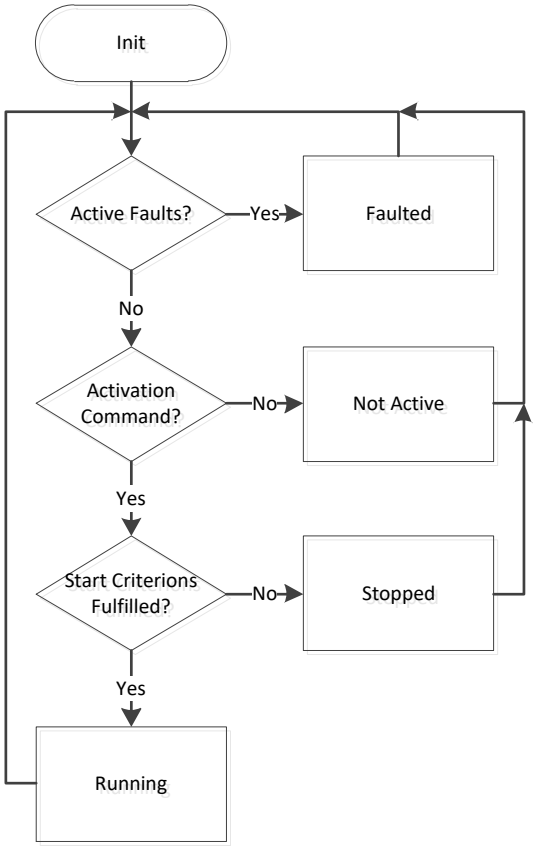
| | | | | |
|---|---|---|---|---|
| | | S2 = Phase supervision active front end | | |
| 11 | Output phase supervision | Output line phase is missing. | Check supply voltage, fuses and cable. | --- |
| 13 | Inverter under-temperature | Heatsink temperature is under –10°C | | --- |
| 14 | Inverter over-temperature | 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.<br>- Check the heatsink for dust.<br>- Check the ambient temperature. | --- |
| 18 | Unbalance (Warning only) | Unbalance between power modules in paralleled units.<br>Subcode in **T.14:**<br>S1 = Current unbalance<br>S2 = DC-Voltage unbalance | Should the fault re-occur, contact your local distributor. | --- |
| 22 | EEPROM checksum fault | Parameter save fault<br>– faulty operation<br>– component failure | Should the fault re-occur, contact your local distributor. | --- |
| 24 | Counter fault | Values displayed on counters are incorrect | Have a critical attitude towards values shown on counters. | --- |
| 25 | Microprocessor watchdog fault | – faulty operation<br>– component failure | Reset the fault and restart.<br>Should the fault re-occur, contact your local distributor. | --- |
| 26 | Start-up prevented | - Start-up of the inverter has been prevented.<br>- Run request is ON when new application is loaded to inverter | - Cancel prevention of start-up if this can be done safely.<br>- Remove Run Request. | --- |
| 29 | Thermistor fault | The thermistor input of option board has detected too high temperature | Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited) | --- |
| 31 | IGBT temperature (hardware) | IGBT Inverter Bridge over temperature protection has detected too high a short term overload current | - Check loading. | X |
| 32 | Fan cooling | Cooling fan of the inverter does not start, when ON command is given | Contact your local distributor. | --- |
| 35 | Application | Problem in application software | Contact your distributor. If you are application programmer check the application program. | --- |
| 36 | Control unit | NXS Control Unit cannot control NXP Power Unit and vice versa | Change control unit | --- |
| 37 | Device changed (same type) | Option board or power unit changed. New device of same type and rating. | Reset. Device is ready for use. Old parameter settings will be used. | --- |
| **Fault code** | **Fault** | **Possible cause** | **Correcting measures** | **Auto Reset** |
| 38 | Device added (same type) | Option board added. | Reset. Device is ready for use. Old board settings will be used. | --- |
| 39 | Device removed | Option board removed. | Reset. Device no longer available. | --- |
| 40 | Device unknown | Unknown option board or inverter.<br>Subcode in **T.14:**<br>S1 = Unknown device<br>S2 = Power1 not same type as Power2 | Contact the distributor near to you. | --- |

