

Introduction

The STPM3x evaluation software is a graphical user interface to read, configure and calibrate the STPM3x energy metering ICs, suitable for parallel and USB hardware interfaces.

The application has a unique work area where the user can read the device's registers and write configuration and calibration parameters.

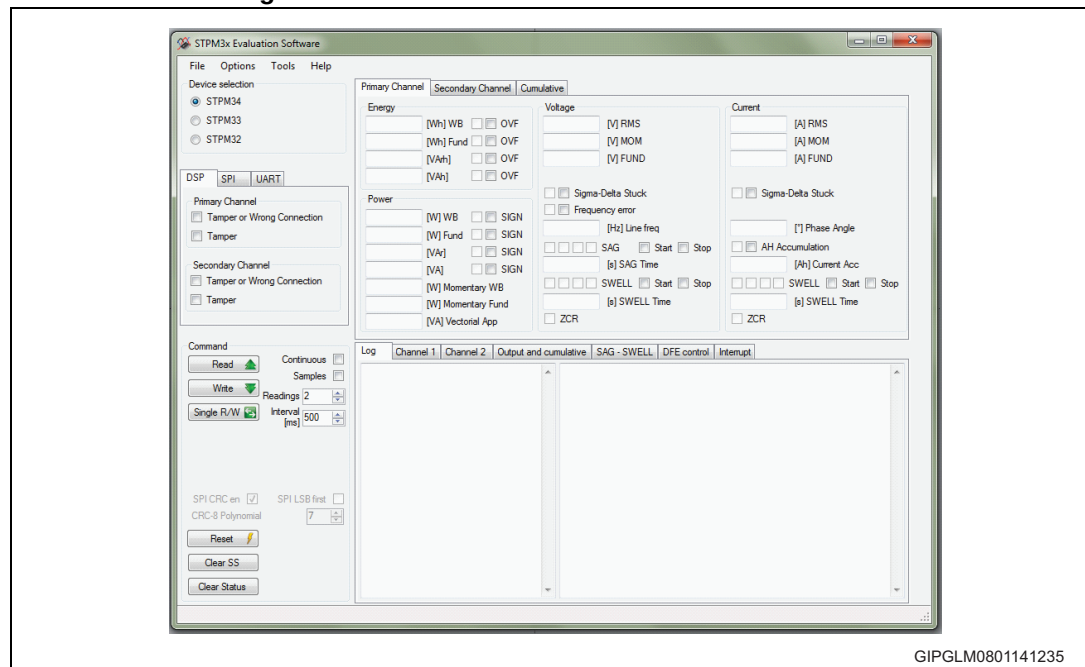
A specific device can be selected and application parameters (such as sensor sensitivity, crystal oscillator frequency) can be configured to calculate measured power, current and voltage.

Data acquisition can be customized to read either a single or a number of data samples from the device. The reading data can be output in table format and saved as an excel file.

Wizard tools are provided to guide the user during the application design and automatically calibrate the device.

At any time, the current session data can be saved in a project, an existing project can be opened or a new project can be created.

Figure 1. STPM3x evaluation software screenshot



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1 Introduction

1.1 Prerequisites

This evaluation software is a window-based application and requires .NET framework 2.0. It is possible to free download and install this framework from www.microsoft.com.

1.2 Hardware programmer

The STPM3x evaluation software can be used with:

