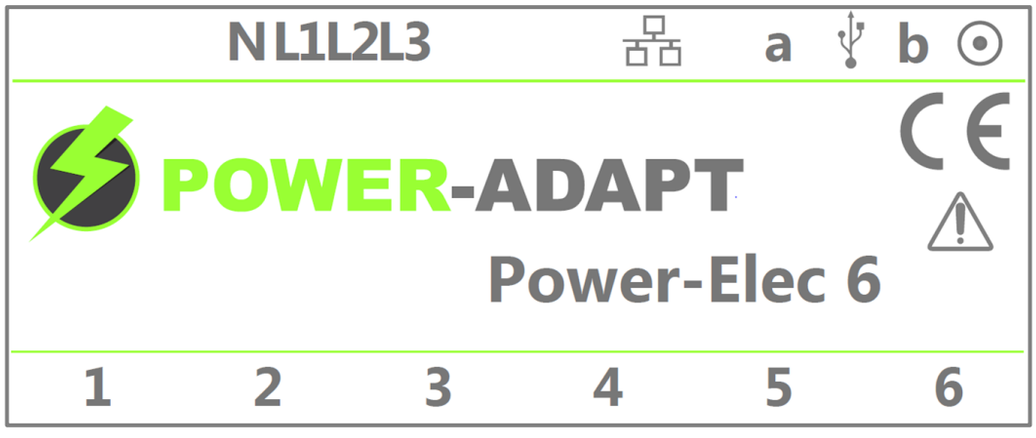
POWER-ADAPT

by ECO-ADAPT

An Energy Sub-metering Solution

User Manual Power-Elec 6

Electric energy sub-metering solution with integrated communication



Eco-Adapt

www.eco-adapt.com

+33(0)1 70 61 67 05

Postbox: 39 rue de Châteaudun, 75009 Paris - FRANCE

Table of contents

1. Warnings 3

2. General description 4

3. Installation 5
   - 3.1 How to install the Power-Elec-6 product in the electrical cabinet
   - 3.2 How to connect voltage inputs
   - 3.3 How to install current transformer
   - 3.4 Circuit specificity
   - 3.5 Communication interfaces

4. Configuration 11
   - 4.1 Licenses download
   - 4.2 Wi-Fi connection
   - 4.3 License activation
   - 4.4 Circuit configuration with Standard license
   - 4.5 Circuit configuration with Expert license
   - 4.6 LoRaWAN configuration
   - 4.7 Ethernet configuration
   - 4.8 Wi-Fi configuration
   - 4.9 Modbus TCP configuration
   - 4.10 Modbus RTU configuration
   - 4.11 BACnet IP configuration

5. Live visualization 37

6. System 39
   - 6.1 Export settings file
   - 6.2 Import settings file
   - 6.3 Export log file

7. Software upgrade 42

8. Status LED meaning 45

9. Technical characteristics 47

10. Appendix 49

1. Warnings

- You must read this manual completely before the beginning of the installation in order to ensure user and equipment safety.
- The installation must be done by a certified professional. This manual doesn't aim to guide someone without proper training.
- To prevent material damage and corporal lesion, you must respect the running ranges indicated in section "technical features"
- To prevent material damage to the sensors or to the meter itself, you must respect the rated current of current transformers and Rogowski coils
- If the Power Elec 6 is installed in a surge category III circuit, you must install a surge arrester before it. To choose the surge arrester, please read the technical features in the appendix.
- In case of unspecified use, the product's protection can be compromised.
- You must respect local standards, directives, rules and regulations. Constructor's responsibility can't be engaged in case of failure to comply to instructions in this manual.

Security Symbols

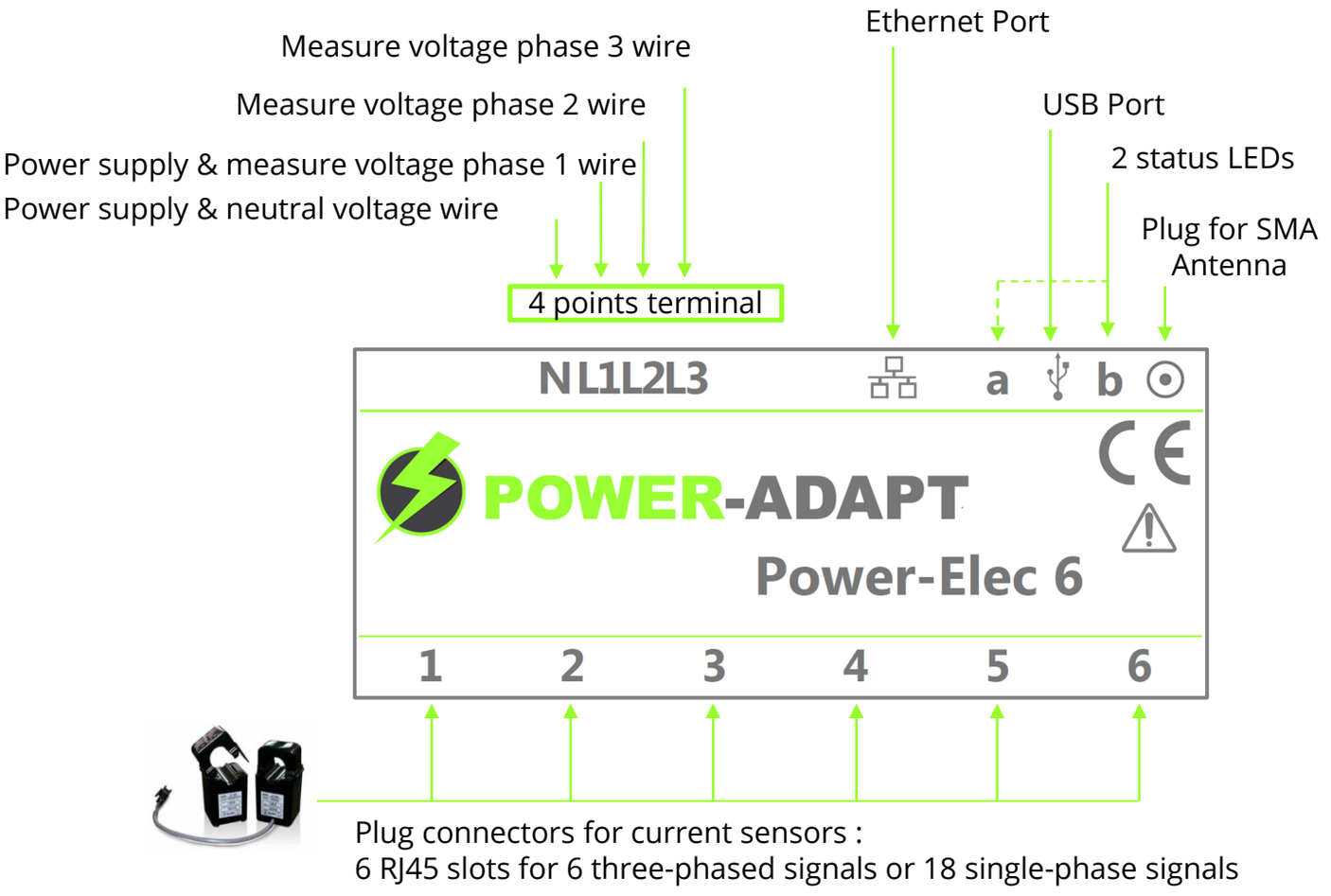
The following symbols aim to attract your attention on potential dangers, they appear in the documentation and on the product.

Security warning - this symbol warns the user of potential risks during the manipulation and invites him to read the documentation.

Risk of electric shock this symbols indicates that there is a risk of electric shock that may cause equipment destruction, lesions or death if the instructions aren't respected.

This product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health. For more detailed information about recycling of this product, please contact your local Civic Office, your household waste disposal service or Eco-Adapt.

2. General description



The **Power-Elec 6** is a communicating electrical sub-metering solution that can measure up to **6 three-phase** or **18 single-phase** inputs (or a combination of both) in the same control cabinet, making it an ideal tool for sub-metering. It performs the functions of electric energy meter (active, reactive energy, power factor) and integrates communication interfaces to a supervision solution.

It generates its own Wi-Fi network to allow quick and easy configuration from a computer or a smartphone.

Depending on the configuration, the metering data is transmitted in Modbus TCP, BACnet/IP, via the Ethernet interface or wirelessly according to the LoraWAN specification.

The main advantages of the solution are real-estate optimization in the cabinets, reduced installation time and cost reduction.

3. Installation

3.1 How to install the Power-Elec-6 product in the electrical cabinet

- The Power-Elec 6 meter must be installed in a mechanical and electrical, fire resistant, enclosure (electrical cabinet).
- In the cabinet, find a 6 DIN modules wide available space on DIN rail in the low voltage switchboard. If there is no remaining space, please install a separate cabinet with DIN rails.
- Transformers are provided with 2.5m long cables, make sure they can be connected to the Power-Elec 6 once it is installed.
- Find an available circuit breaker to connect acquisition voltage wires and power supply wire. If you only have to measure single phase signals on the same phase, you can use a single phase circuit breaker, else a 3P+N circuit breaker is required.
- Mount the Power-Elec 6 on the DIN rail.

3.2 How to connect voltage inputs

- Before any operation on the 4-pin connector, please check that the circuit is isolated
- Voltage connections to Power-Elec 6 use the provided 4-pin connector. Cables used between the circuit breaker and this connector must be rate for 400V and must be less than 1.50m long. Current flowing in these cables is very low.
- To protect the Power-Elec 6 against surges, you must install a surge arrester upstream of the meter. Please read the appendix to choose correctly your surge arrester.

- Install a circuit breaker (single phase or three-phase) upstream of the meter, it will allow you to cut the power. It must be placed so as to be easily reachable.
- Connect wires L1, L2, L3 and N to the 4-pin connector terminals to supply power to the meter and measure the voltage.
    - If phases L2 and L3 are present in the switchboard it is recommended to connect them even if they are not required for metering in single phase configuration.
    - If phases L2 et L3 are not present in the switchboard, connect the neutral wire to terminals L2 and L3 of the 4-pin connector (see wiring diagram in section 3.4).

3. Installation

- It is mandatory to connect phases L2 and L3 for metering in three-phase configuration. Make sure to correctly identify the phases and connect them in the direct sequence L1 ➔ L2 ➔ L3.
- Plug the 4-pin connector in the Power-Elec 6 meter.

Once installation of voltage acquisition is done, please check that

- Isolation between the different circuits is maintained. To do so please make sure that cables with dangerous voltage cannot enter in contact with Ethernet, SMA and USB connectors
- L1, L2 and L3 terminals and external circuits connected to these terminals are not reachable neither linked to other reachable parts.

3.3 How to install current transformer

In the Power Adapt's solution, there are two options to measure the current (based on two criteria: the maximum measured current and the current conductors' section):

A - Current transformers
B - Rogowski coils

These devices are grouped by three and you can connect to the Power Elec 6 them through a RJ45 connector. You can therefore measure one three phase signal or three single phase signals with one RJ45 entrance.
The Power Elec 6 has 6 RJ45 entrances, it can measure 18 single phase signals or 6 three phase signals.

The current measuring devices must be placed be placed around the current conductors as shown below. RJ45 can be linked to one of the six inputs of the Power-Elec 6.

- Only use current transformers and Rogowski coils that are listed in appendix. The RJ45 entrances are not designed to be connected to transformers that are not equipped with internal protection.
- You must not plug telecommunication network into the RJ 45 entrances. That could damage the product in case of surge on the network.

A. Use of opened current transformer

Transformers can be clipped around current conductors. You don't have to isolate the installation. Transformers close with a double clip (you must hear 2 clips to be sure it is correctly closed).

You must respect the phase order, transformers of one RJ45 group are numbered from 1 to 3

Transformers can then be blocked with clamping rings put on each side of the transformer like the adjacent picture.

Note: transformers assembly direction is indicated below of the transformers, the arrow's direction goes from the supply to the equipment. Please read the appendix for more details.

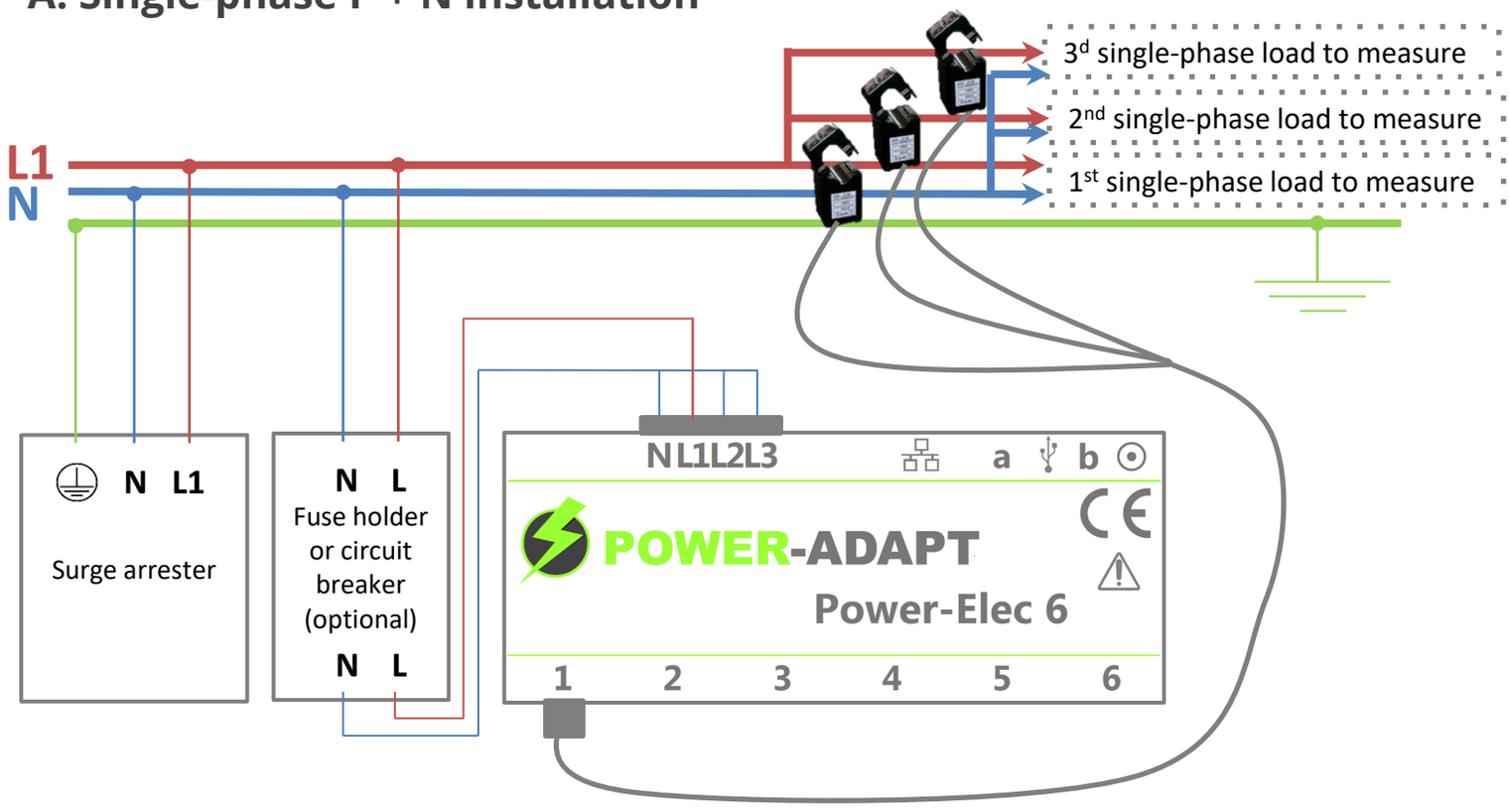
B. Use of Rogowski coil

Rogowski coils must be around current conductors, screw it to close it.

