WATT &WELL

CONVERTING POWER INTO CONFIDENCE

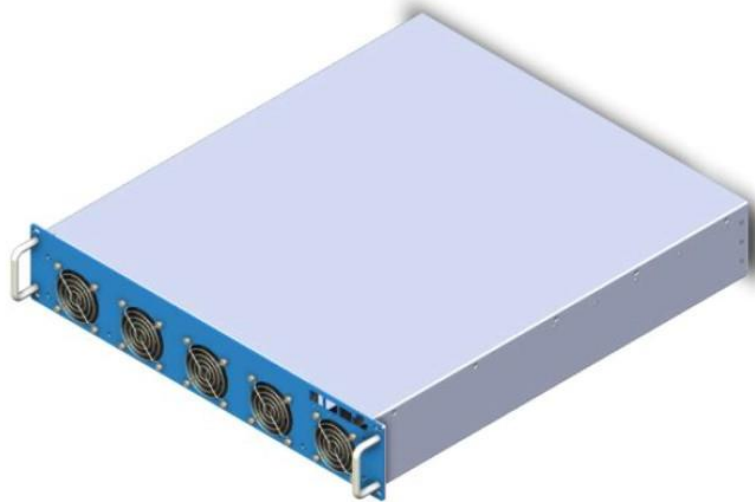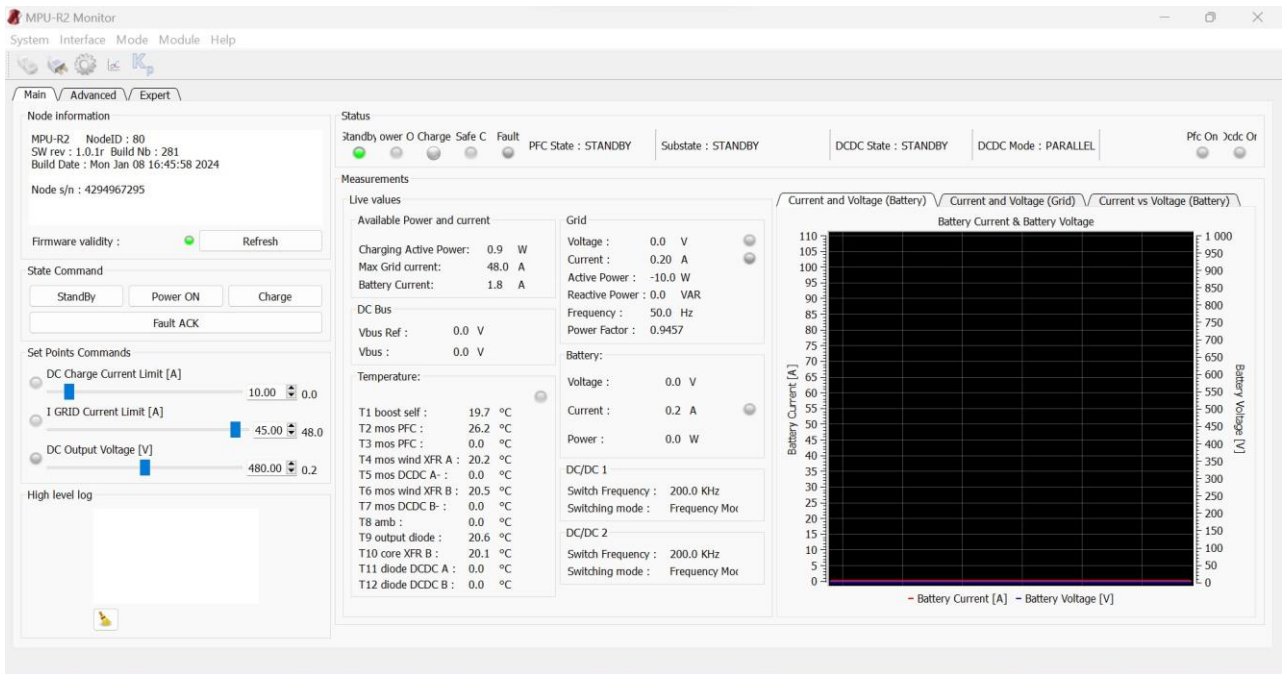| **REFERENCE**	Modular Power Unit R2 – GUI User guide

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IMPORTANT INFORMATION

Warranty – this manual

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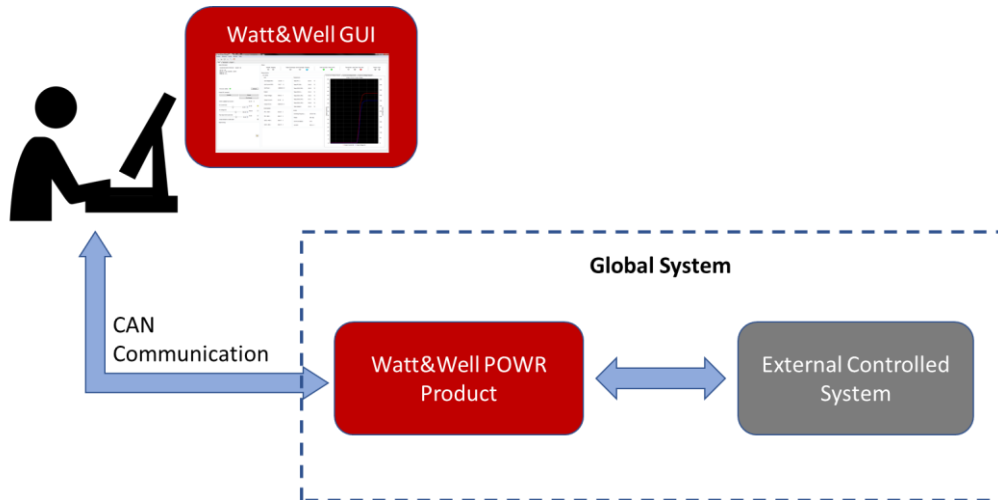# Glossary

CAN: Controller Area Network
FW: Firmware
GUI: Graphical User Interface
MPU R2: Modular Power Unit R2
W&W: Watt & Well

Description

This document describes the MPU-R2 GUI application. The application is used to control, monitor, and configure the MPU-R2 product from a user's Windows computer and via a CAN communication (a USB to CAN transceiver is used).