| | | | | |
|---|---|---|---|---|
| 41 | IGBT temperature | IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current | - Check loading. | X |
| 44 | Device changed (different type) | Option board or power unit changed. New device of different type or different rating than the previous one. | Reset<br>Set the option board parameters again if option bard changed. Set inverter parameters again if power unit changed. | --- |
| 45 | Device added (different type) | Option board of different type added. | Reset<br>Set the option board parameters again. | --- |
| 48 | Parameter Fault | Parameter Fault | Check parameters value | --- |
| 49 | Division by zero in application | Division by zero has occurred in application program | Contact your distributor if the fault re-occurs while the inverter is in run state. If you are application programmer check the application program. | --- |
| 50 | Analog Input Fault | Analog Input has been set to work between 4-20mA or 2-10V and the signal has dropped below tripping limit.<br><br>Subcode gives more info which signal(s) has been lost:<br>- bit0 (+1): Power Limit<br>- bit1 (+2): AC Voltage<br>- bit2 (+4): Digital Input 1<br>- bit3 (+8): Digital Input 2<br>- bit4 (+16): DC Ground | - Check the wiring<br>- Check for loose connections<br>- Check the current / voltage source | --- |
| 51 | External Trip | Trip signal from digital input. | Remove fault situation from external device. | X |
| 53 | Fieldbus Board | A Fieldbus card in slot D or E has status "Faulted" | Check installation.<br>If installation is correct contact the nearest distributor. | --- |
| 54 | Slot Communication | A option board in slot B,C,D or E has status "Communication Lost" | Check board and slot.<br>Contact the nearest Vacon distributor. | --- |
| 55 | SB Board Fault | A systembus card in slot D or E has status "Faulted" | Check the System bus Board | --- |
| 59 | SB Heartbeat | An inverter is activated as a slave inverter in array configuration without a heartbeat signal on the bus, Hence, no master inverter active. | Check the System bus | --- |
| **Fault code** | **Fault** | **Possible cause** | **Correcting measures** | **Auto Reset** |
| 64 | MCC Fault | Contactor acknowledgment is used through digital input and close command is given without response within the time set with parameter "MCont FaultDelay" | Check the main power switch of the<br>Inverter and Acknowledge input. | --- |
| 70 | LCL Temperature | LCL Overtemp trip from digital input. | Check the LCL filter and signal connection. Check fan | --- |
| 72 | AC VoltMax Trip | AC voltage on line side is above the max limit. | Check AC Voltage | Delayed |
| 73 | AC VoltMin Trip | AC voltage on line side is below the min limit. | Check AC Voltage | Delayed |
| 74 | FreqOverLimit | AC frequency on line side is above the max limit. | Check AC Frequency | Delayed |