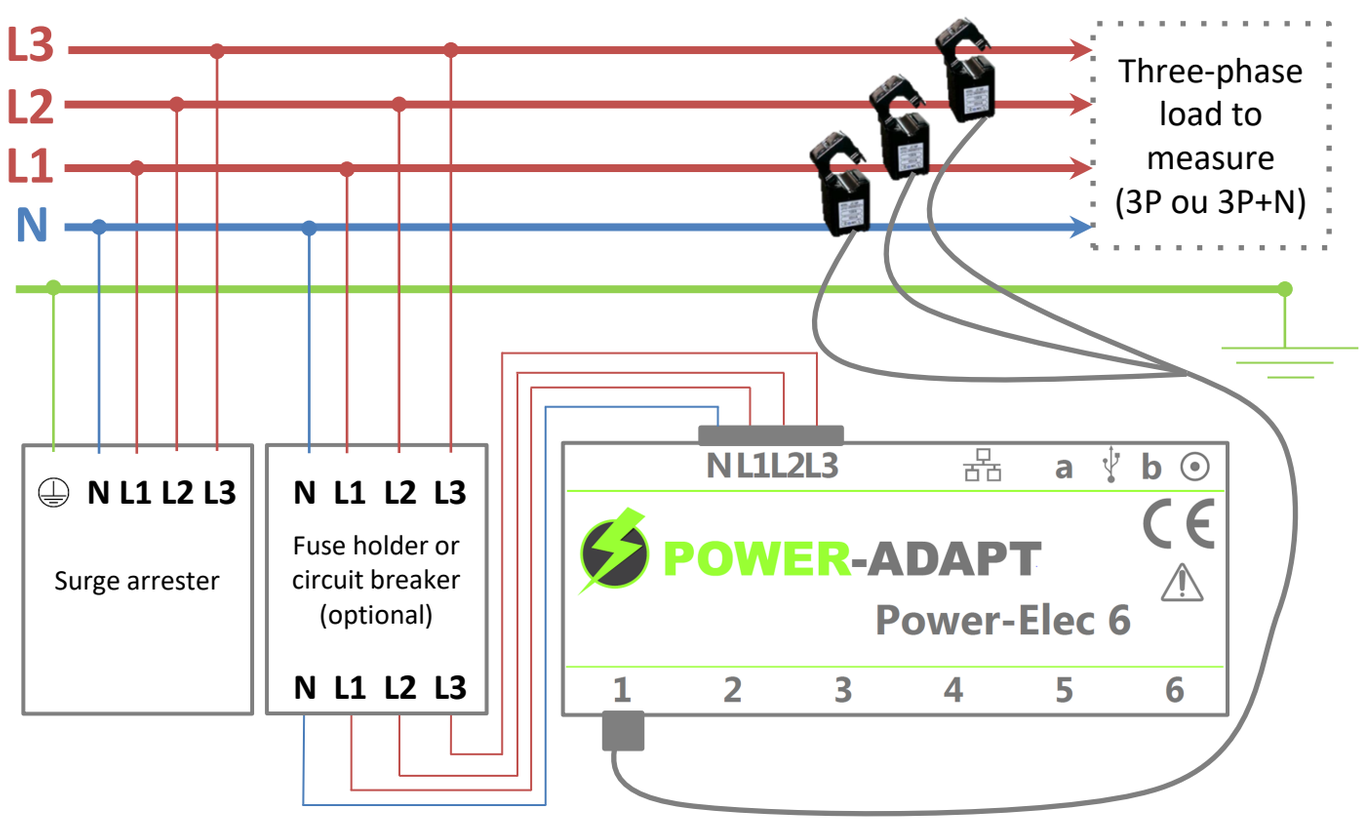
Please try to put the cable in the center of the coils

3.4 Circuit specificity

A. Single-phase P + N installation



B. Three-phase 3P + N installation



3.5 Communication interfaces

A. Wi-Fi direct

Power-Elec 6 has its own Wi-Fi hotspot. It allows you to configure it with a laptop, a tablet or a smartphone.

Wi-Fi is automatically activated. It is working less than one minute after plugging the power supply.

B. LoRaWAN

To use the LoRaWAN radio transmission, you must connect a 868 MHz antenna to the SMA connector. It is advised to use a remote antenna when Power Elec 6 is installed in a close metallic cabinet because radio signal may be perturbed by the Faraday cage effect.

Process for LoRaWAN software activation is explained in the next chapter

C. Ethernet Modbus TCP

If you want to use Modbus TCP to transmit data, you must connect Power-Elec 6 to Ethernet network with RJ45 cable. Software configuration is necessary to enable Ethernet communication. You can do this on the Wi-Fi interface.

D. Modbus RTU

Data can also be transmitted with Modbus RTU with a RS-485 link via USB port.

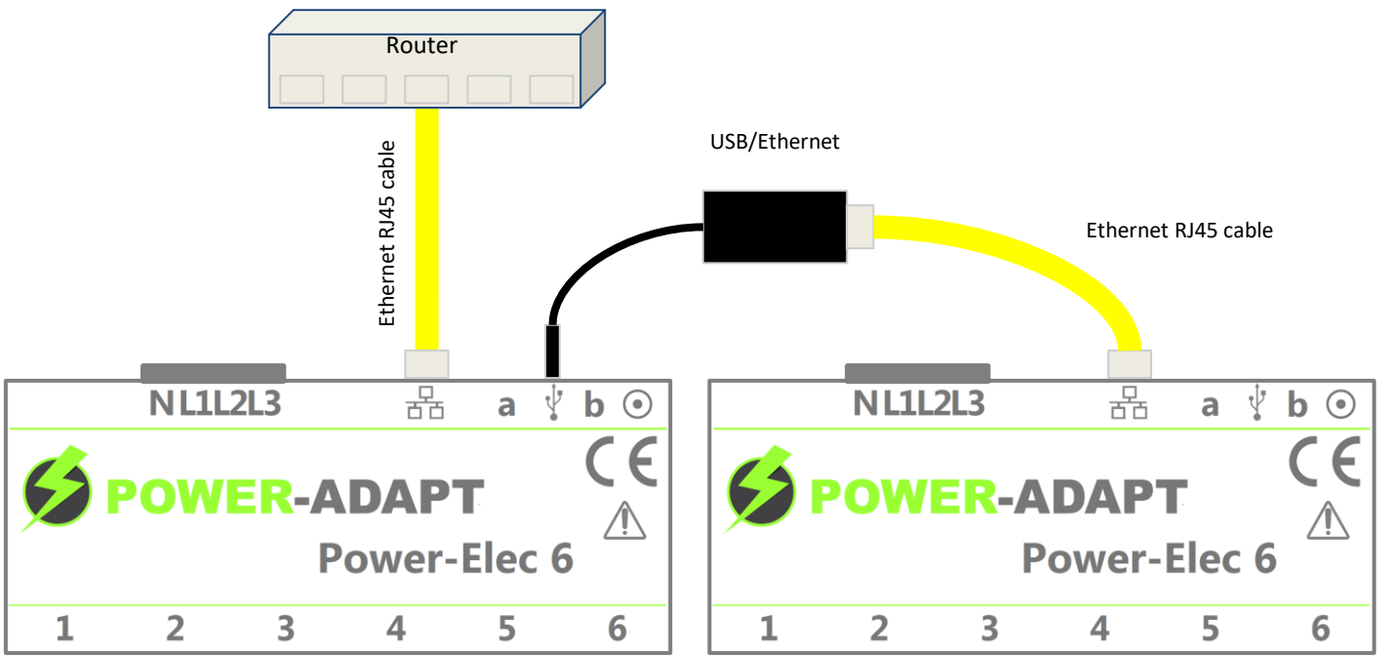
E. BACnet/IP

Data can be transmitted using the BACnet/IP protocol. It is necessary to connect the Power-Elec 6 to the ethernet network with a RJ45 cable and the ethernet input.

Software configuration is necessary to enable Ethernet communication. You can do this on the Wi-Fi interface.

F. USB Ethernet network adapter

You can easily make an ethernet bridge with a USB/Ethernet adapter (USB 2.0 type A - RJ45 10/100 Mbps), plugged on the USB interface. This way, you can connect several devices on the same network.



4. Configuration

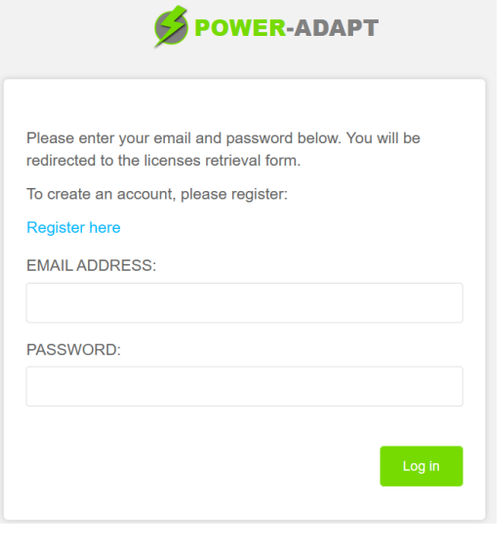
4.1 Licences download

Power-Elec licenses allow the activation of standard or expert functions and LoRa connectivity. They activate from 1 to 6 Power-Elec connectors.

Power-Elec default configuration is PE3-Eth, which means that connectors 4, 5 and 6 are not available. LoRa connectivity and Expert functions are disbled in this configuration.

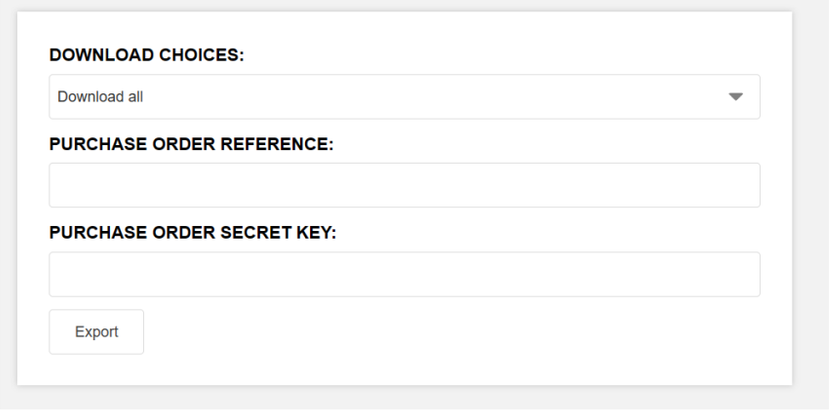
To download all the Power-Elec licenses related to your order, go to the licence download web page.

The following login page is displayed :



If you don't have an account, you can click on **Register here** to open the register form. You will need a purchase order reference and the secret code which figures on your delivery document. Purchase order reference must be the Eco-Adapt reference to the **BC-20xx-xxx** format.

Once you are connected, the following form must be filled to retreive the licenses or the sensors informations.



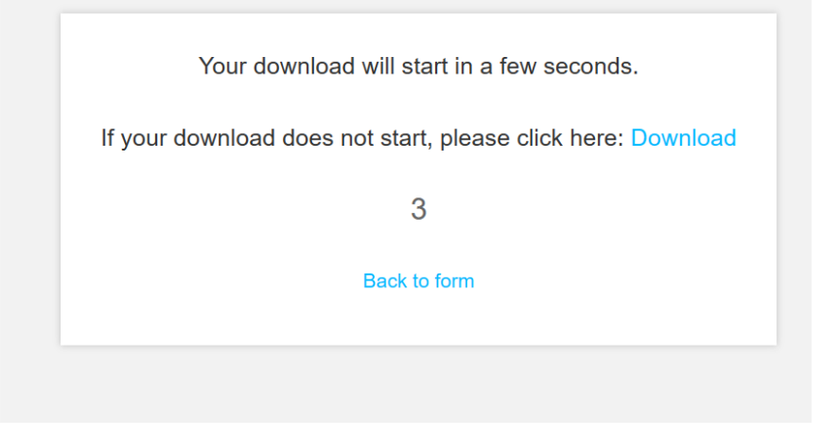
4. Configuration

Three types of download are available :

- **Sensor list** : an excel file containing several information about your sensors :
  - Serial number
  - Lora DEVEUI, APPEUI and APPKEY
  - MAC address
  - Feature set (standard or expert)
  - Connector number
  - LoRa available or not
  - Purchase order reference
- **License files** : a folder containing all the licenses related to the purchase order reference.
- **Download all** : a folder containing both sensor list file and the licenses.