Requirements

- Computer with Windows7 operating system or later.
- The last MPU-R2 Monitor version provided by W&W, the package must contain:
  - The executable file of the GUI, e.g.: "MPU-R2_Monitor_protected.exe"
  - The several library files needed by the GUI
  - The "DataDefinition.xml" file that describes all the objects dictionary required by the CANopen protocol and the FW application of the MPU-R2 product.
- NI CAN transceiver, the transceiver's drivers must be installed on your computer. The compatible USB to CAN transceivers is:
  - Kvaser Light Leaf, High Speed USB CAN interface (W&W uses this one by default)
  - Kvaser U100
  - Kvaser Leaf

Physical CAN network with 2 termination resistors of 120 Ω each. The smallest CAN network is composed of 2 nodes: the MPU-R2 GUI node and the MPU-R2 Product node:
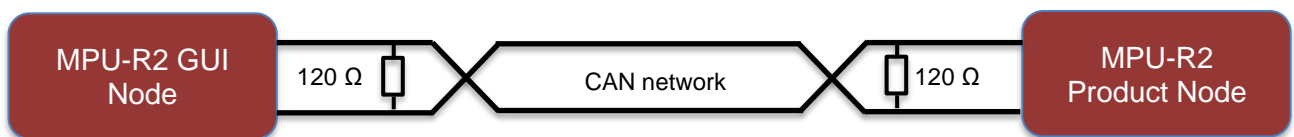
1. Overview

1.1. Communication

The MPU-R2 GUI application integrates the CANopen protocol, it's an application layer based on the CAN communication. In the CAN network, the MPU-R2 GUI is considered as a CAN node.

The MPU-R2 GUI can read and write the several data of the MPU-R2 product's object dictionary using the provided communication objects of the CANopen protocol (SDO, PDO …).

1.2. Features

The MPU-R2 GUI developed by W&W integrates the features below:

- The GUI Main Window, it's composed from 3 tabs:
  - *The Main tab*: it provides access to the MPU-R2 product's information, commands, system status and the main measurements.
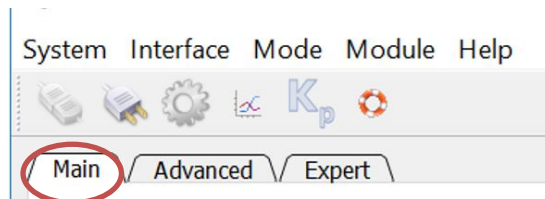
Figure 1 Main tab

  - *The Advanced tab*: it provides access to MPU-R2 product's advanced settings (critical measurements calibration parameters) and some internal measurements.
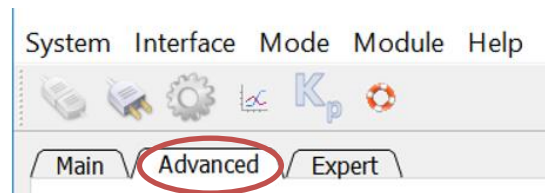
Figure tab

  - *The Expert tab*: it provides access to the MPU-R2 product's Real-Time diagnostics and the fault sensitivity selection

Figure 2: Expert tab

- The Communication Configuration window: it's used to set the CAN communication properties.
- The Device Manager window: it provides access to the complete object dictionary; the user can read and write the several data depending on the access type of the object.

- The Virtual Scope window: it provides the ability to log and display the fast measurements and/or the internal computed variables of the MPU-R2 FW application. The user can select one or many of the proposed variables to log and display for monitoring purpose.
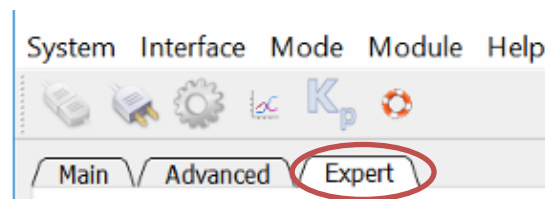
1.3. Operating modes

The MPU-R2 GUI contains two operating modes, the standard mode (default mode) and the expert mode. The expert mode is reserved to the qualified persons that can change the MPU-R2 product configuration (product CAN address, regulation parameters, the thresholds of protections, the faults' sensitivity …), this mode is protected by a password. The accessible features in each mode are:

- In the standard mode: the main and advanced tabs of the Main window (with limited commands and measurements) and the Communication Configuration window
- In the expert mode: all the features

The selection of the operating mode can be done manually or by requesting a tool protected by the expert mode:
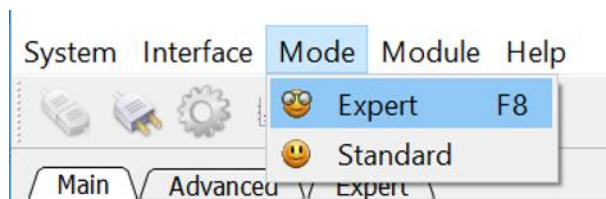

Figure 3: Operating mode selection

If the expert mode is the requested mode, a password dialog box will request the user to provide the correct password:
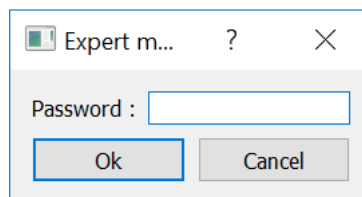

Figure 4: Password dialog box

If the provided password is the correct one, the features protected by the expert mode are unlocked. And they still locked if it's not correct.

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2. Using the MPU-R2 GUI

In this part we assume that the MPU-R2 product is powered up and is connected to the user computer using the compatible CAN transceiver.