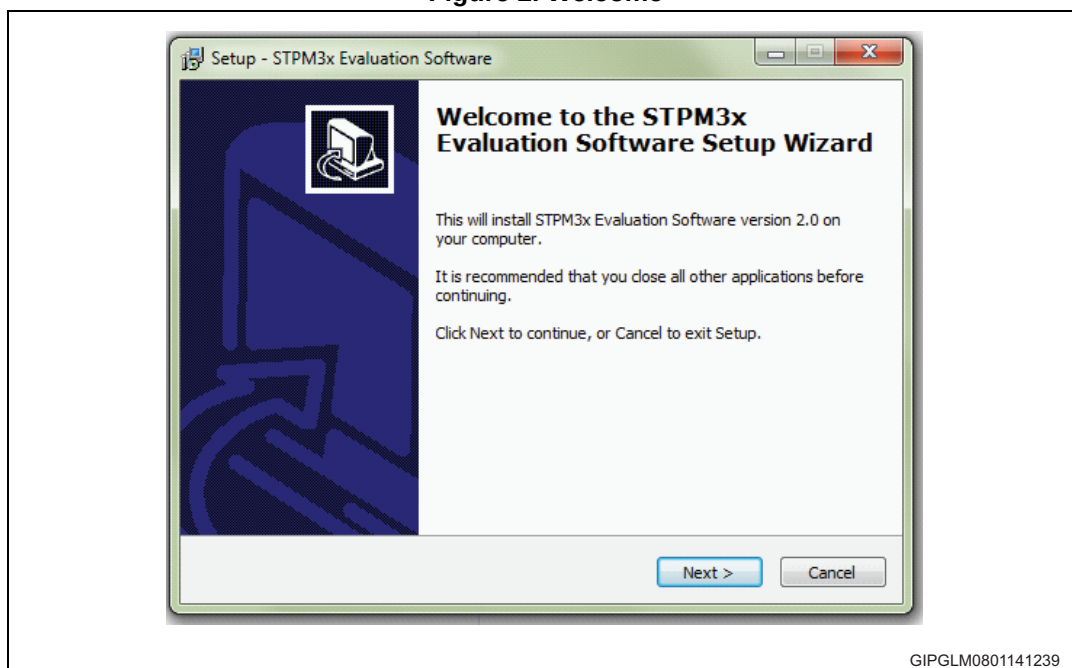
- Parallel hardware interface
- USB isolated hardware interface (available as a separate evaluation board, the STEVAL-IPE023V1)
- UART board interface (available as a tool to connect evaluation boards or, for the STPM3x evaluation board, by UART cable)

2 Getting started

2.1 Application setup

The setup file guides through the software installation. Double-click on the setup file to start the installation ([Figure 2](#)) and follow the guided process.

Figure 2. Welcome



Application setup may also install virtual com drivers for the STEVAL-IPE023V1 USB interface.

Note: In the application folder, the file *STPMxxProg.dfu* is also downloaded. If the USB interface is used, its firmware must be updated by DfuSe application (<http://www.st.com>).

2.2 Hardware setup

In case of parallel programmer, to communicate with the device through the evaluation software, follow below steps:

1. Connect the evaluation board to the parallel programmer
2. Connect the programmer to the PC through a parallel cable
3. Power on the evaluation board

In case of USB interface (STEVAL-IPE023V1), follow below procedure:

1. Plug the USB port in the PC
2. Do not power on the STPM3x board
3. While the red led is lighted, connect the STPM3x board to the USB interface

This procedure assures that the STPM3x SPI (instead of UART) communication interface is correctly selected when the device starts up.

2.3 Application tour

To start working with the STPM3x evaluation board:

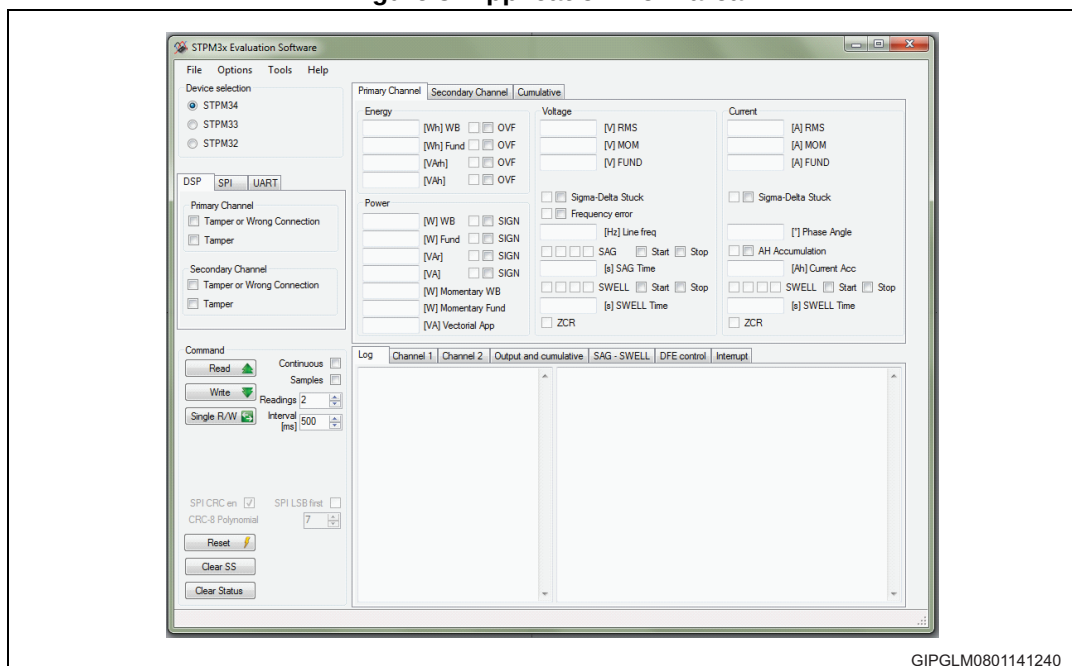
1. Open the STPM3x evaluation software
2. Select the menu Option - Interface - Parallel, USB or UART according to the chosen hardware programmer (see [Section 1.2](#))
3. Configure the application parameters selecting Option - Configuration menu (see [Section 4.2](#))
4. Now you are ready to read, write (see [Section 3.6](#)) or calibrate your application (see [Section 4.3](#))