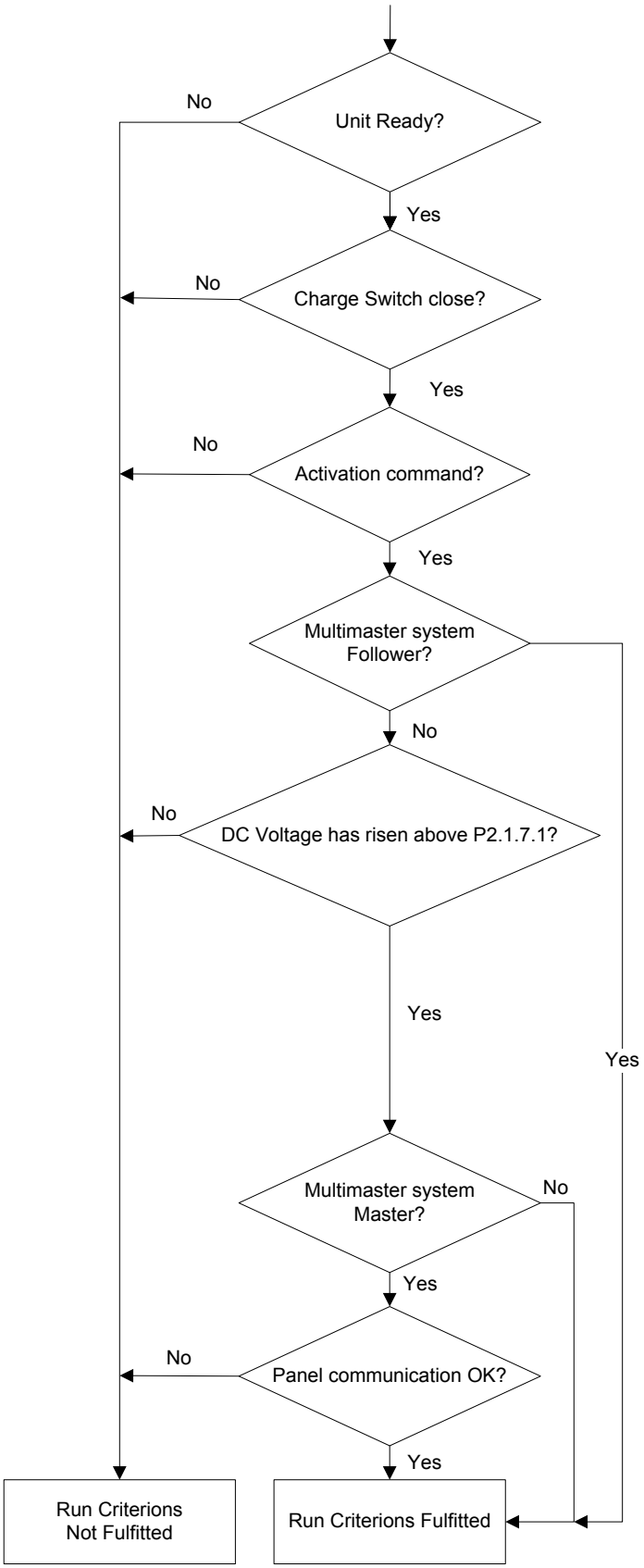
| | | | | |
|---|---|---|---|---|
| 75 | FreqUnderLimit | AC frequency on line side is below the min limit. | Check AC Frequency | Delayed |
| 76 | DC Ground Warning | DC Insulation measurement signal has gone above the warning limit. | Check DC Insulation | --- |
| 77 | DC Ground Fault | DC Insulation measurement signal has gone above the fault limit. | Check DC Insulation | Delayed |
| 78 | DC Overvoltage (only warning) | DC voltage level is over overvoltage ref max | | |
| 83 | Surge Alarm | Surge alarm from digital input. | Remove fault situation from external device. | --- |
| 85 | Fieldbus | Heartbeat signal from touchpad panel is missing while running in array configuration.<br>Warning = inverter not active<br>Fault = inverter active | Check touchpad panel. Check the control place | Delayed |
| 86 | Input Switch | Input Switch in wrong state | Check the input Switch | --- |
| 87 | Emergency Switching | Command for emergency stop received from digital input. | New run command is accepted after reset. | |
| 95 | Gridcode fault | Grid Code tripping limit has been reached.<br>A1 :Invalid grid code license<br>A2: Line Voltage High Level 1<br>A3: Line Voltage High Level 2<br>A4: Line Voltage Low Level 1<br>A5: Line Voltage Low Level 2<br>A6: Line Frequency High Level 1<br>A7: Line Frequency High Level 2<br>A8: Line Frequency Low Level 1<br>A9: Line Frequency Low Level 2<br>A10: LVRT Three Phase trip.<br>A11: LVRT Bi-Phase trip<br>A12: Separated limits or forced trip<br>A13: Line Frequency change rate trip.<br>A14: 10 min average trip<br>A15: Line Voltage High Level 3<br>A16: Line Voltage Low Level 3<br>A17: Line Frequency High Level 3<br>A18: Line Frequency Low Level 3 | Check grid code parameters<br><br>A2: IDs 3256 and 3257<br>A3: IDs 3258 and 3259<br>A4: IDs 3260 and 3261<br>A5: IDs 3262 and 3263<br>A6: IDs 3264 and 3265<br>A7: IDs 3266 and 3267<br>A8: IDs 3268 and 3269<br>A9: IDs 3270 and 3271<br>A10: IDs 3272-3285<br>A11: IDs 3272-3285<br>A12: IDs 3310-3313<br>A13: ID 3322<br>A14: ID 3353<br>A15: IDs 3361 and 3362<br>A16: IDs 3365 and 3366<br>A17: IDs 3368 and 3369<br>A18: IDs 3370 and 3371 | --- |
| 97 | Power Limit Warning | Power is limited by temperature. Temperature is over 75degrees | Check Cooling systems. | --- |
| 99 | TemperaRising (Only Warning) | Temperature has risen above user defined temperature warning level ID 1853 | Check air circulation of the drive | --- |