2.1. Opening, connecting, and configuring the MPU-R2 GUI

➢ Execute the MPU-R2 GUI from the package files provided by W&W, the initially opened window contains disabled panels (in grey color) because the communication is not yet configured and requested:
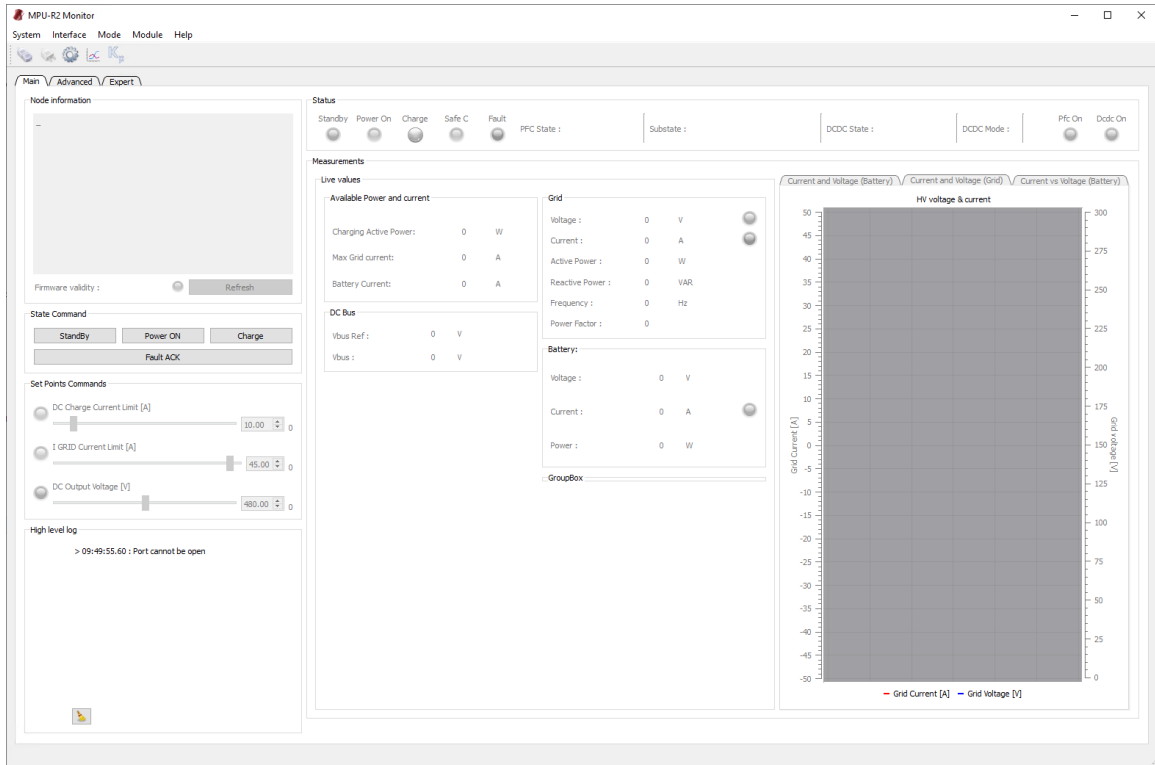

Figure 5: The MPU-R2 GUI's main window (communication not configured)

➢ Open the CAN Communication Configuration window to set and then request the communication:
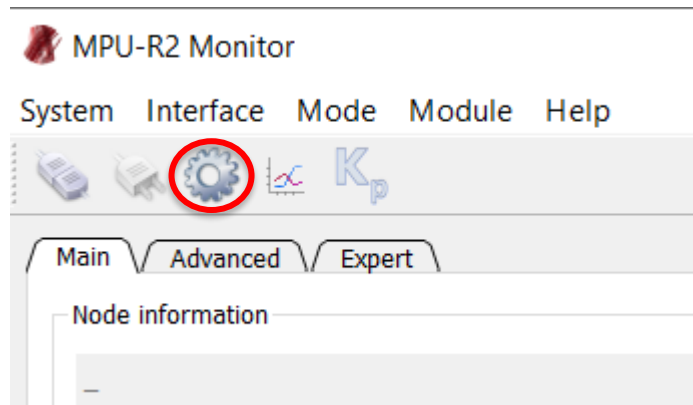
Figure 6: Request configuring the CAN communication

The opened window:
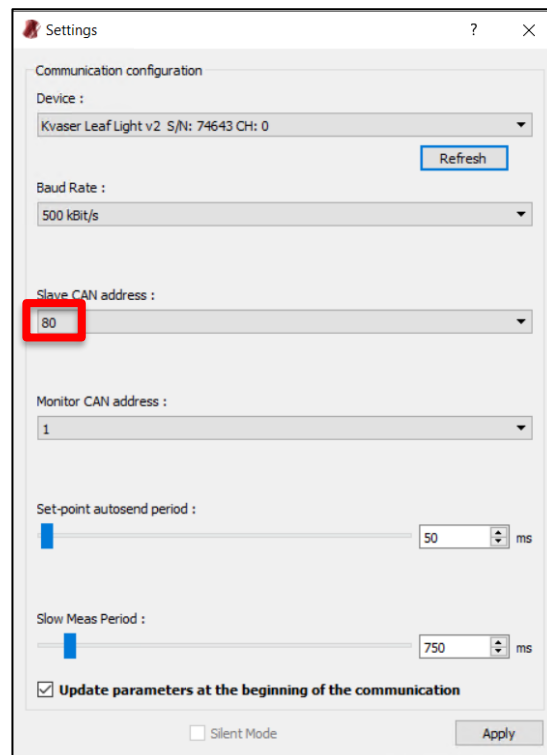
Figure 7: The communication configuration window

The several settings are:
- CAN port: the allocated port to the NI CAN transceiver in your computer
- Baud Rate: The CAN communication speed
- Slave CAN address: the MPU-R2 product (slave) CAN address
- Monitor CAN address: the MPU-R2 GUI (master) CAN address
- Set-point auto-send period: the sending period of the set-points from the MPU-R2 GUI
- Slow Meas Period: the sending period of the measurements from the MPU-R2 product