3 Application work area

The application work area is divided into several sections logically grouping the relevant information of the device.

In this way, the status of the device and the data of registers are always available to the user at a single glance.

Figure 3. Application work area



3.1 Device selection

On the top left of the work area, a group-box is available to select the device. The application work area changes according to the selected device's features.

3.2 Calculated values

On the topmost section of the work area, all data are available, such as:

1. Energy and power values
2. RMS and instantaneous (wide-band and fundamental) values of voltage and current
3. Line voltage frequency
4. Information about sag and swell events

Status and event bit check boxes are close to the information they refer to; event bits are read only, because they are updated by the device DSP, while status bits are enabled since they are set by the DSP but they must be cleared by the user. He can clear status bits either unchecking the single check box and then pressing the "Write" button (the configuration and

status bits are written as shown in the GUI) or pressing the "Clear Status" button in the command area.

3.3 Status bits

Tamper status bits, SPI and UART status bits are shown on the left of the form.

The user can clear status bits either unchecking the single check box and then clicking on the "Write" button (the configuration and status bits are written as shown in the GUI) or pressing the "Clear Status" button in the command area.

3.4 Log tab

The log tab displays registers and application messages as they are read from the device.

3.5 Configuration bits

In the configuration area, divided into several tabs, all device configuration bits can be read and written.

These bits are automatically updated every time the device is read. To set or clear a configuration bit, the user should select the desired value from the check box or combo-box, then use the button "Write" from the command area.

Note: All configuration bits are written at the same time.

3.6 Command area

The command buttons to read, write, reset the device, clear status bits and sag-swell event information are in this area.

3.6.1 Read button

The "Read" button performs the latch and reading of all data, status and configuration registers.

The device can be read once or continuously by checking/unchecking the "Continuous" check box. The time (in ms) can be also set between two readings through the "Interval" numeric text box.

3.6.2 The reading of samples

To perform the reading of samples, the "Samples" check box has to be checked, then the "Read" button has to be pressed. It is possible to choose:

- the number of samples ("Readings" numeric text box)
- the delay between samples readings ("Delay" numeric text box). If the USB interface is selected, the reading interval is expressed in μs , since, in this case, the USB board microcontroller can collect all readings and then download all values to the PC
- First register is the first data register by default (configuration registers in the first part of the memory are not sampled)
- Last register is the last data register by default

After the samples reading is completed, a form (see [Figure 4](#)) is opened displaying in a grid all data taken from registers and the corresponding energy values in two different tabs.

Data contained in the read registers are displayed only.

Sampled data can be filtered through the filter form opened by the "Filter" - "Filter Results" menu item. All filters can be reset by the "Filter" - "Reset filters" menu item.

Sampled data can be exported to excel by selecting one of the "Export Data" menu options.

3.6.3 Write button

"Write" button allows the configuration and status bits, shown in the GUI, to be written.

3.6.4 Single read and write transaction

The "Write" button allows all configuration registers to be written at the same moment.

Thanks to this form, several read/write transactions can be performed by specifying read and write addresses and hexadecimal content of the register to write. Selecting "None" check box means that the correspondent address is the "dummy" 0xFF address.

The CRC (cyclic redundancy check) is automatically calculated by the GUI and displayed when the "GO" button is pressed.

The "GO" button starts the single read/write transaction. The received data and CRC are then displayed in the text box below.

Note: The read address sets the device read pointer of the next transaction. This means that received data during the second transaction are taken from the register, at the address sent during the first transaction.

3.6.5 Reset button

The reset button performs a software reset of the device (sets all configuration bits to default and restarts all energy counters).

The reset can be performed in different ways, according to the hardware interface:

1. Send two pulses onto SYN (for UART and parallel interfaces)
2. Write the "SW RESET" bit in DSP_CR3 (for USB hardware interface)

3.6.6 Clear SS

This button sends the device the command to reset sag and swell event history bits, writing "Clear SAG-SWELL" bits (bits n.4 in DSP_CR1 and DSP_CR2 for primary and secondary channels respectively).