# 11. STATE MACHINE:

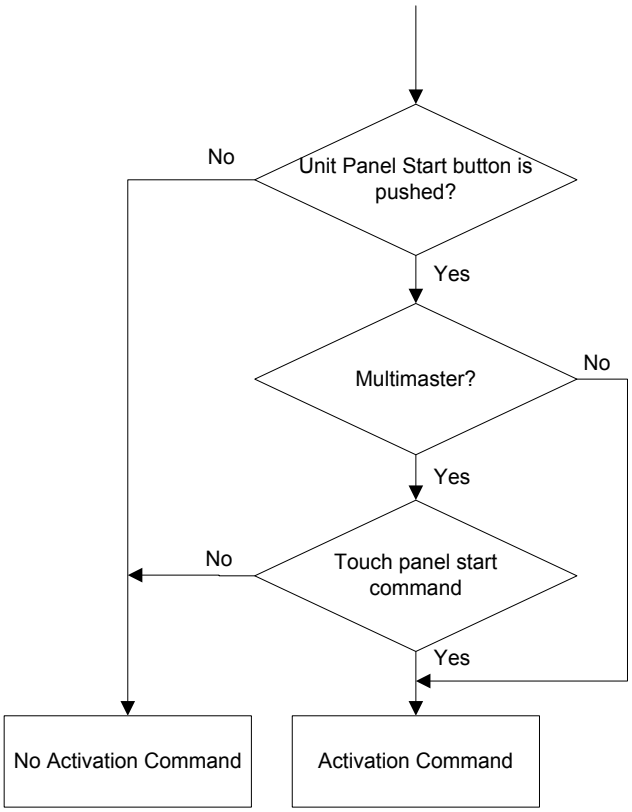
## 11.1 General state machine:



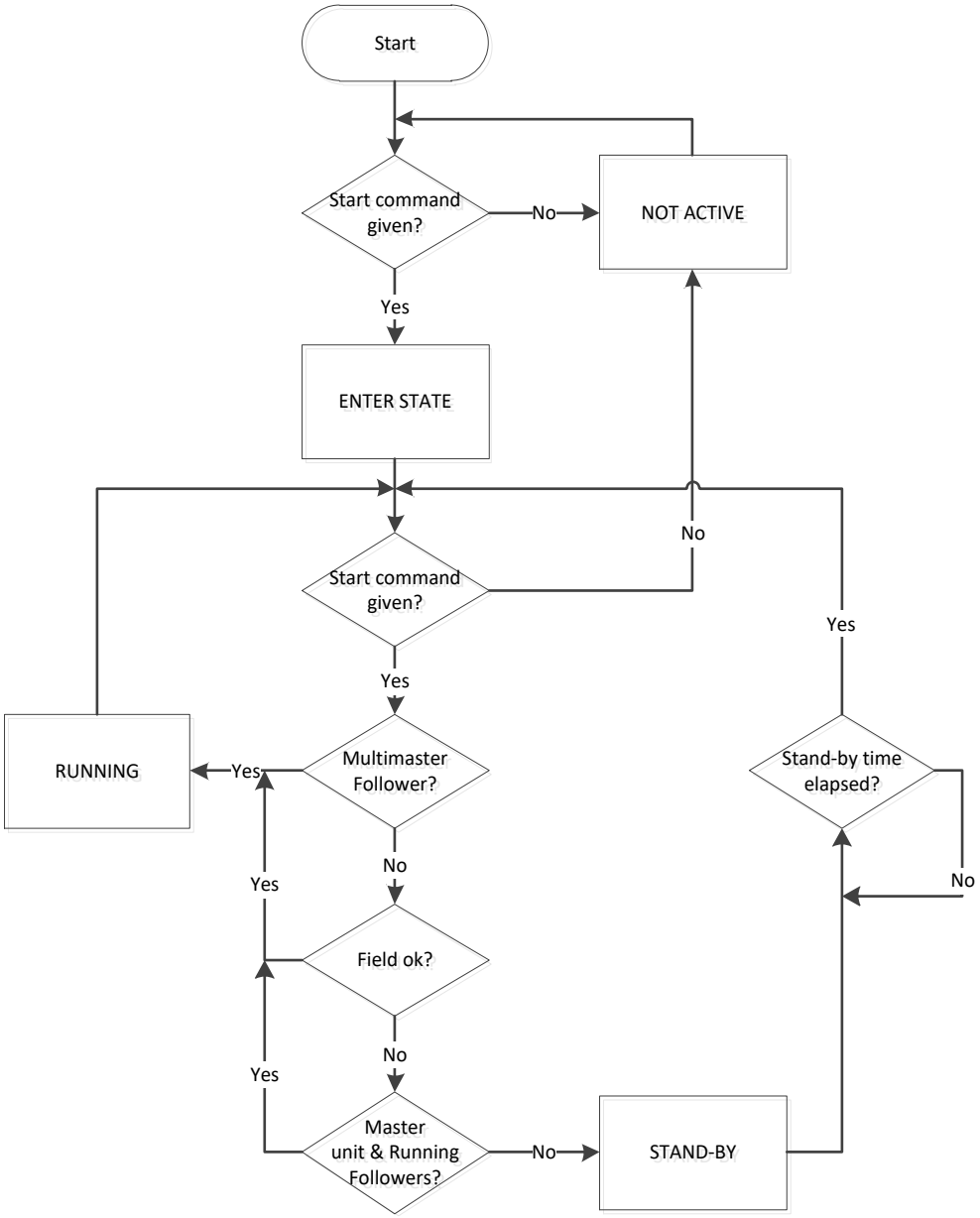
### *11.1.1* Start Criterions:



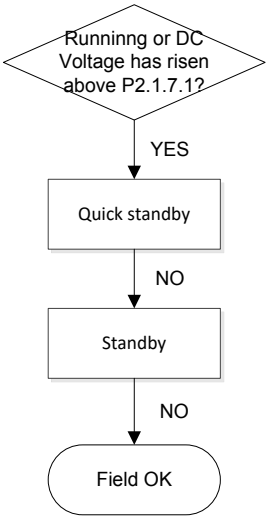
*11.1.2* Activation command:



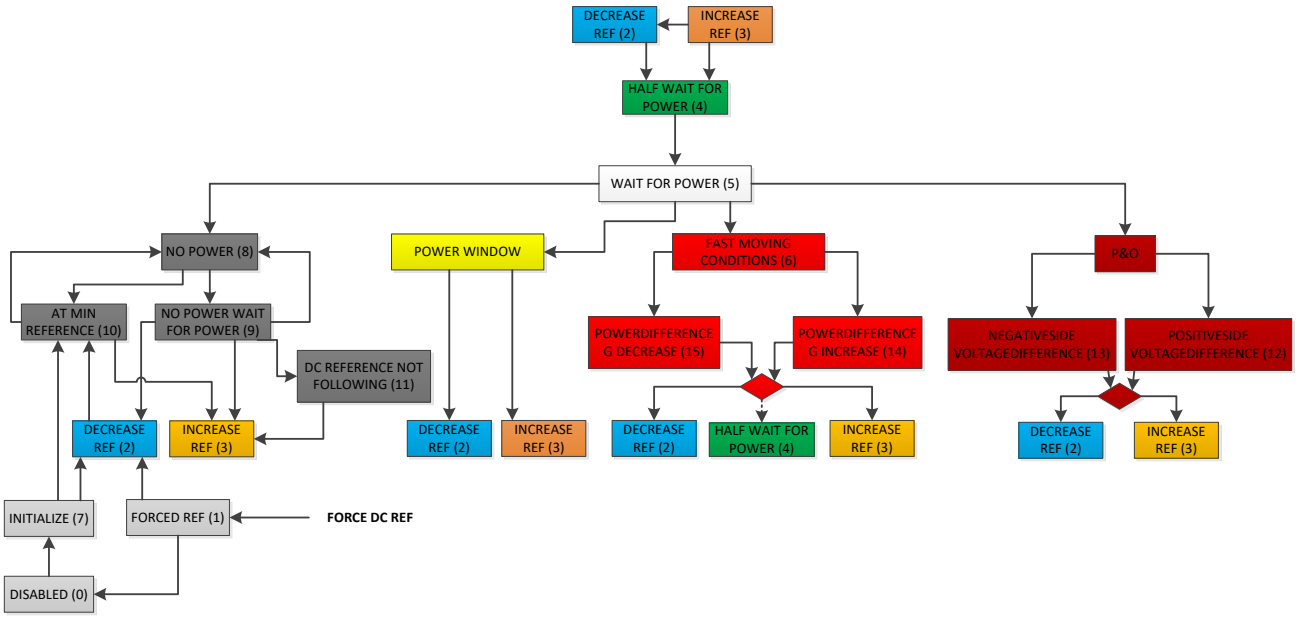
## 11.2 General Substate Machine




### *11.2.1* Field OK



## 11.3 MPPT State:

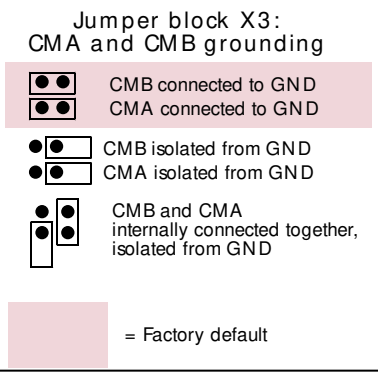


# 12. IO-CONNECTIONS

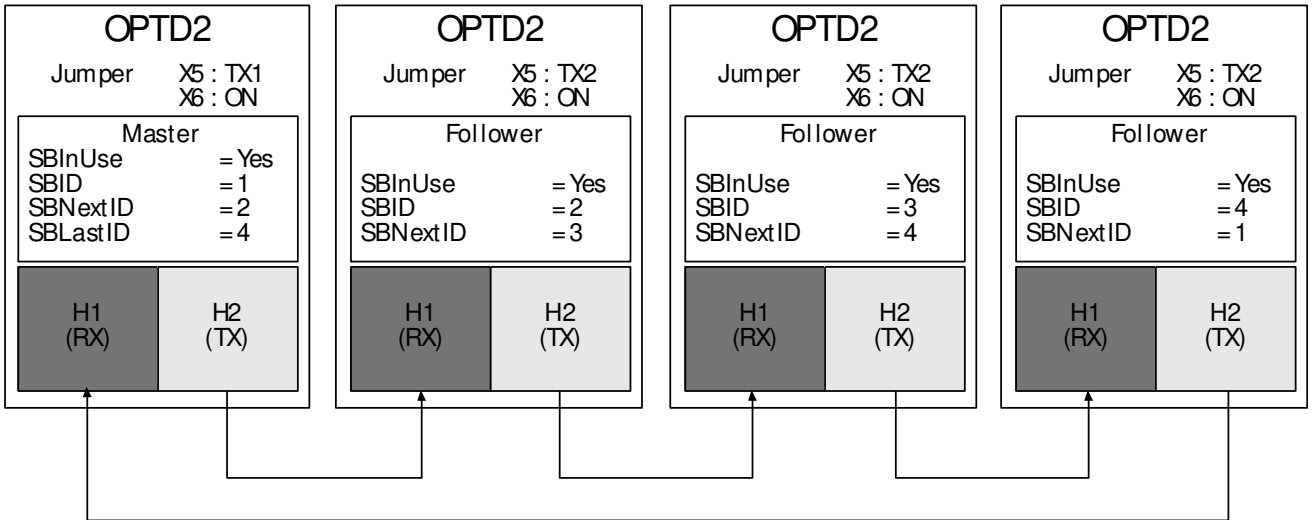
| OPTA1 | | | |
|---|---|---|---|
| Terminal | | Signal | Description |
| 1 | +10V$_{ref}$ | Reference output | Voltage for potentiometer, etc. |
| 2 | AI1+ | DC Ground Analogue input, voltage range 0—10V DC | Voltage input DC Ground |
| 3 | AI1- | I/O Ground | Ground for reference and controls |
| 4 | AI2+ | AC Measurement range 0—10V DC | Current input AC Measurement |
| 5 | AI2- | | |
| 6 | +24V | Control voltage output | Voltage for switches, etc. max 0.1 A |
| 7 | GND | I/O ground | Ground for reference and controls |
| 8 | DIN1 | External trip (programmable) | Normal closed = external trip |
| 9 | DIN2 | Surge alarm (programmable) | Normal closed = Surge alarm |
| 10 | DIN3 | Filter over temperature (programmable) | Contact open = Filter over temperature<br>Contact closed = No fault |
| 11 | CMA | Common for DIN 1—DIN 3 | Connect to GND or +24V |
| 12 | +24V | Control voltage output | Voltage for switches (see #6) |
| 13 | GND | I/O ground | Ground for reference and controls |
| 14 | DIN4 | Main contactor acknowledge (programmable) | Contact closed = Main contactor closed |