By applying the communication settings (using the Apply button), a request to set the communication is sent, then the communication with the MPU-R2 product establishes if the settings are correct. When the communication is established with the MPU-R2 product, the Main window is enabled:
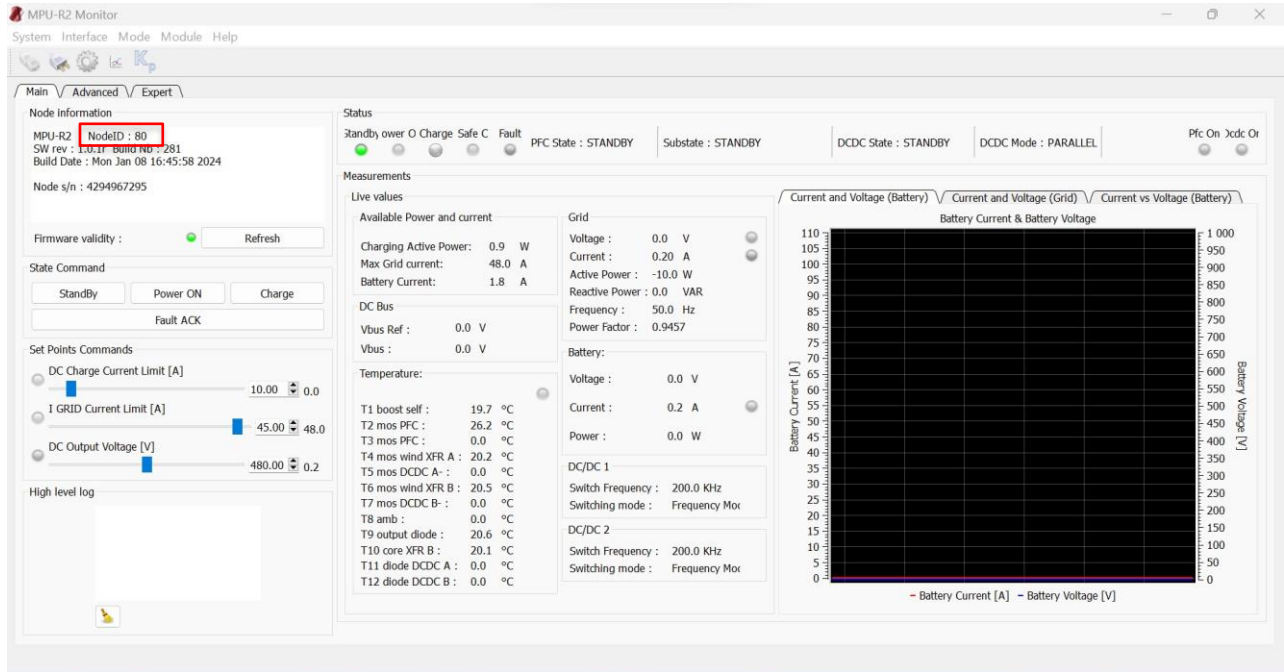

Figure 8: The MPU-R2 GUI's main window after the communication is established.

By default, the operating mode is the standard one. So, the user has limited usage of the MPU-R2 GUI.

To upload the model description, the user has two options. Either upload the model description manually from an external file or download the model description from the GUI interface.

2.1.1. Automatic load of model description

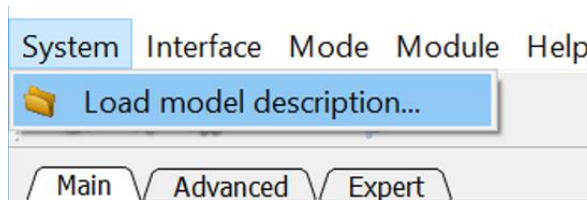Load the "DataDefinition.xml" file to configure the MPU-R2 GUI, it's used to load the model description:

Figure 9: Load the model description

A browse file dialog box is opened to select the "DataDefinition.xml" file:
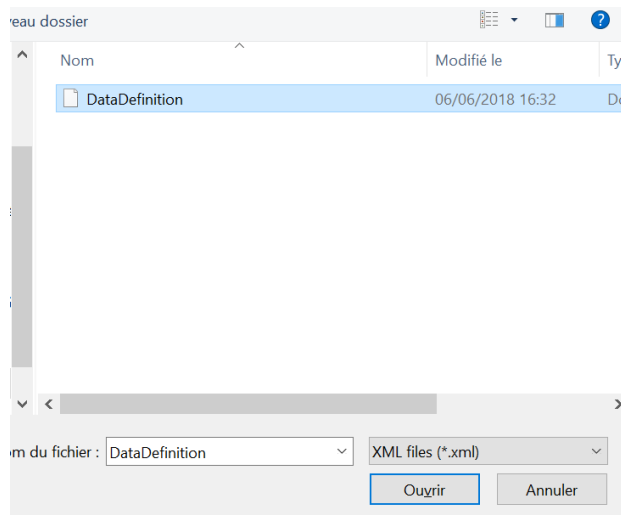
Figure 10: Browse file dialog box

And make sure that loaded model description ("DataDefinition.xml" file) revision corresponds to the FW revision to avoid any damage of the converter.

2.1.2. Automatic load of model description

Please refer to the advanced tab section to have more details on this feature.

2.2. Main Window

The Main Window provides access to all the GUI features (depending on the operating mode). In this part we will describe the use of the 3 tabs that compose it.