Fill the Purchase order reference (BC-20xx-xxx) and the secret code.

The download page then appears. Download will start within a few seconds.



You can then click on **Back to form** to retreive licenses from other purchase orders.

4. Configuration

To configure Power-Elec 6, you need an internet browser on a laptop, a tablet or a smartphone.

When you plug the power supply, the state LED "a" flashes GREEN after 5 seconds and the Power-Elec 6 initializes in less than one minute. The system is ready as soon as "a" LED lights up in GREEN. Once finished, you will have access to the configuration interface.

4.2 Wi-Fi connection

Wi-Fi network name looks like PE6-******** where the last 8 characters are the serial number last 8 characters. You can find the serial number on the case of Power Elec 6.

For instance, for the Power-Elec 6 with the following serial number (SN): 37381234 56ABCDEF:

- The corresponding Wi-Fi network name is PE6-56abcdef
- Wi-Fi password is: pe6admin

A. Connection with QR Code

You can use an app to scan the QR code (in the front of the Power-Elec 6) with your smartphone. You will be automatically connected on the Wi-Fi network.

Once connected, go to the following address: http://powerelec.net. On the first page, you can access to the following menus :

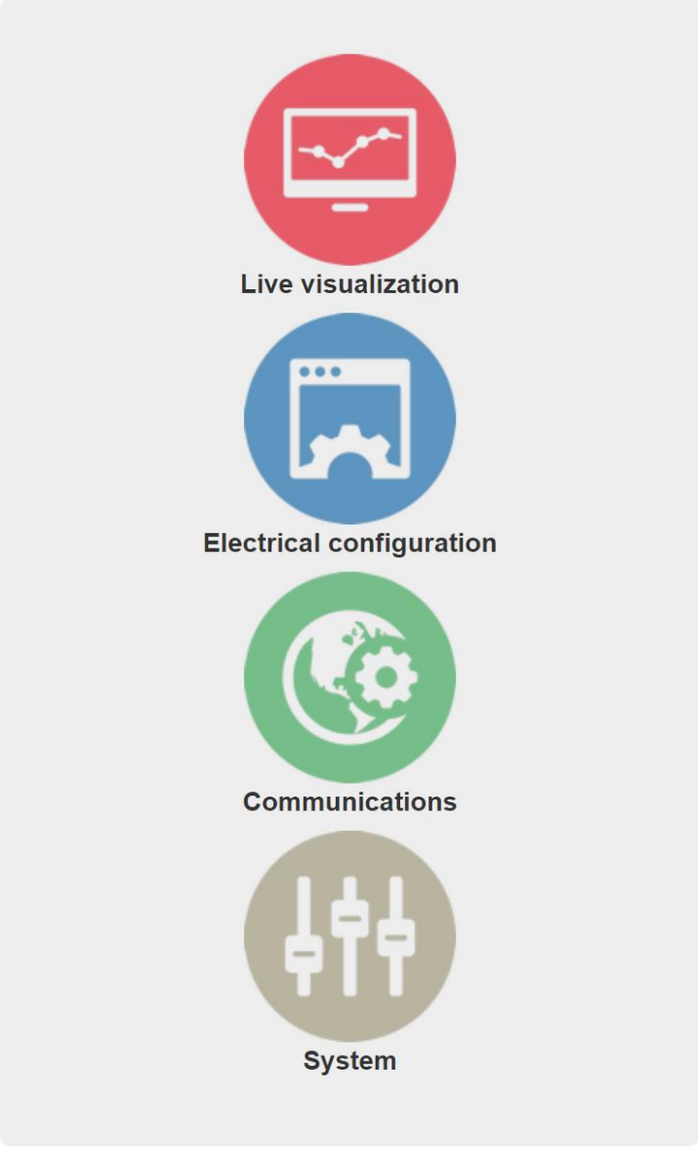
- Menu "**Live visualization**" to visualize instant measure and expert key indicators
- Menu "**Electrical configuration**" to manage electrical configuration
- Menu "**Communications**" to monitor the communications interfaces
- Menu "**System**" to access and modify information of the system

B. Authentication

- The access for "**Electrical configuration"**, **"Communications"** et **"System**" is restricted. A pop-up will ask you for ID and password :
- ID: admin
- password: adminpe6

4. Configuration

Home page for the web interface, you can see the differents menus.



4. Configuration

"**Electrical configuration**" gives you access to the setting of the measuring unit:

- Electrical measurement
- Advanced features

"**Communications**" gives you access to the radio and communication settings:

- Radio
- Ethernet
- Wi-Fi
- Modbus
- BACnet

"**System**" is for all the others settings of the measuring unit:

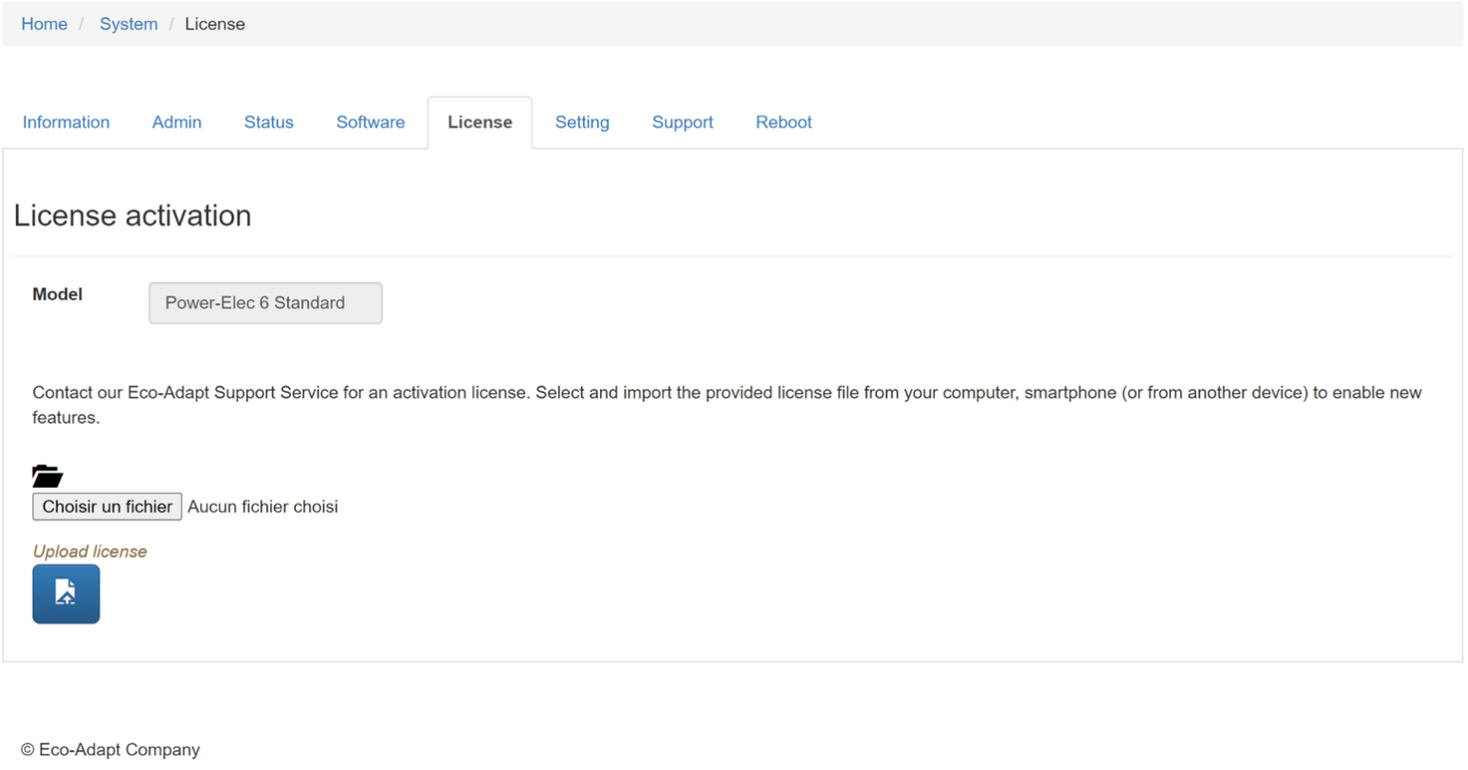
- Information
- License
- Status
- Firmware
- Settings
- Support
- Restart

You can come back to the home page by clicking on the house or the logo.

4. Configuration

4.3 License activation

The license is activate in the **System** menu in the **license** tab. You will need the license from the file downloaded in section **4.1**.



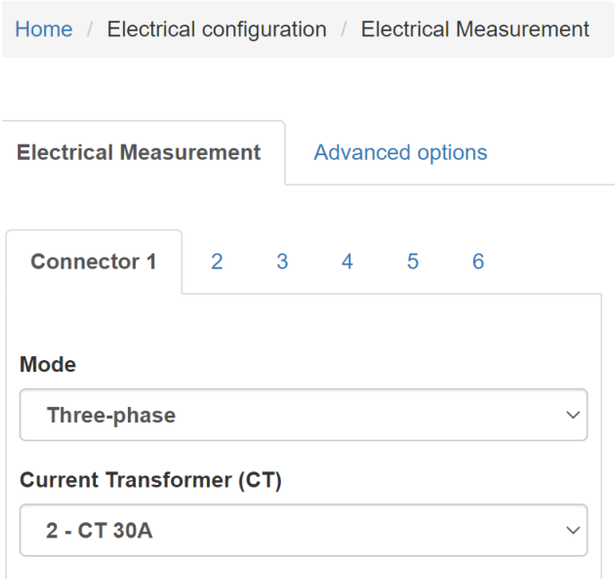
Click on **Choisir un fichier**, or **Choose file**, then **Upload license.**

4. Configuration

4.4 Circuit configuration with Standard license

Click on "**Electrical configuration**" to access to the configuration of the 6 inputs:

- Choose the connector mode:
  - Single phase
  - Three-phase (or with Neutral)
  - Three-phase balanced (or with Neutral)
  - Three-phase with potential transformer
- Choose the kind of current transformer:
  - CT 10mm 5A
  - CT 10mm 30A
  - CT 10mm 70A
  - CT 16mm 100A
  - CT 24mm 200A
  - CT 36mm 400A
  - Coil Rogowski

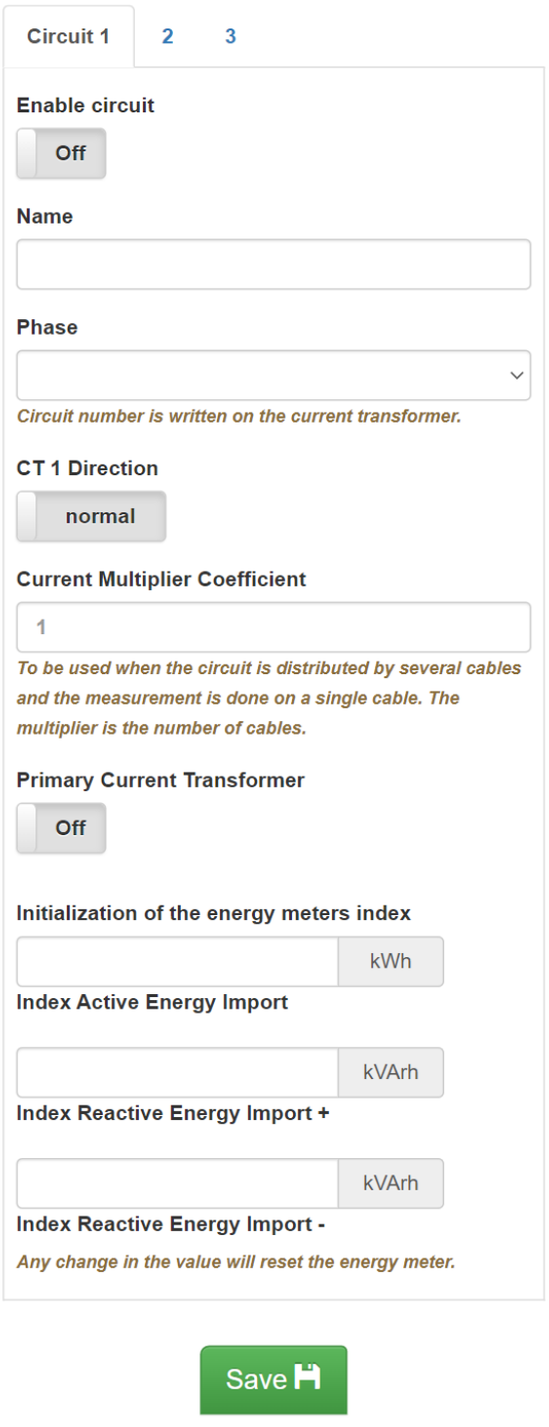


- Enable the circuit with the button On/Off and choose the name of the connector with only alphanumerics characters.
- Change the CT direction if the current transformer was mount in the wrong way.
- indicate the current multiplier coefficient. You must use it when the signal is distributed by several cables and that you measuring it only with one cable. The coefficient is equal to the number of cables (Default: 1).
- Select the phase for the associated channel:
  - In three-phase balanced/single-phase mode: The selected phase corresponds to the phase measured by the current transformer of the channel.