3.6.7 Clear status

This button clears both the DSP_SR1 and the DSP_SR2 status register.

4 Application menu

4.1 File

From the "File" menu it is possible to:

- Open: open an existing .stpm3x file
- Save: save data in the current .stpm3x file
- Save as: save data in a new .stpm3x file
- Exit: quit the application

The file .stpm3x contains:

- Configuration bits
- Application parameters set as in the "Configuration" form (see [Section 4.2](#) below)

4.2 Options

- Interface: to open the communication with the device, select the proper hardware interface:
 - "Parallel" for the parallel hardware interface. Select one of the default LPT ports or insert a different port address.
 - "USB" if the STEVAL-IPE023V1 is used. When the board is plugged, virtual com drivers map the USB interface as new com. Verify its number in the device manager and select it; the small arrow button on the right refreshes the port list.
 - "UART" if the device is connected using UART. Select the proper com port, the device default baud rate is 9600, so this value must be selected for the communication.

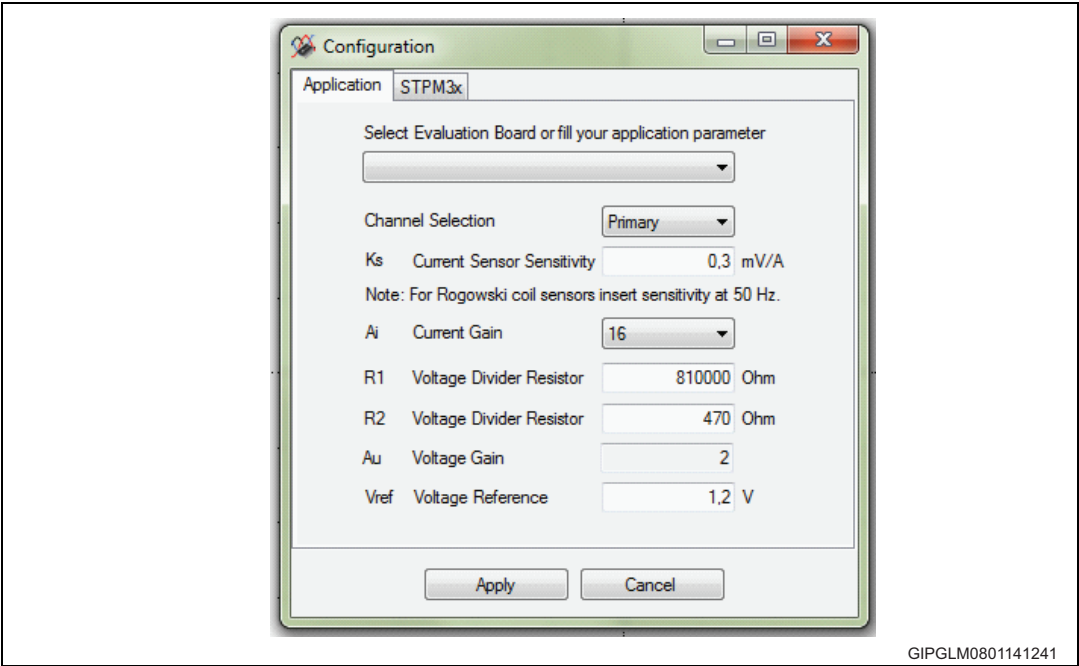
Press "Open" to start the communication with the device or "Close" to close the communication. Once the interface is selected "Advanced" button allows device parameters to be written, impacting the communication (Baud Rate, CRC polynomial, etc).