2.2.1. Main tab

The Main tab allows the user to:

➢ Get the MPU-R2 product information, it's displayed in the "Node information" panel:
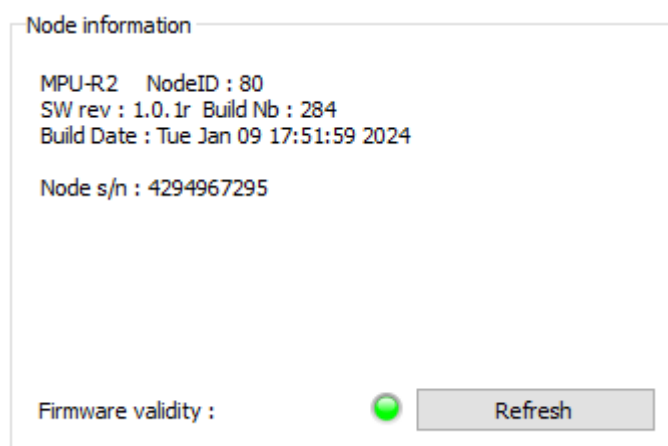

Figure 11: Node information panel

- Name of the MPU-R2 product
- NodeID: the CAN address of the product (8 bits)
- HW rev: Hardware revision of the product.
- SW rev: Software revision of the product.
- Build Nb: Versioning revision of the product firmware.
- Build Date: Versioning date.
- Node S/N: Serial number of the product
- Firmware validity: Versioning verification, the LED is red when the firmware is not under versioning control.

The user can also request the Node information by pressing the [Refresh] button.

➢ Change set points commands of the MPU-R2 product, start/stop the charging, receive the system status, and live general measurements, change the mode command and the grid configuration:
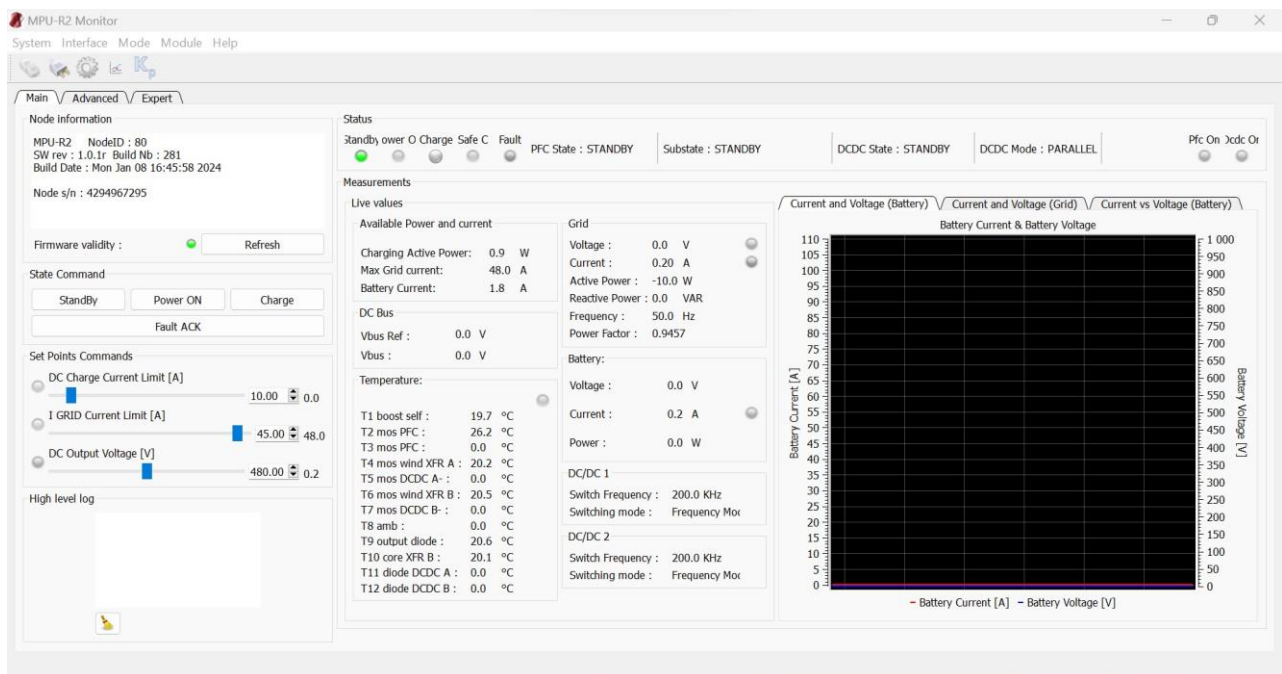
In the Expert operating mode:

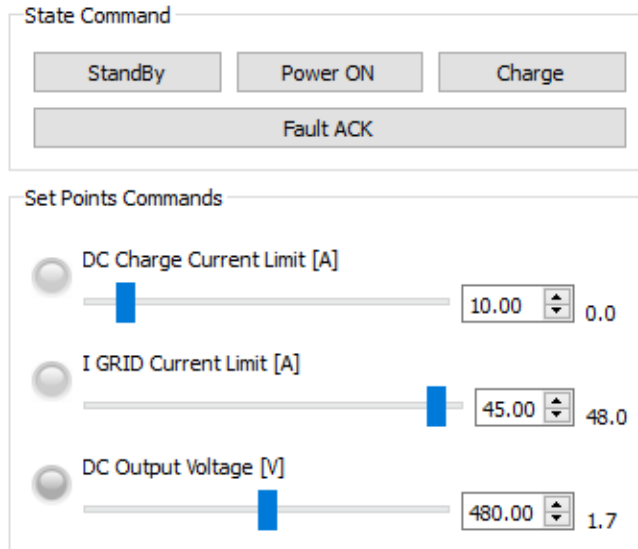**Figure 12: The MPU-R2 GUI's main tab in standard mode**

State request and setpoints

Figure 13 Setpoint and state mode command bar

<u>**State commands**</u>: are used to request change of the state of charger.

Four main states can be requested:

- **Standby**: No power mode
- **Power On:**
    o Precharge of internal buses
    o No power transfer between AC and DC
- **Charge**: Power transfer between AC and DC
- **Fault Ack**: acknowledge fault and clear fault register (Fault Word).

Please refer to MPU-R2 datasheet for further detail on the charger state machine.