    For example: For the single-phase circuit supplied on phase 1 and configured on connector 2 channel 3, select phase 1 which is measured by current transformer 3 on connector 2.
- If necessary, initialize the value of the active and reactive energy index offset before starting the electrical measurements (Optional option. By default, the energy indices are initialized to 0)
- Confirm the configuration by clicking on "Save"

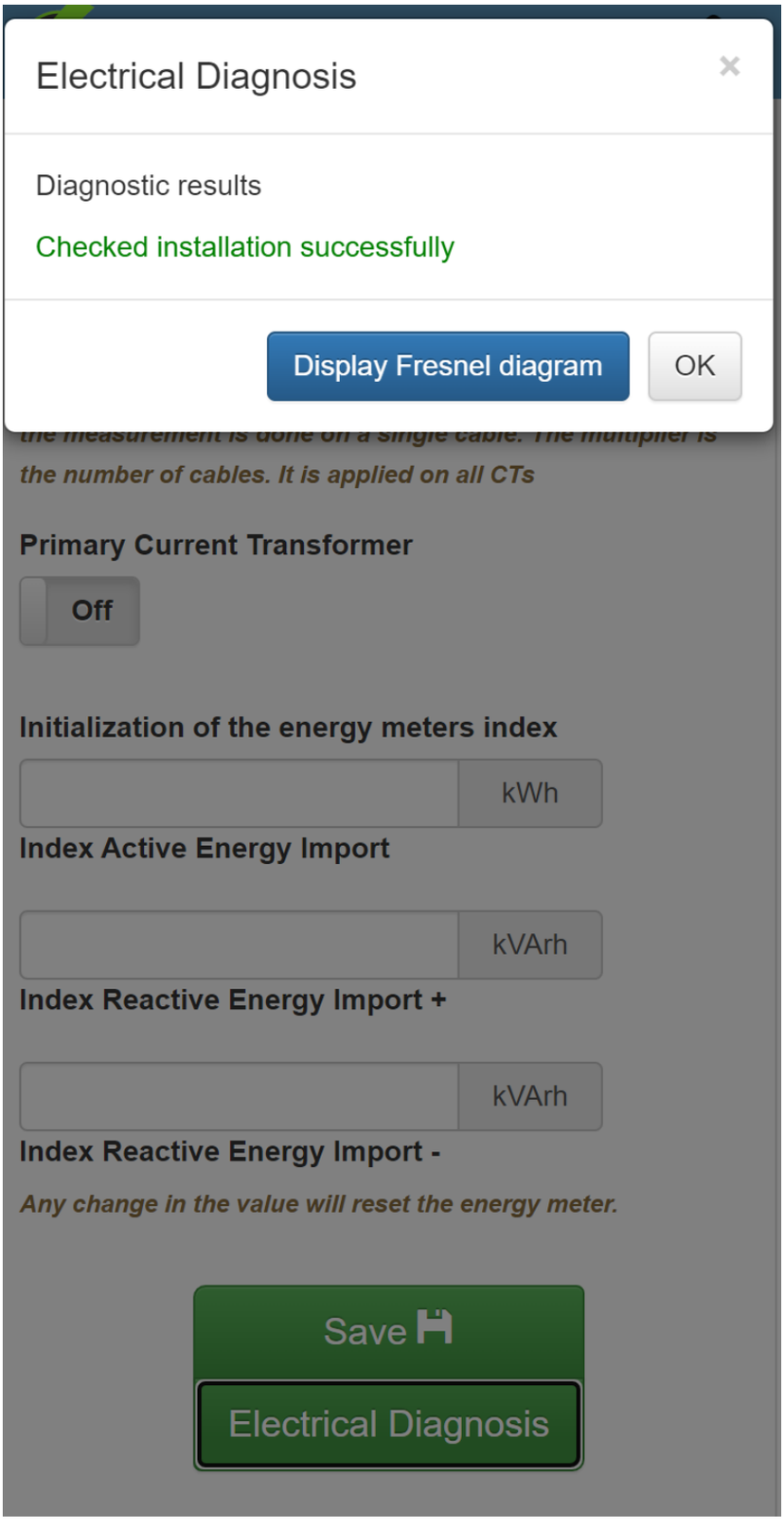
4. Configuration

In the example below, it is possible to configure up to 3 electrical inputs with the Single Phase Mode. In three-phase configuration, only one input can be configured.



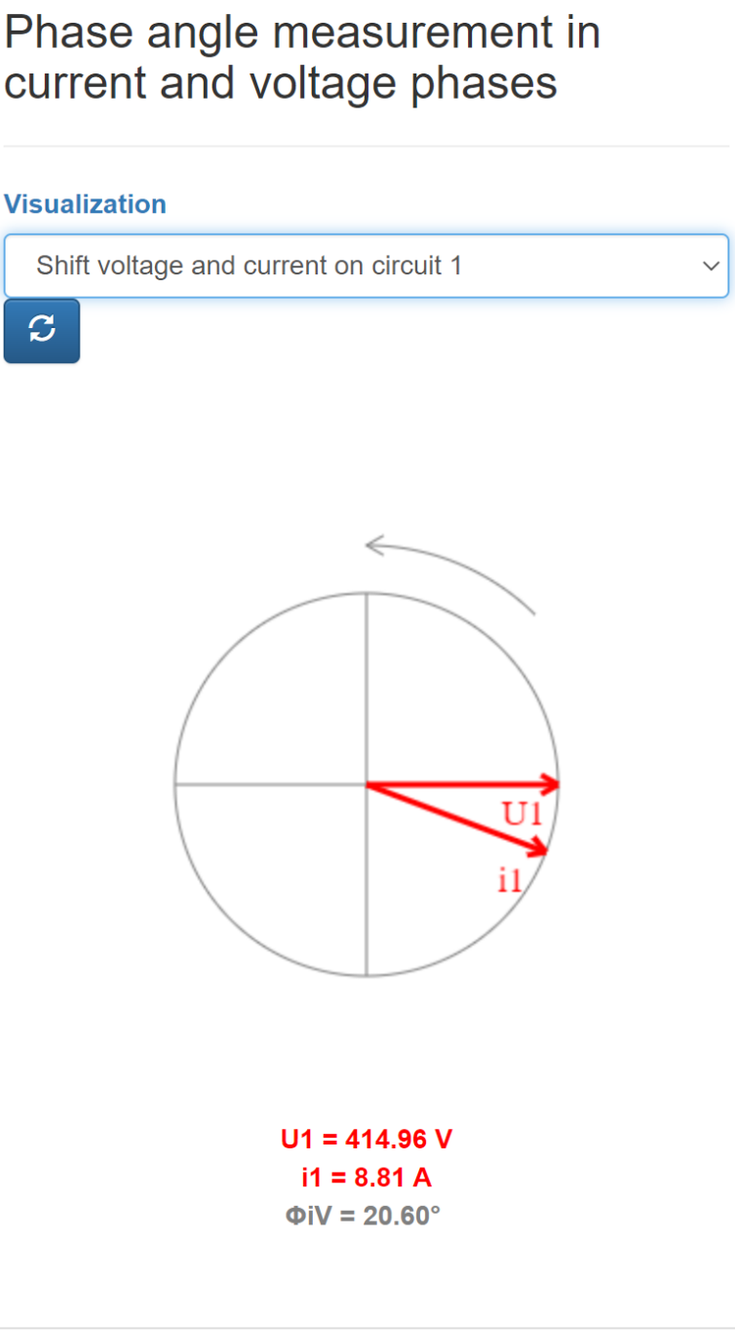
4. Configuration

After saving, you have the possibility to check your electrical installation via our diagnostic application by clicking on the button "Electrical Diagnosis". It allows you to analyze the phase shift of the L1 L2 L3 phases as well as the current transformers and detects connection errors.



4. Configuration

For more details on the phase shift and the voltage and current measurements, click on "Show Fresnel diagram". The application displays a vector representation of phase voltages and currents on a Fresnel diagram. It brings you an assistance on the verification of your electrical connections.



4. Configuration

The Power-Elec central unit offers advanced options on voltages and currents.

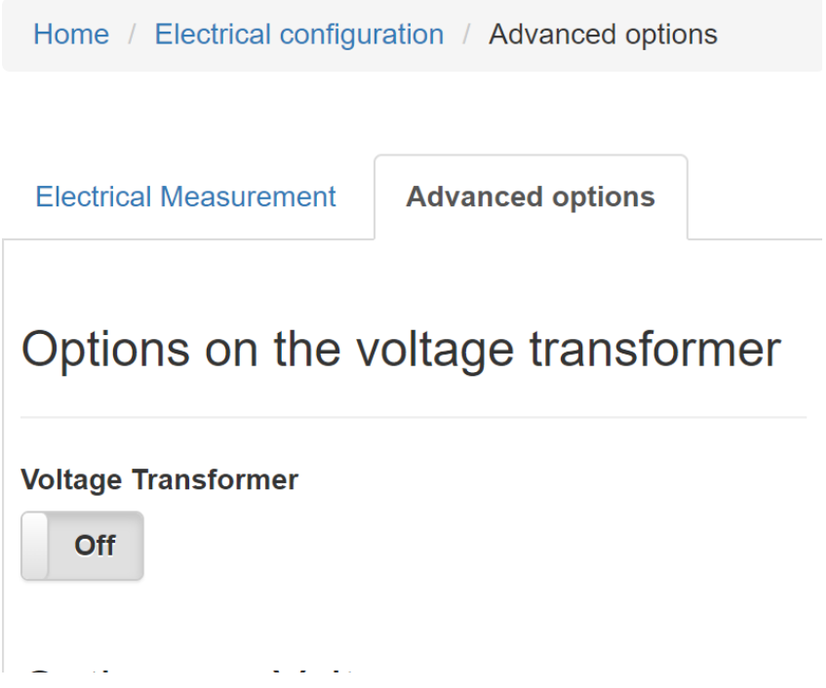
Click on the "**Advanced options**" tab to access the different options.

In this section, all the options are applicable to all the connectors of the Power-Elec control unit.

Options on the potential transformer

The first option allows you to activate the potential transformer option in the case of a three-phase circuit configuration.

Before making any electrical connections, contact Eco-Adapt support and consult the document "Note PE6 Three-phase potential transformer".

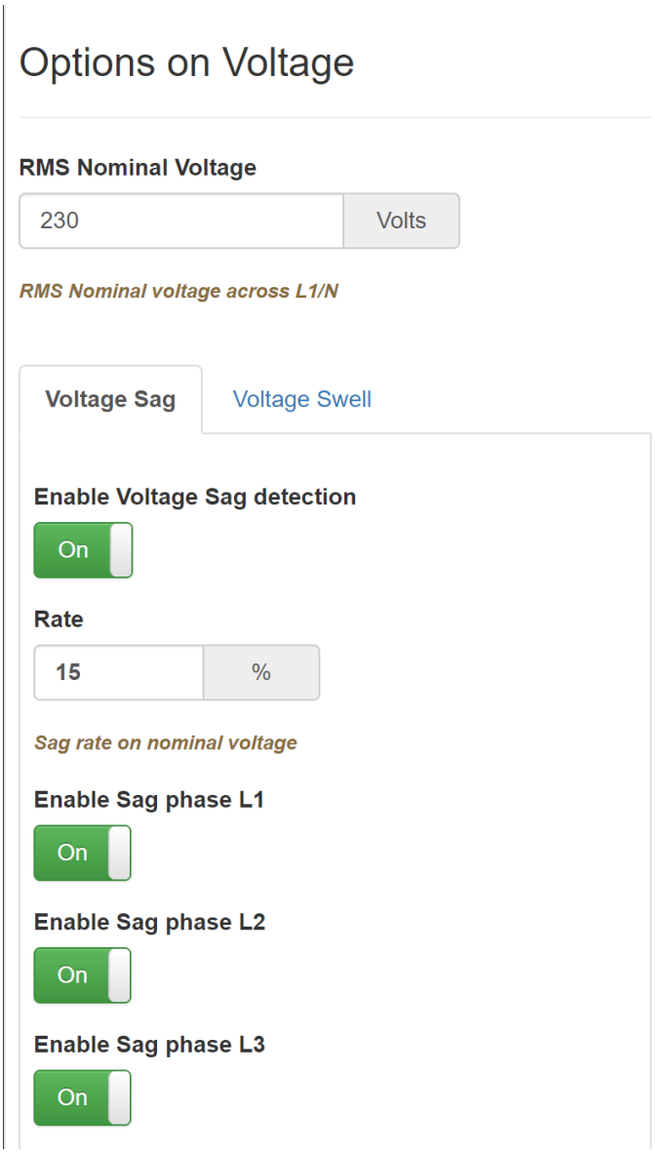


4. Configuration

Options on the voltage transformer

The voltage options allow the detection of voltage sag and swell with respect to an instantaneous measured voltage.
The reference voltage is based on the nominal RMS voltage and the limiting rate you define.

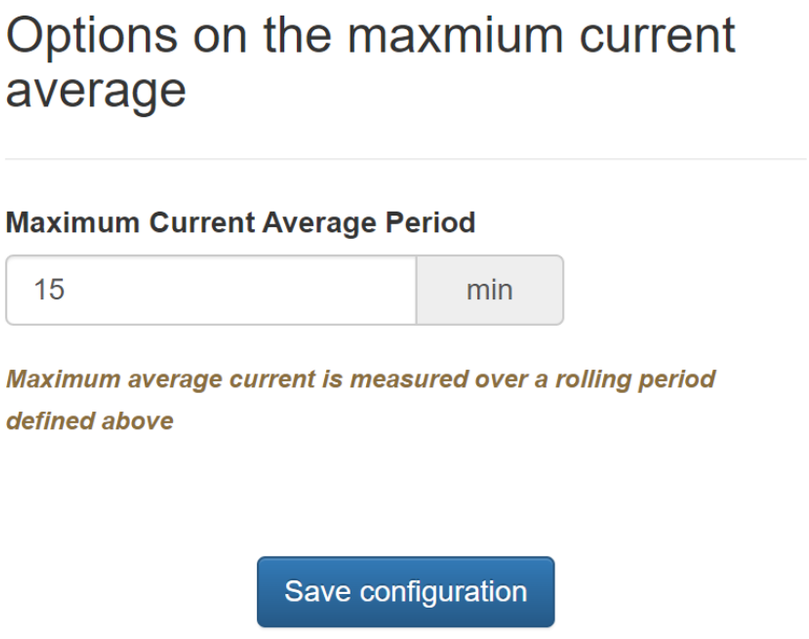
In the case of a nominal voltage RMS at 230 Volts and a rate of 15%, the central unit will detect the voltage sag in instantaneous value below 276.48 Volts.



4. Configuration

Options on the maximum current average

This option allows the calculation of the maximum average current on each electrical inputs over a sliding period defined by the user.
This option can be activated in the Expert parameters (**subject to activation of the Expert license**) of an electrical input under the "**Electrical measurement**" tab.



4. Configuration

4.5 Circuit configuration with Expert license

A. Schema of the connectors configuration

In the Expert version, the configuration of the connectors depends on the number of three-phase circuits measured by the Power-Elec central unit and the number of connectors activated by the license.