- Configuration

This form allows the application

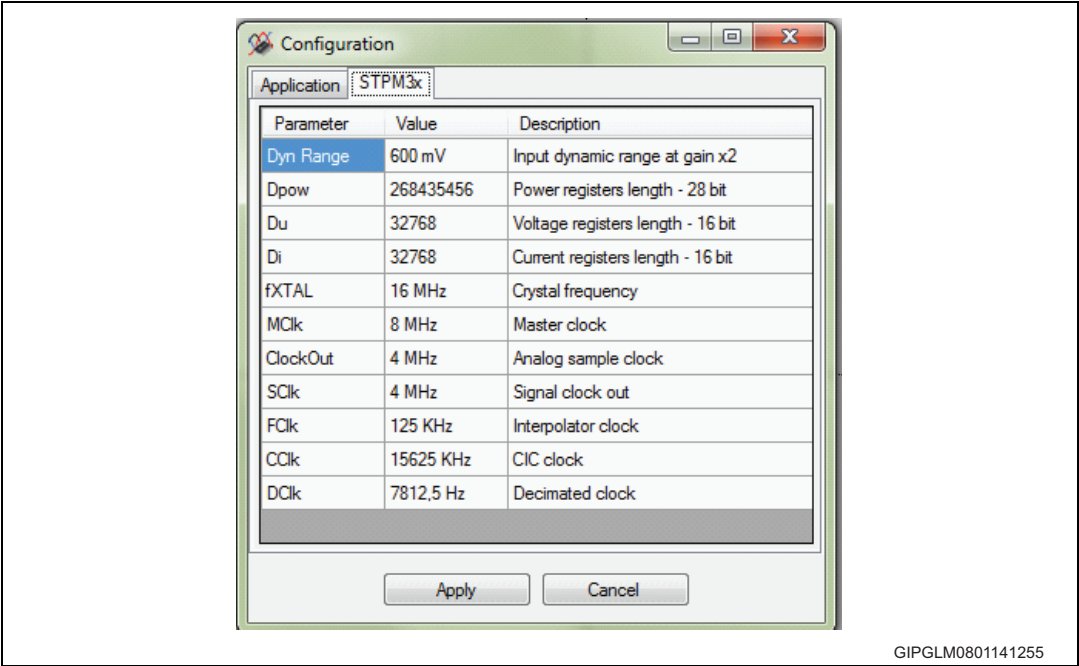
- Application: to correctly transform data coming from the device into meaningful values, the basic parameters of the board have to be configured, such as: resistors of the voltage divider, current sensor sensitivity, voltage and channel amplification gains. As far as the STPM34 and STPM33 are concerned both channels must be configured; each channel can be selected through a combo-box. The "Apply" button is used to save the channel data and "Cancel" is used to exit without applying changes. If a connection interface has been selected, the "Apply" button also writes the channel gain configuration on the device.

Figure 4. Configuration - application tab



- STPM3x: in this tab, all internal device parameters with their values are reported. These parameters are used in the conversion of registers.

Figure 5. Configuration - STPM3x tab



4.3 Tools

4.3.1 Design wizard

This tool helps the application design and it is a preliminary step of the calibration process. By setting the application parameters and selecting a design method, all ratings of the meter are calculated.

Figure 6. Application design

Application Design of a single channel

Application Parameters

Channel Selection: Primary

Current sensor: CT - Shunt

VL Nominal Voltage: 230 V

IL Nominal Current: 5 A

fL Nominal Frequency: 50 Hz

P Target constant pulse: 40800 p/kWh

Vref Voltage Reference: 1.2 V

Ai Current Ch. Gain: 16

Au Voltage Ch. Gain: 2

Design Method

☒ Ks and R2 constant to calculate R1

☐ R1 and R2 constants to calculate Ks

Ks Current sensor sensitivity: 0.3 mV/A

R1 Target Voltage divider resistor: 826324 Ohm

R1 Actual Voltage divider resistor: 810000 Ohm

R2 Voltage divider resistor: 470 Ohm

Output

f frequency at LED @ PL: 13.03 Hz

f frequency at LED @ 1kW: 11.33 Hz

Vmax Maximum voltage: 366 V

Imax Maximum current: 88 A

Imin Minimum Current: 8.72 mA

Xu Voltage register value: 1865 HEX

Xi Current register value: 23D HEX

Buttons: Apply, Cancel, Go To Calibration

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As to the STPM34 and STPM33, the channel can be selected through a combo-box.

The user is asked to input the current sensor type (if CT/Shunt or Rogowski Coil), the calibration working point (nominal voltage, current and frequency of the line), some board parameters and the target value of P (number of pulses per kWh from the LED pin). This is the default value; in fact it can be scaled by configuration bits.

The choice of a design method is required to calculate one of the analog front end components. A target value is suggested for this component, and its real value should be chosen as closer as possible to it.

Once all these data are input, the "Output" section gives some information about the meter ratings, such as output frequencies, voltage and current maximum ratings and target values of RMS registers at specified load (Xi and Xu).

Use the "Apply" button to save the channel data and "Cancel" to exit without applying changes. If a connection interface has been selected, the "Apply" button also writes the channel gain configuration on device.

The "Go To Calibration" button opens the calibration wizard form, if a hardware interface is selected.