<u>**Setpoints commands:**</u> are used to set control targets and limitations:

- I GRID current limit: to limit the phase current of the AC side, in Amperes.
- DC charge current limit: to limit the current on the DC side, in Amperes.
- DC output voltage: to set the battery voltage target, in Volts.
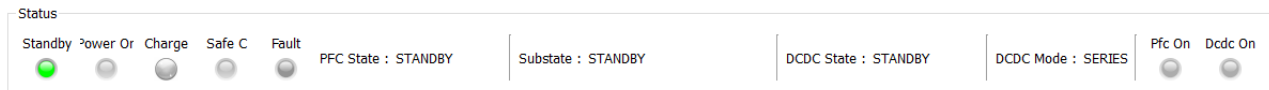
Status feedback

Figure 14 Status feedback bar

To indicate state of charger, the monitor shows the status feedback:

- **Standby**: Charger in Standby mode
- **Power On**: Charger in Power on mode
- **Charge**: Charge in Charging mode
- **Safe *C:*** an event occurred on AC side (example DIPS & Shorts) and charger has interrupted the power transfer. An automatic restart of charge will occur when AC side recovers to nominal behavior.
- **Safe D:** this state indicates that system is in FAULT following Critical event.
- **PFC On:** PFC drivers and PWMs are On
- **DCDC On:** DCDC drivers and PWMs are On
- **PFC state, substate and DCDC state:** states of the system state machine. Refer to MPU-R2 datasheet for more details.
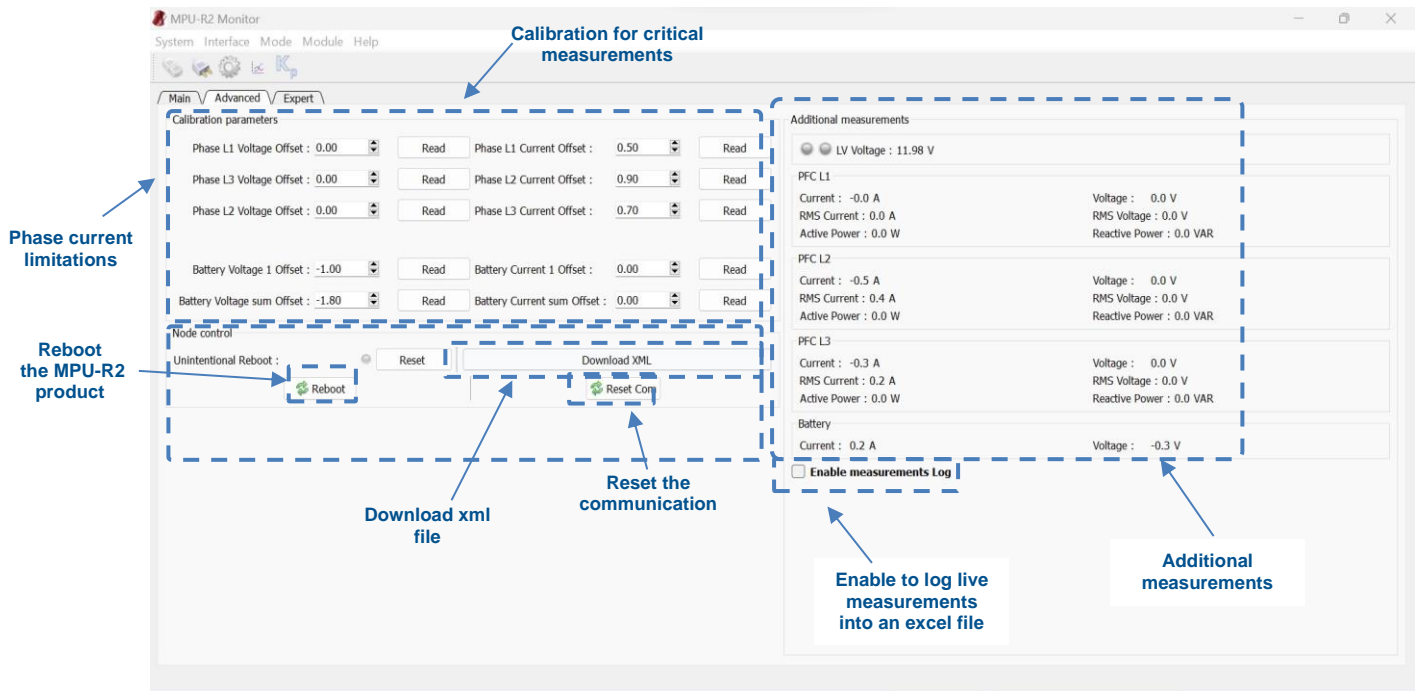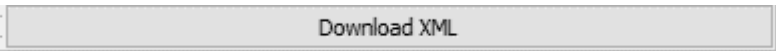
2.2.2. The Advanced tab

Figure 15 The MPU-R2 GUI's advanced tab

The Advanced tab allows the user to

- Calibrate the critical measurements.
- Reboot the product and reset the communication.
- Reset the LED that detects an undesired reboot of the MPU-R2.
- Get additional measurements.
- By checking the "Enable measurements log" checkbox, the received measurements are saved into an excel file located in the same folder as the MPU-R2 GUI executable.
- Download the XML file:

When the user presses on the [Download XML] button, the MPU-R2 GUI will automatically download the XML file "Data_Definition.xml" of the FW and the binary file of the same XML file. Then, it will store them in the "XMLfiles" which can be found in the same repository as the GUI.