The configuration diagram of the connectors is visible in the "**Electrical configuration**" menu under the "**Electrical measurement**" tab, by clicking on the setting button ⚙ in the "Type" field.

By default, when a three-phase circuit is measured, it will be a circuit using ***3 current transformers*** for this electrical input. Conversely, for a single-phase or balanced three-phase circuit, we will speak of a circuit with ***1 current transformer*** for this electrical input.

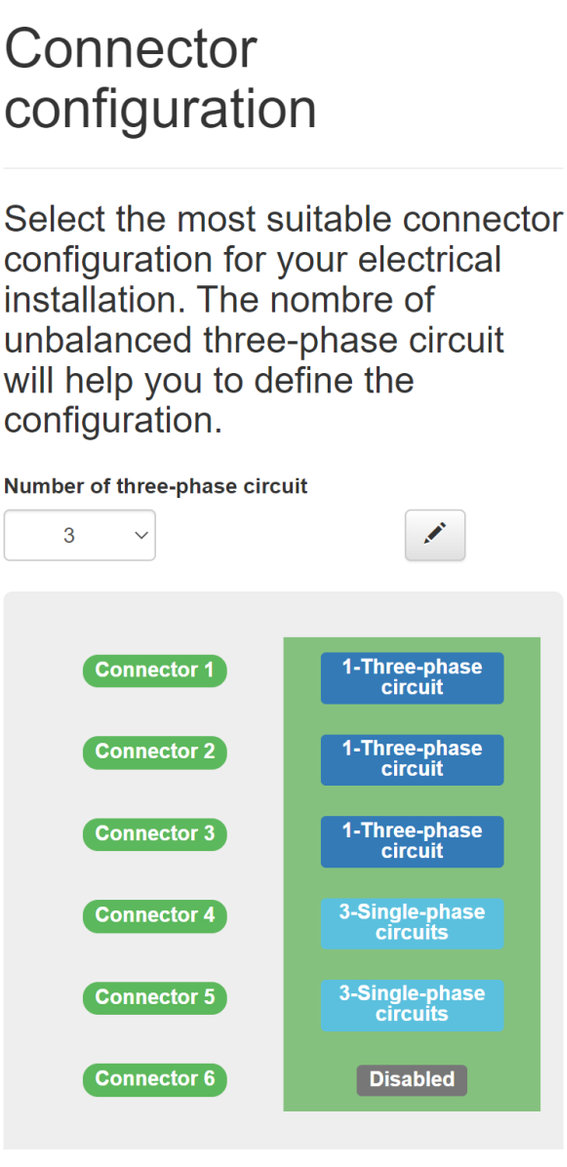
Before starting to configure the electrical inputs, always remember to reserve the first connectors 1 to 6 for three-phase circuits (or with neutral or with potential transformer).

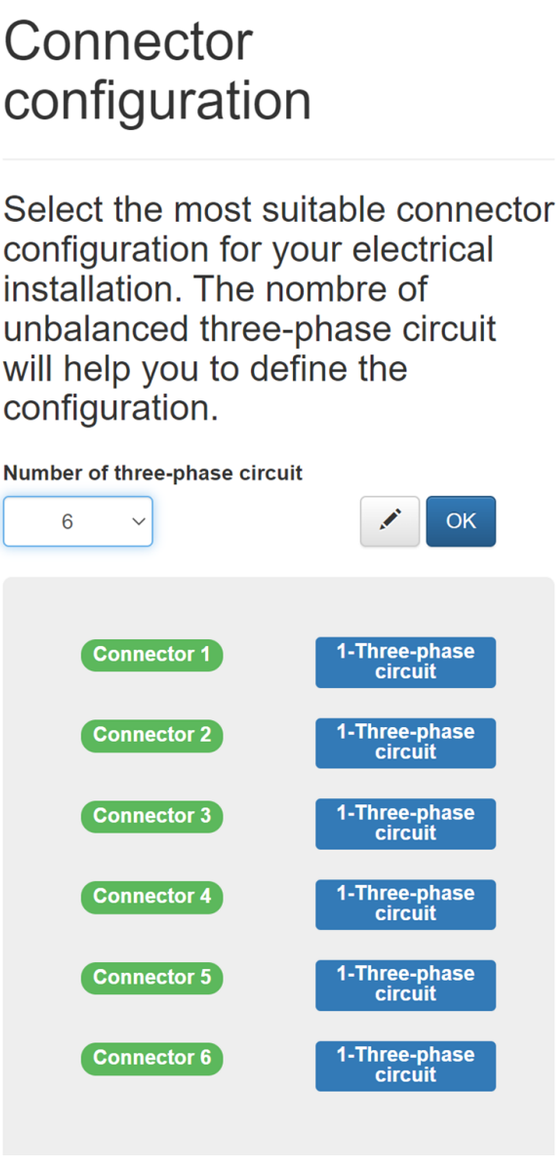
4. Configuration

There are 6 configuration schemes for the connectors depending on the number of three-phase circuits.

The other connectors are automatically disabled or pre-configured with only **1 current transformer** (Mode: Single phase, balanced three phase or balanced three phase with neutral).

An example of configuration is given below, for 3 and 6 connectors configured in three-phase:





4. Configuration

B. Settings Expert configuration

The configuration of the Expert parameters is made in the "**Electrical configuration**" menu under the "**Electrical measurement**" tab.

Choose the connector mode according to the connector configuration diagram:

- 1 current transformer per input:
  - single phase
  - Balanced three-phase (or with Neutral)

or

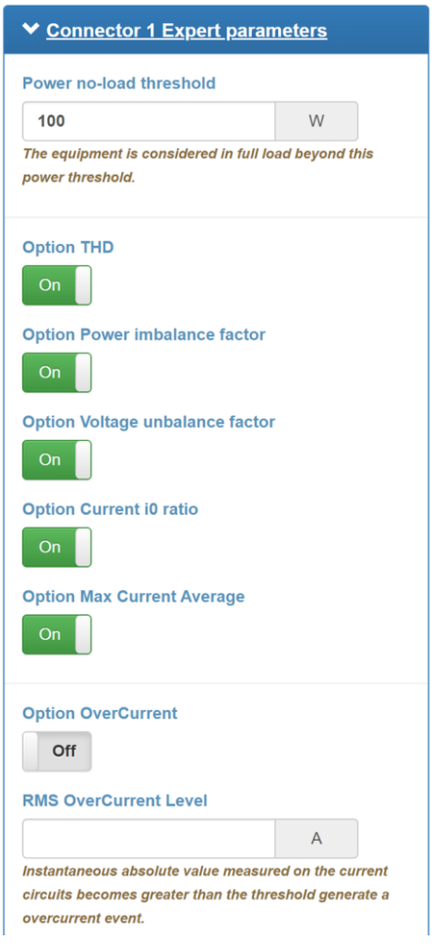
- 3 current transformer per input:
  - Three-phase (or with Neutral)
  - Three-phase with voltage transformer

4. Configuration

Expert options can be activated in the "Expert Settings Connector / Start" section

The Maximum Average Current option determines the maximum average current for a connector channel over a predefined sliding period.

The Overcurrent option detects all instantaneous overcurrents, on a channel of the connector, greater than the Overcurrent Threshold (RMS). This threshold is identical for all channels 1, 2 and 3 of the connector.



The following Expert options are based on the Power No Load threshold, which defines the power threshold beyond which the supervised equipment is considered to be on load:

The THD option calculates the average and instantaneous harmonic distortion rate when the load exceeds the Power No Load Threshold.

The Power Unbalance Rate option calculates the power unbalance rate for a three-phase circuit when the load exceeds the Standby Power Threshold.

The Voltage Unbalance Rate option calculates the voltage unbalance rate for a three-phase circuit when the load exceeds the Standby Power Threshold.

The Current Ratio i0 option calculates the ratio of neutral current to average current for a three-phase circuit when the load exceeds the Standby Power Threshold.

The Run Time option counts the hours of operational run time when the load exceeds the Standby Power Threshold.

The Number of Starts option saves the number of start cycles logged when the load exceeds the Standby Power Threshold.

All overcurrent, run time and start cycle counters can be reset.

4. Configuration

4.6 LoRaWAN configuration

On the web configuration interface, you can access Radio service with the button “Radio“ You can activate it with the button On/Off.

- Choose the Radio protocol (default LoRa)
- Choose the Radio frequency (default 868 Mhz in Europe EU 868
- Choose the transmission Radio period for the aimed granularity (10min, 15min, 20min, 30min, 1h, 2h, 4h - default 10 minutes)
- Choose the kind of data you want to transmit on the transmission Radio profile
    - Send only ACTIVE energy index (PT 10 minutes)
    - Send alternatively ACTIVE and REACTIVE energy index (PT 20 minutes)
    - Send Expert Data (**Only if you have license**)
- Modify or maintain the Lora App Key : 16 bytes hexa, separated by “:”
- Modify or maintain the ID LoRa App EUI, by default 45:43:41:5F:50:45:36:6E

  The modification of the key or the ID can only be made when Radio is not activated Off.
- Confirm the Radio service activation with the button: “**Enregistrer la configuration”**

Wait few seconds during the connection to the LoRa network.

The ORANGE “b” LED lights up and flashes few seconds during the connection.

When the connection succeeds, the following message appears on the web interface :

“Connected to the LoRa Network”. The ORANGE “b” LED stays lighted up.

As soon as this first connection to the network is established, the Radio service will automatically connect to the LoRa network in case of restart of the Power-Elec unit or power failure.

If it doesn’t manage to connect to LoRa network when you activates the radio service on the web interface, the message “Non connecté au réseau LoRa” appears. Radio service is disable and ORANGE “ LED switches off.

You can try to do it again if necessary. Please check the connection SMA and the kind of antenna that is used if the problem persists.

* In transmission profile ‘index d’énergie active et réactive the active and reactive energy index are sent alternatively every 20 minutes

4. Configuration

The LoRa radio service transmits energy indexes in 10-minute points and also transmits Expert data (***subject to activation of the Expert license***) on our Cloud Power-Adapt platform.

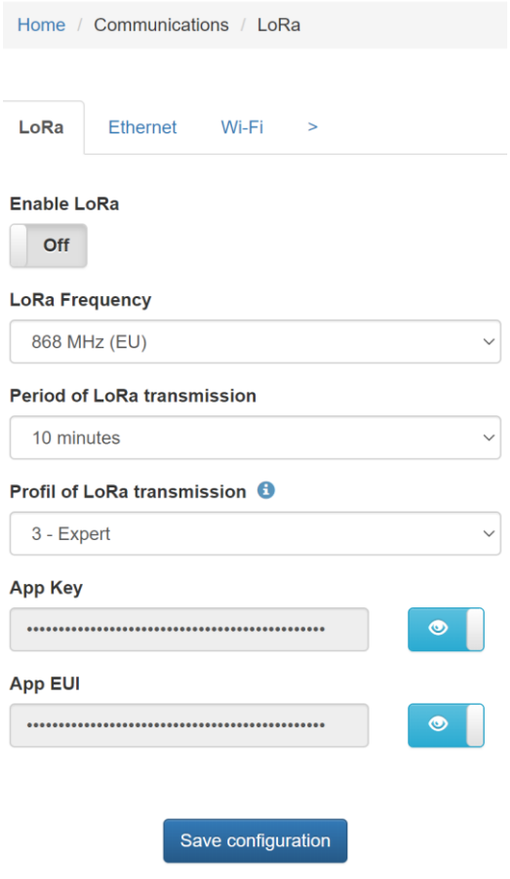
The frequency of sending Expert data depends on the configuration scheme of the connectors.

The LoRa radio service sends several Expert indicators on the operational status and electrical distribution of the feeders by transmitting:

- The duration of operation since the start was activated (hours)
- The number of start cycles since the start was activated
- The number of occurrences of detected voltage dips (sag)
- The number of occurrences of detected overvoltage (swell)
- The detection of a circuit breaker overload since the last transmission
- The average maximum current over a predefined period (Amps)
- The average harmonic distortion rate (%)

For three-phase inputs configuration, the LoRa radio service transmits more information including:

- The power imbalance rate (%)
- The voltage imbalance ratio (%)
- The ratio of neutral current to average current (%)



4. Configuration

4.7 Ethernet configuration

A. IP Ethernet static configuration

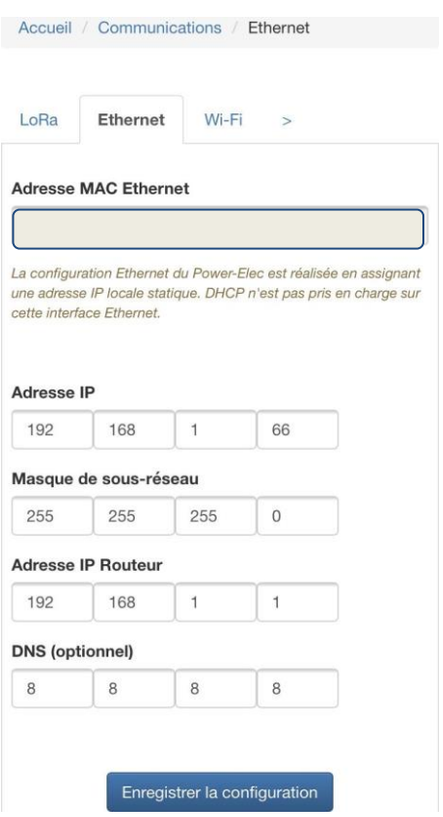
You can change Ethernet IPv4 connection configuration on the Power-Elec-6 configuration interface. To do so, you have to connect to the Wi-Fi network of Power-Elec-6 and click on “Ethernet” button in the configuration interface.

Ethernet interface accept only static or manual IP configuration. DHCP protocol isn’t tolerated on the Ethernet interface. Default configuration for this IP address: 192.168.1.66 for all the Power-Elec in the local subnet 192.168.1.0/24

If you want to change the IP address or the local subnet, you have to change the following parameters:

- IP address
- Network subnet mask
- Gateway IP address
- DNS server address (optional)

Confirm the configuration and wait few seconds while the configuration is updating.
Connect the Power-Elec-6 to your local subnet with an Ethernet RJ45 cable. You can now access to the configuration interface through IP address by using the following URL: http://192.168.1.66 or with the new IP address you chose: http://*.*.*.*



4. Configuration

B. Ethernet wired direct connection

Ethernet IP¨address is ***192.168.1.66*** for all Power-Elec in the local subnet **192.168.1.0/24** (default configuration)

To connect to the Power-Elec-6 via Ethernet without router or gateway, you have to change IPv4 configuration of your computers using MANUAL mode to configure it in the same subnetwork than the Power-Elec-6.