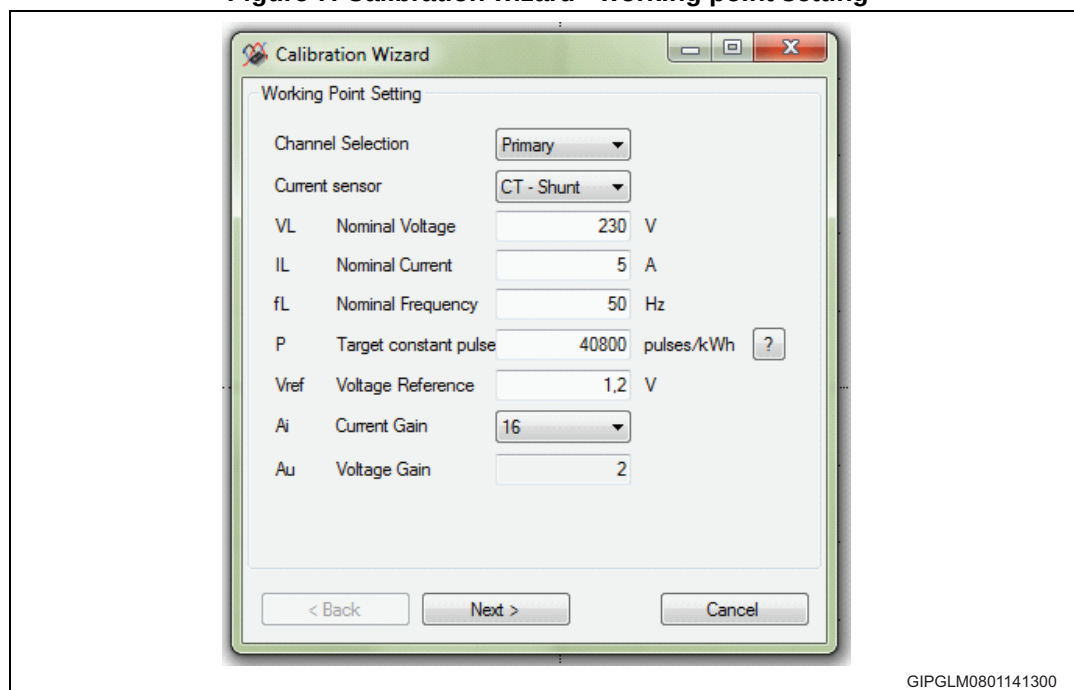
4.3.2 Calibration wizard

The calibration wizard consists of four steps. In the first one, shown in [Figure 7](#), the user has to insert the board parameters and the working point for calibration.

First three steps of calibration are those implemented in the design wizard.

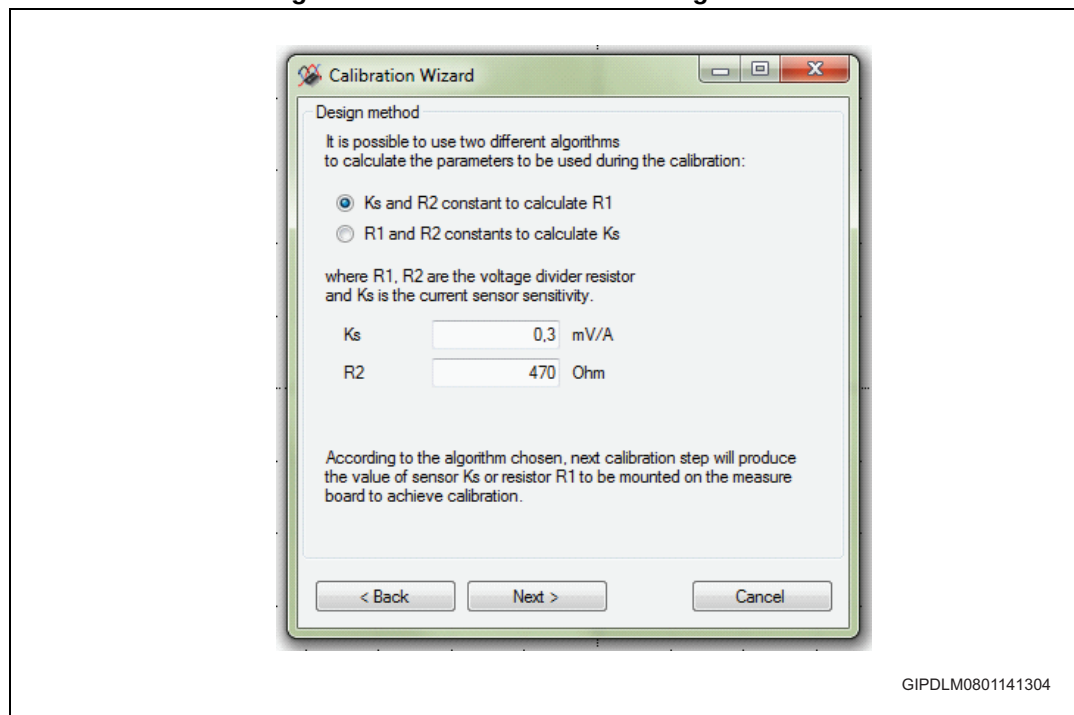
One voltage/current channel can be calibrated at a time, through the channel combo-box.