If no file has been loaded in the model description, the downloaded xml file will be automatically loaded. Otherwise, the GUI will ask the user if they desire to upload the newly downloaded file to the model description.
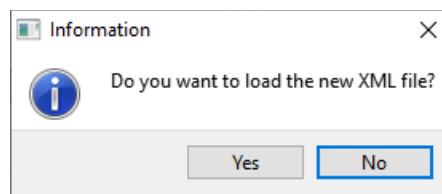

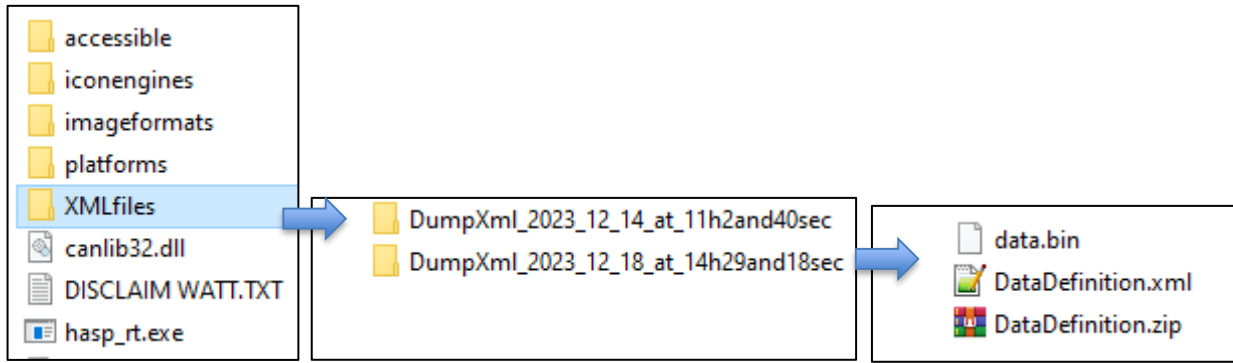**Figure 16 Request to load the new xml fie**

Figure 17 Selection of the DCDC mode

2.2.3. The Expert tab

The Expert tab provides access to the MPU-R2 product's Real-Time diagnostics and the fault sensitivity selection.
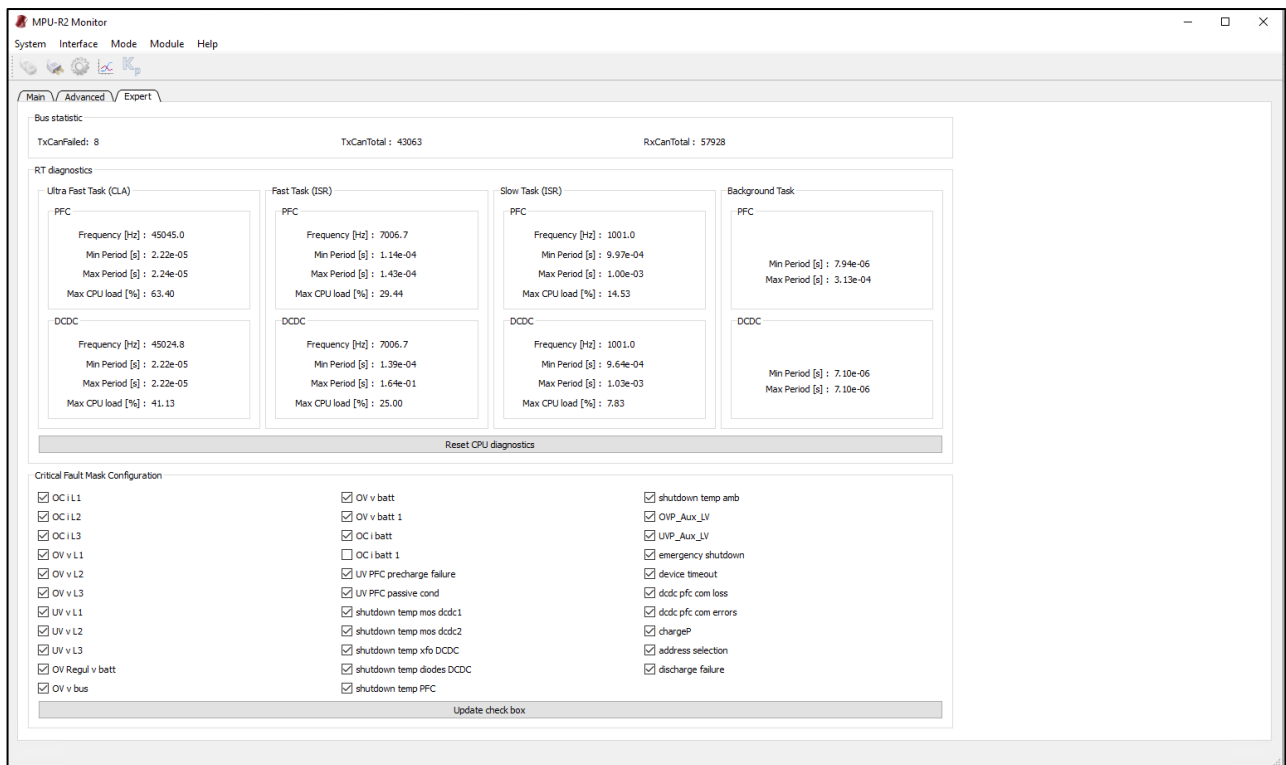

Figure 18: The MPU-R2 GUI's expert tab

2.3. The Device Manager

The Device Manager feature provides access to the complete object dictionary that is presented on a tree form, the user can read and write the several data depending on the access type of the object. Please refer to the *object dictionary .html* file provided by W&W that describes in detail each object.

This feature is only unlocked under the expert operating mode because any modifications of the MPU-R2 product data in the object dictionary can damage the converter.
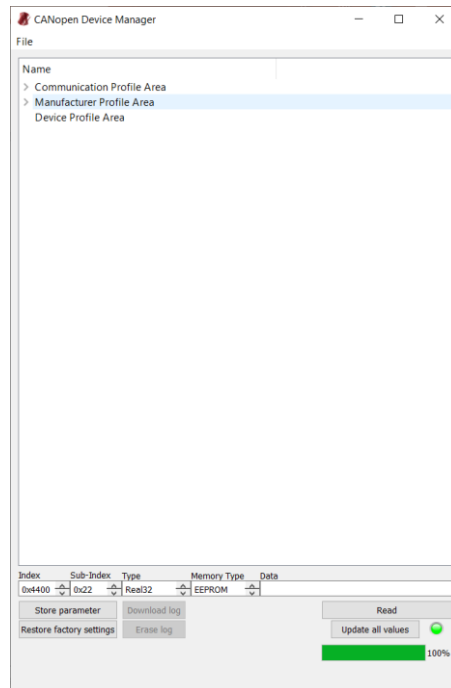