For instance, configure your network interface as following:
IP Address: 192.168.1.10
Subnetwork mask: 255.255.255.0
Default gateway: 192.168.1.1

You can access to the configuration interface through Ethernet interface with RJ45 Ethernet cable connected to your computer. To do so, use URL: http://192.168.1.66 in your web browser.

Windows 10:

1. Select Start, then Settings > Network and Internet
2. Select Manage Known Networks, choose the Ethernet network whose settings you want to change, and select Properties.
3. Under IP assignment, select Edit.
4. Under Change IP settings, choose Manual and then enable the IPv4 option.
5. To specify an IP address, in the IP Address, Subnet Prefix Length and Gateway fields, enter the IP address settings.
6. When you are finished, select Save.

Windows 8.1 ou 7:

Do one of the following:

- In Windows 8.1, click the Start button, start typing Show Network Connections, and then select Show Network Connections from the list.
- In Windows 7, open the Network Connections window by clicking the Start button and selecting Control Panel. In the search box, type adapter, and then under Network and Sharing Center, select Show Network Connections.

Right-click the Local Area Connection (Ethernet) and choose Properties.

1. Select the Network Management tab. Under This connection uses the following, select Internet Protocol version 4 (TCP/IPv4) and choose Properties.
2. To specify an IP address, select Use the following IP address, and then in the IP Address, Subnet Mask, and Default Gateway fields, enter the IP address settings.
3. When you are finished, select OK.

You can revert to the original Ethernet configuration of your computer by changing the IPv4 settings on the Network card to AUTOMATIC or DHCP mode.

4. Configuration

4.8 Wi-Fi configuration

The configuration interface of the Power-Elec 6 central unit allows you to modify the Wi-Fi IPv4 connection parameters. To do this, connect to the Power-Elec central unit via the wired or wireless network and access the "**Wi-Fi**" sub-menu in the "**Communications**" tab.

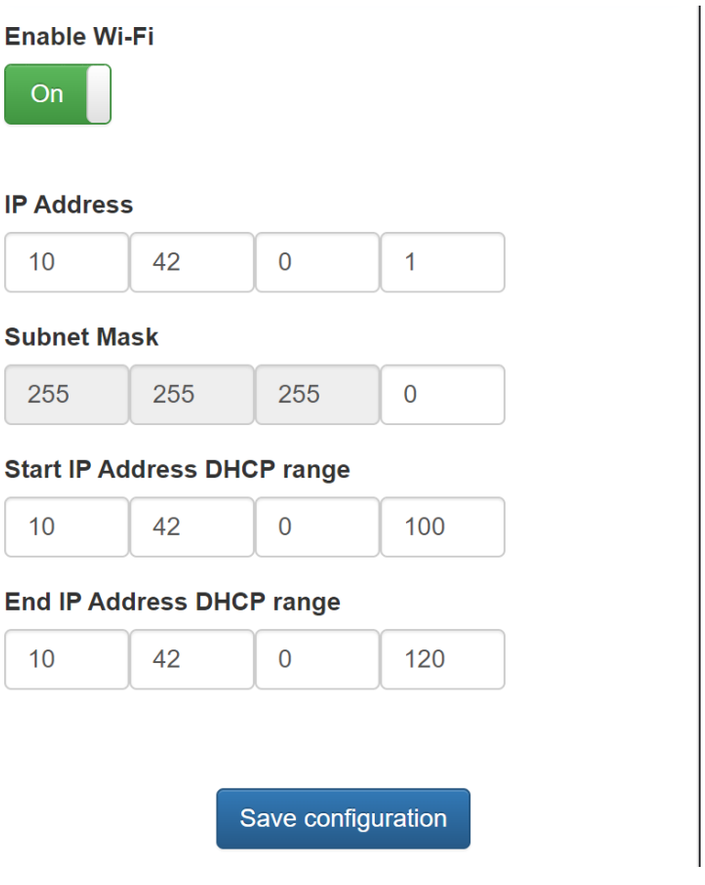
By default, the IP address is **10.42.10.1** for all the Power-Elec units in the local subnet **10.42.0.0/24**.

You have the possibility to disable the Wi-Fi network of the central unit. In this case, you can activate the Wi-Fi network again by connecting to the wired network via its Ethernet interface.

The configuration interface allows you to modify the following Wi-Fi parameters:

- *IP address*
- *Subnet mask*
- *Start IP DHCP address*
- *End IP address DHCP range*

Confirm the configuration and wait a few seconds while the settings are saved.



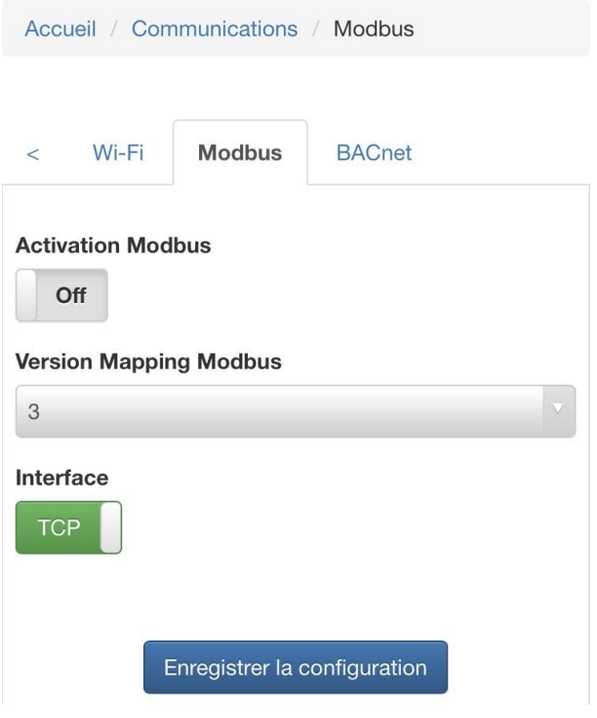
4. Configuration

4.9 Modbus TCP configuration

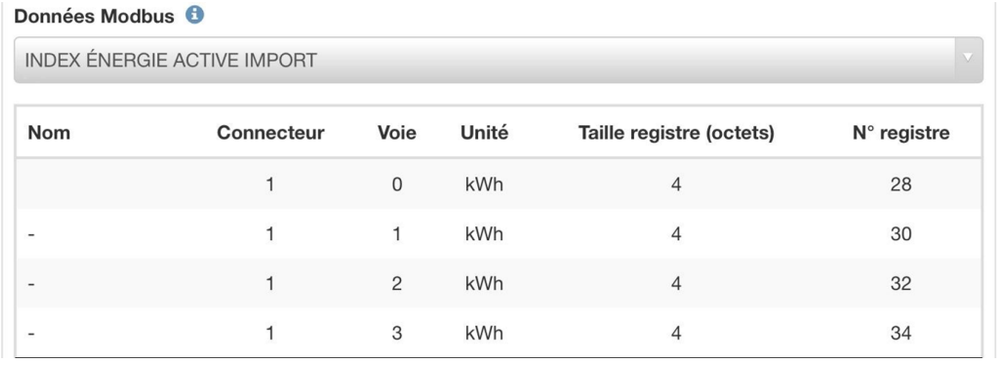
Power-Elec-6 can communicates with Modbus TCP protocol. It allows to transmit measured data through Ethernet interface.

On the web configuration interface, click on "**Modbus**" button to access Modbus service. Click on On/Off button to activate this service.

- Choose the Mapping Modbus version (version 2 or 3)
- Select Ethernet interface TCP
- Confirm Modbus TCP service with the button "**Save configuration"**



You can find a Modbus mapping table with data register addresses on the web configuration interface.



Nom	Connecteur	Voie	Unité	Taille registre (octets)	N° registre
	1	0	kWh	4	28
-	1	1	kWh	4	30
-	1	2	kWh	4	32
-	1	3	kWh	4	34

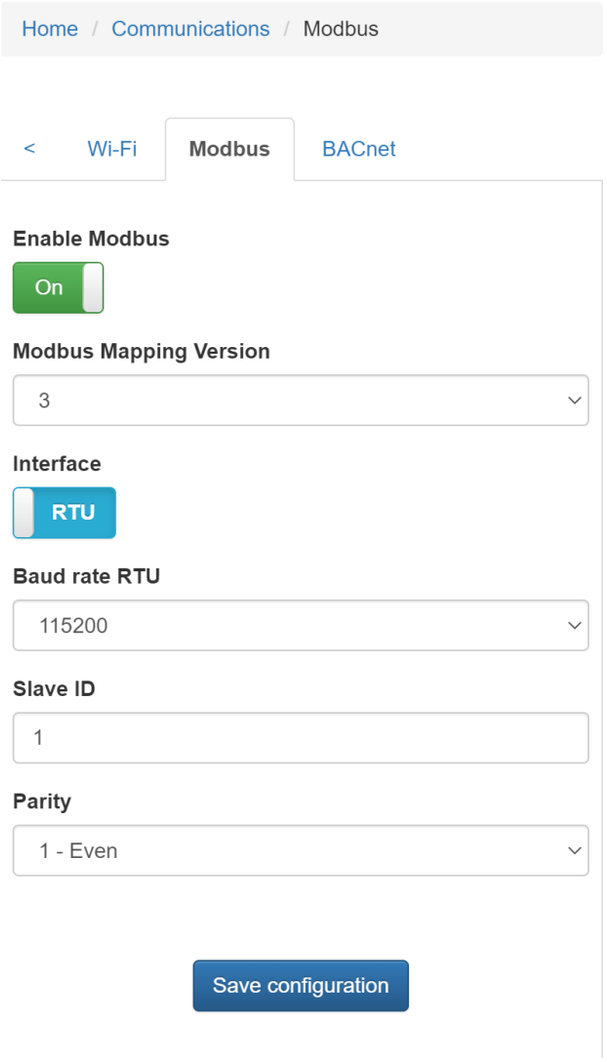
4. Configuration

4.10 Modbus RTU configuration

The Modbus protocol also works on an RS-485 link via its USB interface.

On the web configuration interface, access the Modbus service in the "**Modbus**" tab. You can activate the service by clicking on the On/Off button.

- Select the RTU interface
- Select the baud rate (115200, 9600, 19200, 38400, 57600). By default, the transmission speed is 115200 Bd
- Select the device ID (Slave ID)
- Configure parity
- Confirm the activation of the Modbus RTU service via the "**Save configuration**" button



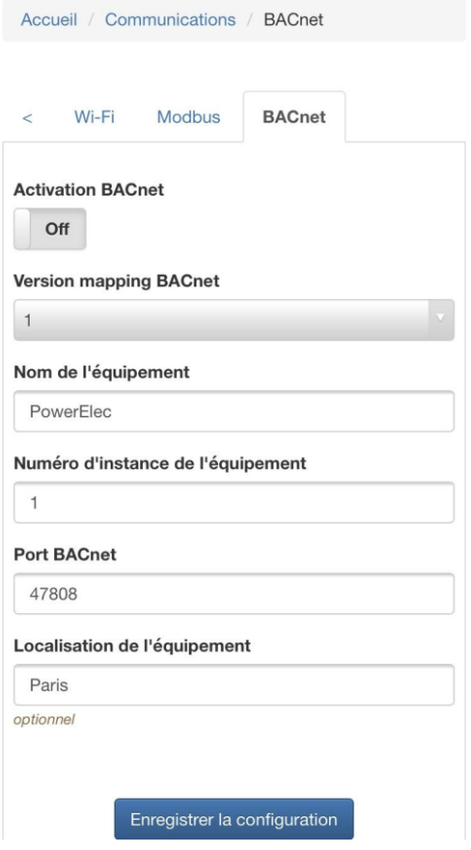
4. Configuration

4.11 BACnet IP configuration

Power-Elec-6 is compatible with BACnet/IP protocol. It allows to transmit measured data of every inputs (Standard or expert) with the Ethernet interface.

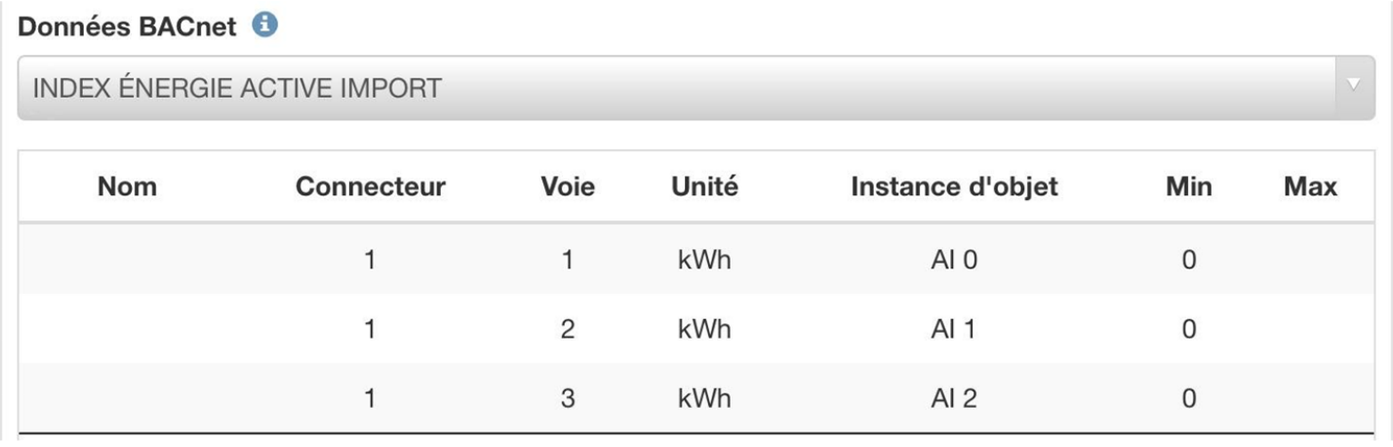
On the web configuration interface, click on “BACnet” button to access BACnet service. Click on On/Off button to activate this service.