Figure 7. Calibration wizard - working point setting



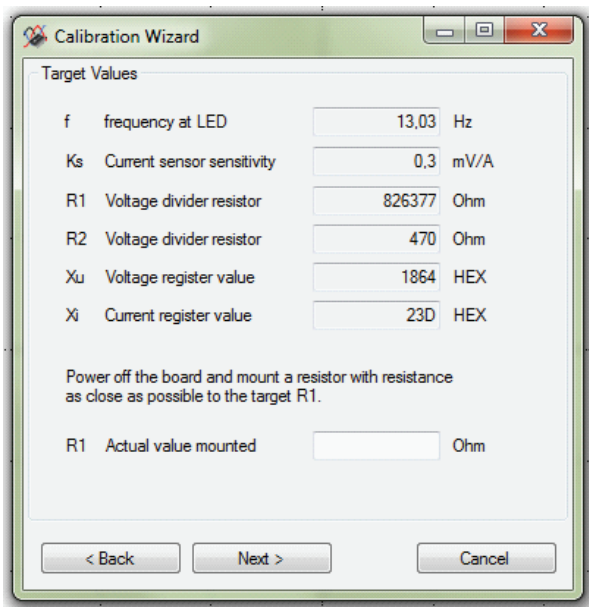
In the second step ([Figure 8](#)), the user has to select a design method, choose mutually compatible sensor sensitivities for voltage and current so to achieve the calibration.

Figure 8. Calibration wizard - design method



The third step resumes some of the board parameters, the meter ratings and some target outputs at the selected load: the frequency of LED pin and the hexadecimal values of RMS voltage and current reading.

Figure 9. Calibration wizard - target values



The screenshot shows a 'Calibration Wizard' window with a 'Target Values' section. It contains several input fields with pre-filled values and units. Below these fields, there is a text instruction and an additional input field for the actual value of resistor R1.

Parameter	Value	Unit
f frequency at LED	13.03	Hz
Ks Current sensor sensitivity	0.3	mV/A
R1 Voltage divider resistor	826377	Ohm
R2 Voltage divider resistor	470	Ohm
Xu Voltage register value	1864	HEX
Xi Current register value	23D	HEX

Power off the board and mount a resistor with resistance as close as possible to the target R1.

Parameter	Value	Unit
R1 Actual value mounted		Ohm

Buttons: < Back, Next >, Cancel

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Filling in the mask, by indicating the value of the component mounted on the board, (R1 or Ks according to the design method) allows a later correct calculation of voltage, current and energy values.

The last step, in [Figure 10](#), requires the board to be connected to PC through a communication interface (selected by "Option" - "Interface" menu) and also connected to the selected load.

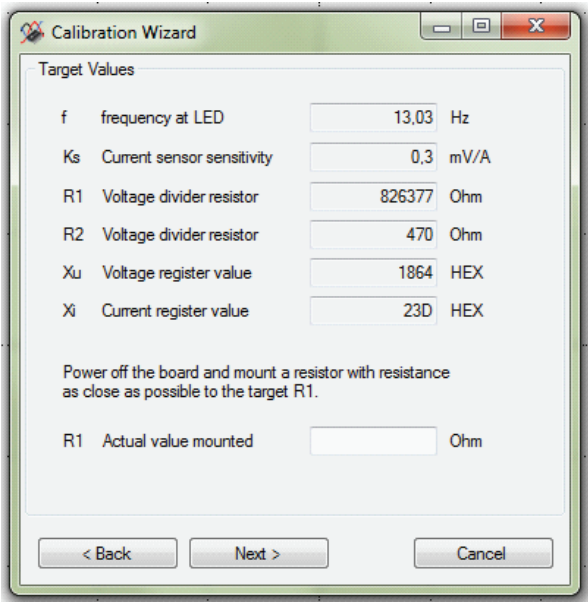
Select the number of samples to average and the delay between two samples.