| 15 | DIN5 | DC Ground trip (programmable) | Normal closed= DC Ground trip |
| 16 | DIN6 | Emergency switching off (programmable) | Normal Close = Emergency switching |
| 17 | CMB | Common for DIN4—DIN6 | Connect to GND or +24V |
| 18 | AO1+ | Analogue output | Set the ID ID no. Of a signal to be connected to AO1<br>Programmable<br>Range 0—20 mA/$R_L$, max. 500Ω |
| 19 | AO1- | | |
| 20 | DO1 | Digital output<br>External Fan | Programmable<br>Open collector, I≤50mA, U≤48 VDC |
| **OPTA2** | | | |
| 21 | RO1 | Relay output 1<br>DC supply ready | Programmable |
| 22 | RO1 | | |
| 23 | RO1 | | |
| 24 | RO2 | Relay output 2<br>Main contactor control | Non-Programmable |
| 25 | RO2 | | |
| 26 | RO2 | | |

12.1 Appendix

**Note:** See jumper selections below. More information can be found in Vacon NX Option Board Manual, Chapter 6.2.2.2.




The OPTD2 board in the Master has default jumper selections, i.e. X6:1-2, X5:1-2. For the followers, the jumper positions have to be changed: X6:1-2, X5:2-3. This board also has a CAN communication option that is useful for multiple Inverter monitoring with NCDrive PC software when commissioning Master Follower functions or line systems.



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Document ID:
DPD02125A
Rev. A

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