- Indicate the BACnet instance number of your Power-Elec-6
- You can choose the mapping version (default: V1)
- You can change the name of the device (default: PE6). Only use alphanumeric characters.
- You can indicate the geographical localization of the device.
- Confirm by clicking on “**Save configuration”**



4. Configuration

You can find an architectural table of BACnet object on web configuration interface.
Version 2 is for Standard and Expert.



Données BACnet

INDEX ÉNERGIE ACTIVE IMPORT

Nom	Connecteur	Voie	Unité	Instance d'objet	Min	Max
	1	1	kWh	AI 0	0	
	1	2	kWh	AI 1	0	
	1	3	kWh	AI 2	0	

5. Live visualization

On the home page, click on "**Live visualization**" to see the measured data, including:

- Imported active / reactive power
- Active import energy index
- Reactive import energy index, positive and negative
- Current
- Voltage
- Power factor
- Frequency

With the Expert License, you can see more electrical indicators :

- The duration of operation
- The number of start-up cycles
- The number of occurrences of detected voltage dips (sag)
- The number of occurrences of detected overvoltage (swell)
- The number of occurrences of detected overcurrent
- The number of occurrences of circuit breaker overload
- The rate of instantaneous harmonic distortion

Remark : *This functionality requires a configuration of the electrical inputs and a connection with equipment in operation. No data will be visible without these prerequisites.*

Advices for values verification:

- Voltage: it must be roughly ~220-240V for single phase or three-phase with neutral signal and roughly ~400V for three phase without neutral signal. You can use a multimeter to check this value.
- Current: if the device consumes energy, current must be positive. You can check this with an ammeter.

5. Live visualization

This page presents an instantaneous visualization for a three-phase circuit under Expert license.

Live visualization

Connector 1		
Operation	ON	
Name	Banc	
Mode	Three-phase	
Active Power	1 740,22	W
Energy Active	93,0861	kWh
Reactive Power	-152,67	VAr
Energy Reactive +	70,5577	kVArh
Energy Reactive -	4,5396	kVArh

Details Connector 1

Information | Expert

Power factor			0,42	
Frequency			49,96	Hz
Phase	**L1**	**L2**	**L3**	
Intensity	6,34	4,92	5,65	A
Active Power	654,38	467,84	562,71	W
Reactive Power	0,00	20,46	-133,48	VAr
Line Voltage	**U23**	**U13**	**U12**	
Voltage	417,43	418,74	415,94	V

Details Connector 1

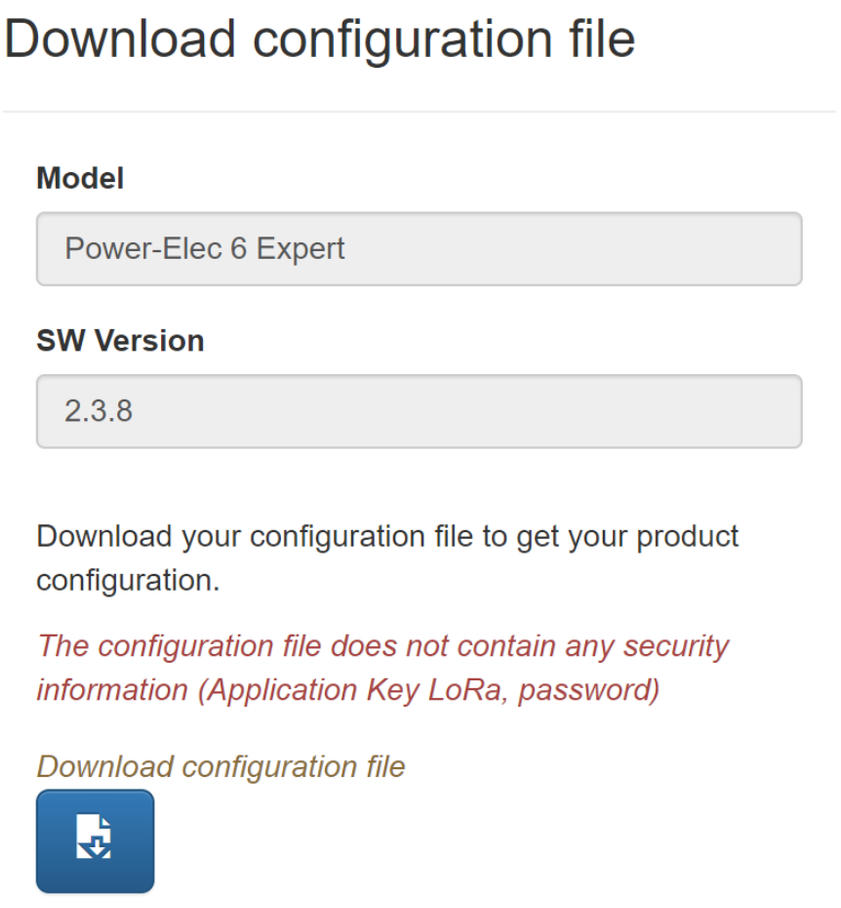
Information | Expert

Operating Time			0 h 02 mn	
Nb cycle			2	
Phase	**L1**	**L2**	**L3**	
THD	113,81	123,05	114,51	%
Sag	0	0	0	
Swell	0	0	0	
OverCurrent	0	0	0	
Circuit breaker tripping	0	0	0	

6. System

6.1 Export settings file

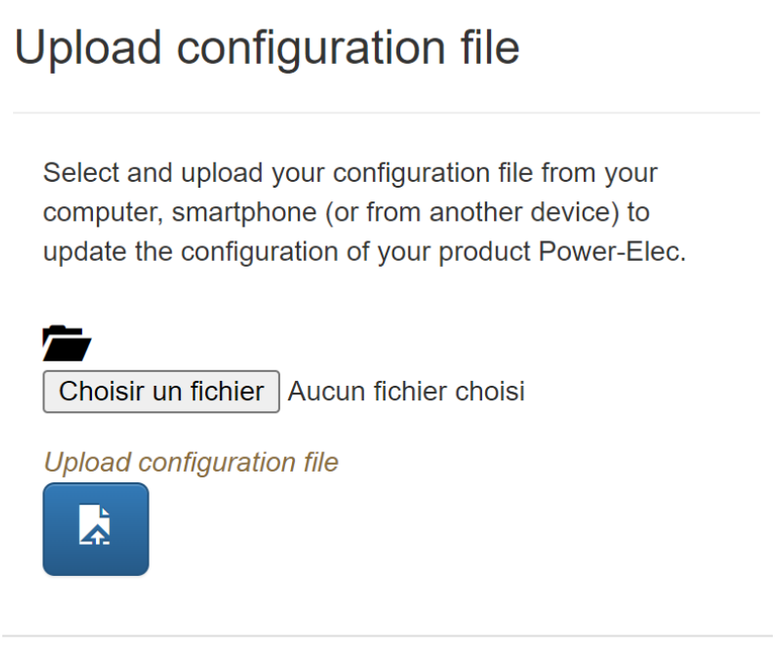
The configuration file export is available in the "**System**" menu under the "**Settings**" tab.
This functionality allows to download a copy of the current configuration.
The file is exported in JSON format and contains all the user parameters of the Power-Elec product.



6. System

6.2 Import settings file

The configuration file import is available in the "**System**" menu under the "**Settings**" tab.
This feature allows you to apply a set of user settings by importing a configuration file from your computer or your smartphone.
The file must respect the JSON format.

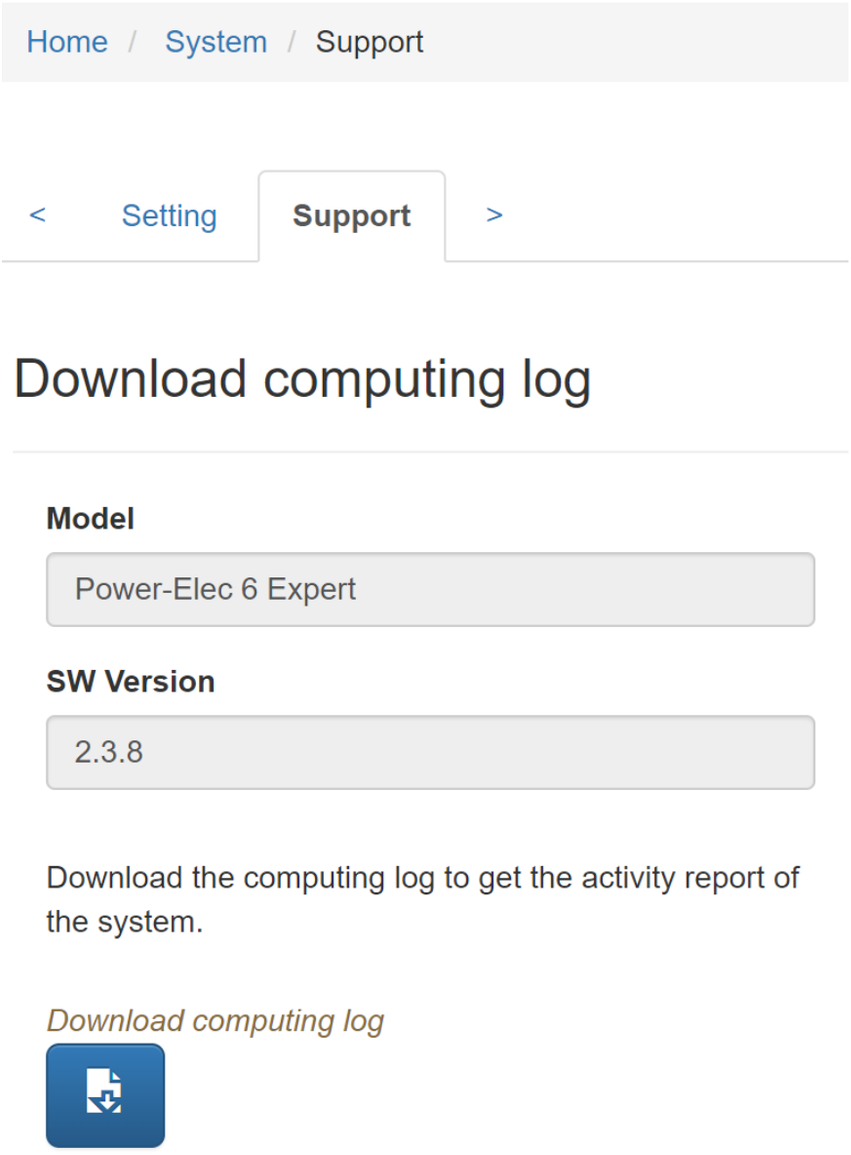


6. System

6.3 Export log file

This feature allows you to download a report of the latest system activities. The Eco-Adapt service can analyze and exploit this log to improve the quality of our products.

The file download is available in the "**System**" menu under the "**Support**" tab.



7. Software upgrade

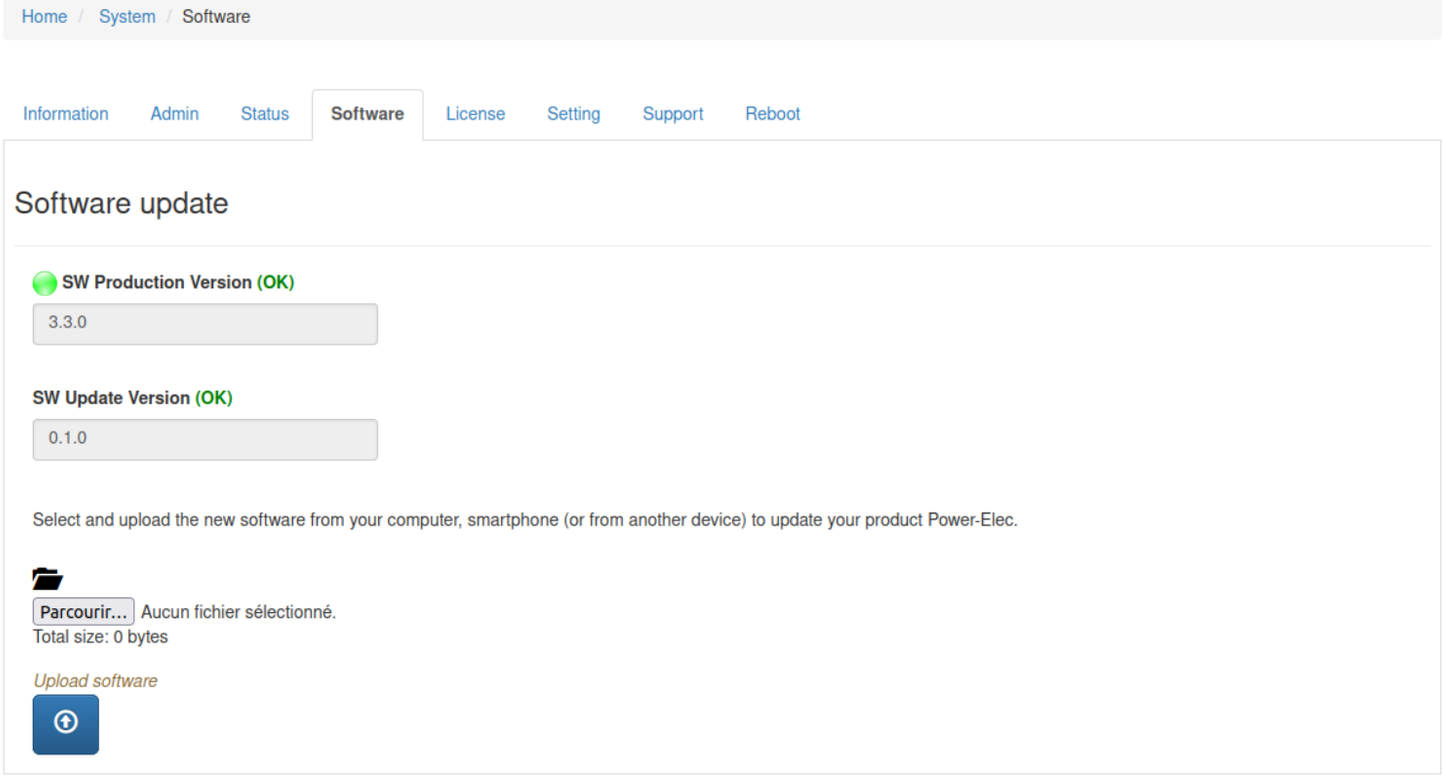
Download from your computer, tablet or smartphone, the new version of the software of the Power-Elec 6 via our platform or contact the Eco-Adapt customer service. The software update operation may take several minutes depending on the connection mode:

-In Wi-Fi, you must connect to the web interface of the central unit via its Wi-Fi hotspot network

-In Ethernet, you will have to check the IPv4 parameters of the Ethernet interface of your computer and of the Power-Elec 6

- To make the update, go to the Power-Elec 6 home page by typing the following URL in the address bar of your web browser:
  - -Wi-Fi: http://powerelec.net
  - -Ethernet: http://192.168.1.66 or the configured IP address

- Click on tab "**System**" then "**software**"
- *At this point, if you want to cancel the update, leave the web page or navigate to the home page*
- Select the firmware Eco-Adapt “newpe6-b*-v*-bin.tar” through “**Choose File”** then click on the button "**Upload software**" and wait a few seconds, the Power-Elec is checking its authority and validity...