Figure 19: Device Manager window

To load the model description (the "DataDefinition.xml" file) from the Device Manager, open the file using *file menu*:
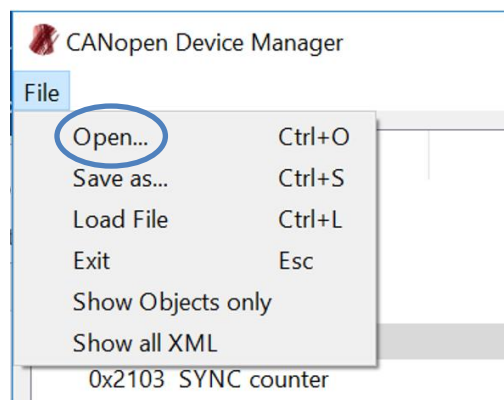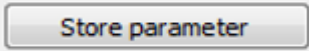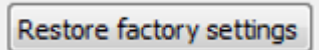

Figure 20: Load DataDefinition.xml file from Device Manager

In addition, this Device Manager also provides the ability to store the non-volatile parameters (with memory type EEPROM) in the external non-volatile memory or to restore the factory settings:

- When a store parameter is requested using the **Store parameter** button, all the non-volatile parameters values are stored in the external memory, and they will be loaded at each boot-up of the MPU-R2 product.

- When a restore factory settings is requested using the **Restore factory settings** button, the external memory part reserved to store the non-volatile parameters is erased and the application loads the default parameters provided by W&W (expect Serial Number).

For example, the calibration parameters and the regulation control parameters are non-volatile ones, and they present a part of the MPU-R2 product's configuration. When the user decides to change those parameters for some reason, he can store the new configuration in the external memory to be loaded at each MPU-R2 product's boot up.

N.B: After a store parameter or a restore factory settings, you must reboot the MPU-R2 Product

2.4. The Virtual Scope

The Virtual Scope feature provides the ability to log and display the fast measurements and/or the internal computed variables of the MPU-R2 FW application. The user can select one or many of the proposed variables to log and display for monitoring purposes.
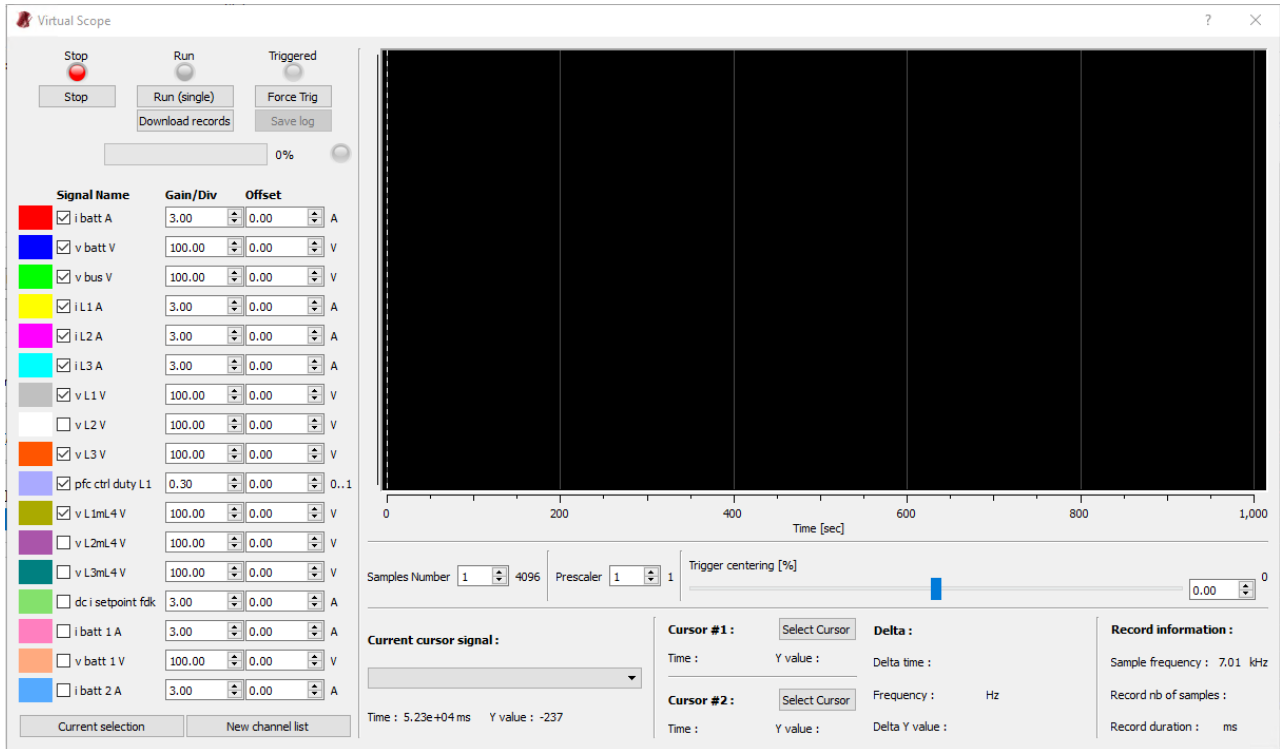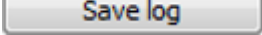

Figure 21: Virtual Scope window

The Virtual Scope is configured automatically after loading the model description (the "DataDefinition.xml" file), the configuration consists of loading the signals' description.

To use the Virtual Scope, the flow presented below must be respected:

Select signals: Check the corresponding checkbox → Trig the record: Press the Trigrecord button → Download records: Press the Downloadrecords button

The user can select/deselect each signal using the corresponding checkbox, change the displayed Gain/Div and change the displayed offset.

In addition, the user can also save the displayed data, by pressing the **Save log** button, into an excel file that will be created in the same folder as the MPU-R2 GUI executable.