Pressing the "Calibrate" button, the calibration procedure starts and it consists of:

- Writing device configuration bits and setting calibrators in the middle of the range
- Reading and averaging samples of voltage and current RMS
- Calculating the calibrators to reach the target measure calculated above

If the calibrators are out of range (error on one or both RMS values is greater than the correction range) the user goes back and modifies board parameters and/or the constant pulse to achieve calibration.

Once the calibration process is completed correctly, go back to the first page to calibrate the other channel.

Figure 10. Calibration wizard - calibration completed

The screenshot shows a 'Calibration Wizard' dialog box with a title bar containing a close button (X) and standard window controls. The dialog is titled 'Calibration Wizard' and has a 'Target Values' section. It contains a table of parameters with their target values and units. Below the table, there is a note about powering off the board and mounting a resistor. At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'.

Parameter	Target Value	Unit
f frequency at LED	13,03	Hz
Ks Current sensor sensitivity	0,3	mV/A
R1 Voltage divider resistor	826377	Ohm
R2 Voltage divider resistor	470	Ohm
Xu Voltage register value	1864	HEX
Xi Current register value	23D	HEX

Power off the board and mount a resistor with resistance as close as possible to the target R1.

R1 Actual value mounted Ohm

< Back Next > Cancel

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To close the process, press "Write CFG" to write all calibrators in memory and return to the main form.

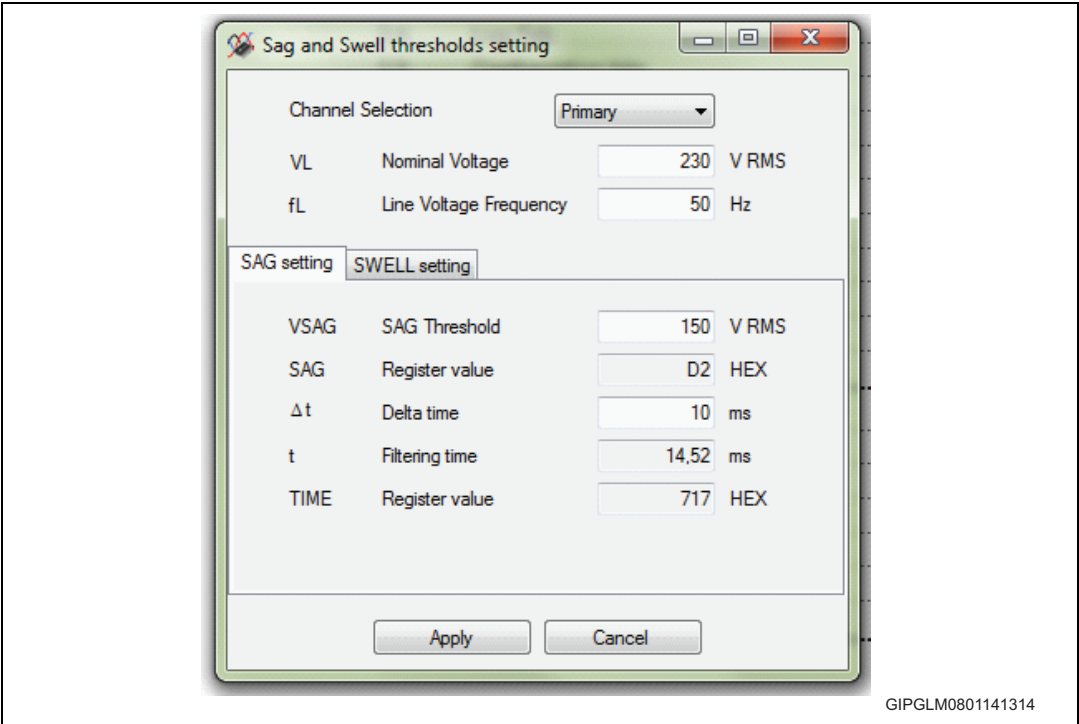
4.3.3 Sag and swell threshold

Thresholds for voltage sag and current, voltage swell event detection inside the device are referred to instantaneous values. The form, shown below, allows the user to calculate thresholds from RMS values, and the sag time threshold as well.

Analog front end parameters set in the configuration form impact these calculations.

Use the "Apply" button to configure the device and "Cancel" to exit without applying changes.

Figure 11. Sag and swell threshold



5 Revision history

Table 1. Document revision history

Date	Revision	Changes
29-Jan-2014	1	Initial release.

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