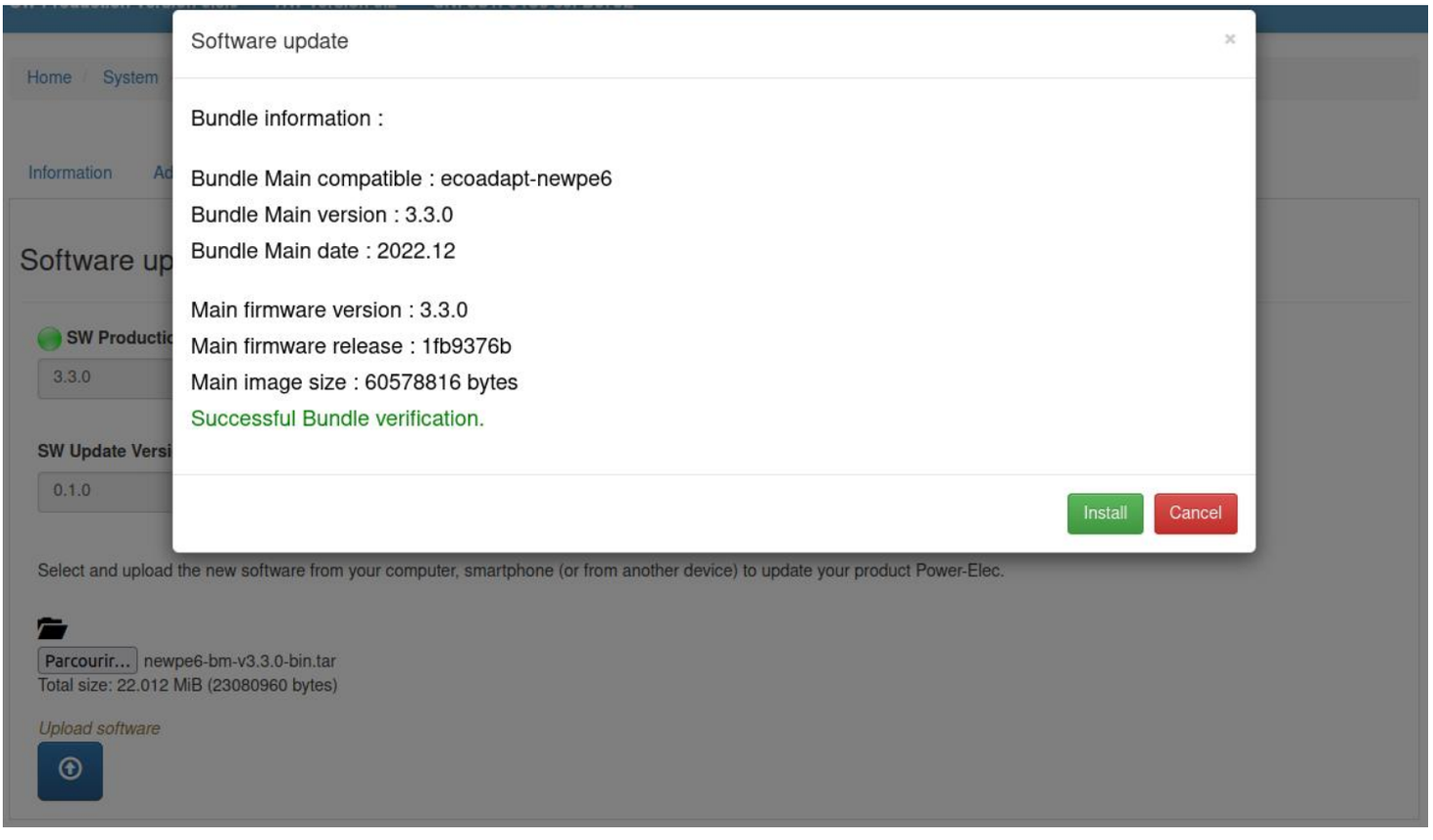


7. Software upgrade

- After verification, the Power-Elec displays information about the new update software.

- Click on the button "**Install**" to upgrade the software.

- Wait for few seconds, the upgrade software application will install the new software version in the background then the device will reboot with the energy sub-metering application.



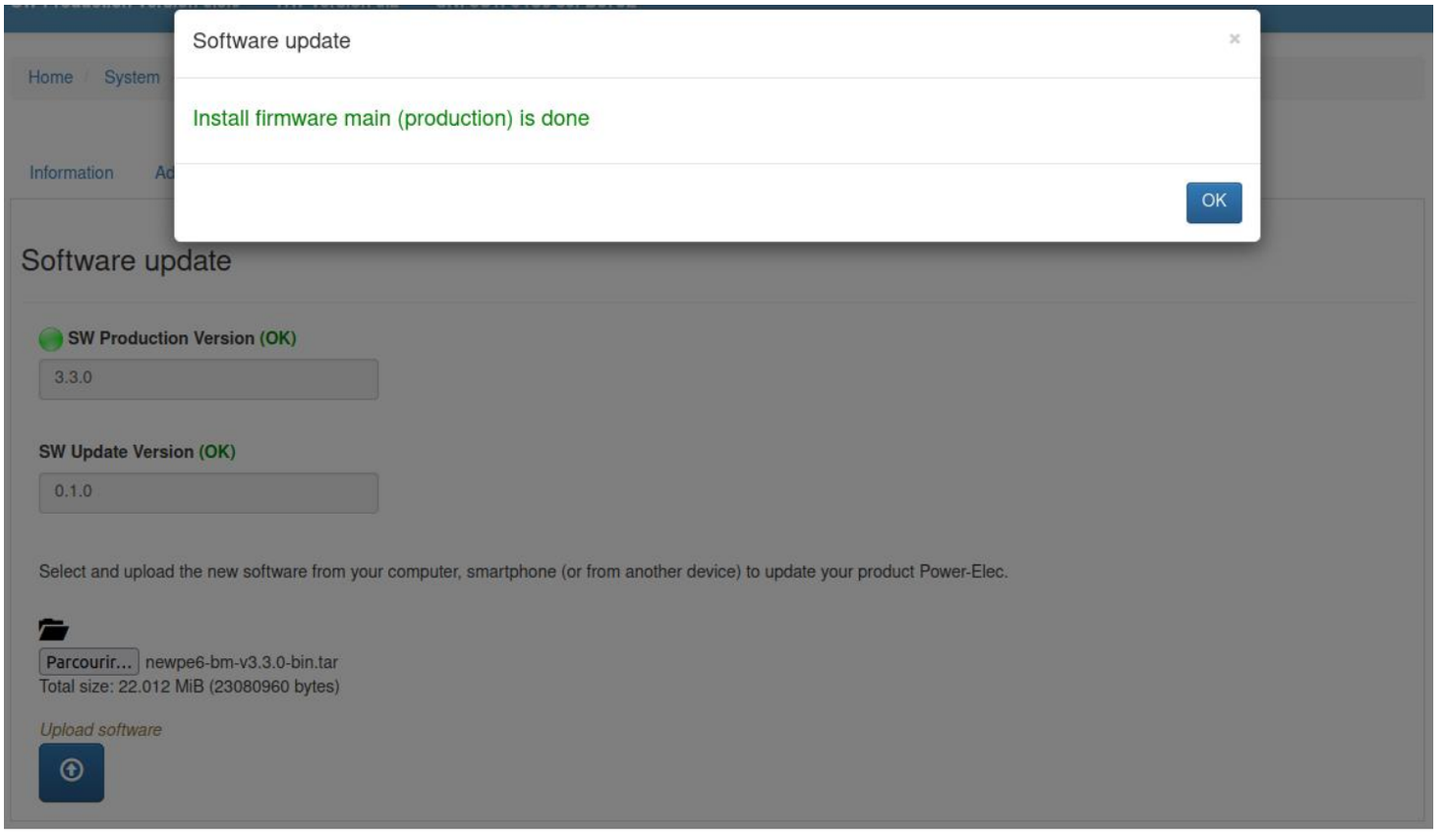
7. Software upgrade

- During the restart, the LED "**a**" and "**b**" light down then light up respectively in **RED** and **ORANGE**. The LED "**a**" blinks few seconds then lights up in **ORANGE**.

- While the upgrade software application is running, the LED "**a**" and "**b**" blink synchronously in **ORANGE**.

- Once the operation is successfully completed, the Power-Elec 6 will restart with the new software version.

During the restart, the **GREEN** LED "**a**" will flash for a few seconds and then light up. The central unit is operational and you can then connect to its web interface.



8. Status LED meaning

LED meaning in normal case

Status LEDs indicate the Power Elec 6 status. The table below resumes the different possibilities on normal running.

a	b	DESCRIPTION	SIGNIFICATION
		ORANGE “**b**” LED lights up during 2 seconds	Once you plug the power supply, the software boot loader runs. “**a**” and “**b**” LEDs blink few seconds and the Power-Elec-6 starts.
		GREEN “**a**” LED blinks during 40 seconds	The Power-Elec-6 is starting
		GREEN “**a**” LED lights up	The Power-Elec-6 is active
		GREEN “**a**” LED and ORANGE “**b**” LED lights up	Radio service is active
		GREEN “**a**” LED lights up. ORANGE “**b**” LED ***blinks like heartbeat*** during 5 seconds	Radio service sends a pairing request to the network
		GREEN “**a**” LED lights ORANGE “**b**” LED ***blinks regularly*** during 5 seconds	Once the pairing to radio network is done, radio service sends the measured data.
		GREEN and RED two tone “**a**” LED blinks regularly during 40 seconds	The software for the software updating and installation is starting
		GREEN and RED two tone “**a**” lights up (“**a**” LED is ORANGE when GREEN and RED LEDs light up)	The system is ready for the software updating.

Note: “**a**” LED is a two tone LED (GREEN and RED). When GREEN and RED light up, the LED is ORANGE.

8. Status LED meaning

Status LEDs meaning in warning case

Status LEDs indicate the Power Elec 6 status. The table below resumes the different possibilities of warning.

a	b	DESCRIPTION	SIGNIFICATION
		ORANGE “**b**” LED lights GREEN “**a**” LED lights RED “**a**” LED **blinks like a heartbeat**	Radio service is active. A disconnection of the LoRa network has been detected. The device tries to reconnect.
		RED “**a**” LED **blinks like a heartbeat**	**A surge has been detected. Please check immediately the connections and the power supply of the Power Elec 6. Your product may be damaged.** 

Note: “**a**” LED is a two tone LED (GREEN and RED). When GREEN and RED light up, the LED is ORANGE.

9. Technical characteristics

Environmental conditions

- Indoor use
- Altitude: up to 2000m
- Operating temperature: 0-50°C
- Relative humidity: 80% maximum up to 31°C. Beyond, linear decrease up to 50% of relative humidity at 40°C.
- Mains voltage fluctuation: ±10% of nominal voltage
- Overvoltage category: CATII
- Pollution degree: 2

Technical operating conditions:

- Supply voltage: 110-230V~
- Operating frequency: 50/60Hz
- Maximum power consumption: 7W

Assigned characteristics of the terminals :

- 4-point terminal block: product power supply and voltage acquisition
  - Maximum voltage with respect to ground: 265Vrms/375Vpeak
  - Maximum voltage (N-L): 265Vrms/375Vpeak
  - Maximum voltage (L-L): 400Vrms /565Vpeak
  - Frequency: 50/60Hz
  - Measurement category: CAT II
  - Allowable transient overvoltage: 2.5kV
  - Connection:
    Tightening torque: 0.5Nm
    Length of cable to be stripped: 6-7.5mm
    Cable section: 1.5-2.5mm² (16-12AWG)
- RJ45 connectors 1 to 6: current acquisition by external transformers or Rogowski cores
  - Maximum voltage : ±600mV
  - Frequency : 50/60Hz
  - Allowable transient overvoltage : ±2V
- Ethernet connector: Modbus TCP and BACnet/IP
  - Allowable transient overvoltage: 1.5kV
- USB: Modbus RTU connection (via RS485) or creation of an Ethernet bridge via USB Ethernet adapter
  - Nominal voltage: 5V
  - Max current: 500mA
- SMA : LoRa/Sigfox
  - Impedance : 50 ohm

9. Technical characteristics

External circuit insulation characteristics:

- Current Transformer
  - Insulation : CAT III
- Rogowski coil:
  - Max voltage : 600V
  - Allowable transient overvoltage: 10kV

Metering

- Measurement of active and reactive power and power factor
- Measurement of active import and reactive import energy indexes (positive/negative)
- Measurement of the frequency
- Power factor measurement
- Up to 18 single-phase feeders and 6 three-phase feeders in standard license
- Calculation of the operating time
- Calculation of the number of starting cycles
- Calculation of the minimum number of voltage dips
- Calculation of the minimum number of overvoltage occurrences
- Calculation of the minimum number of occurrence of overcurrent
- Calculation of the minimum number of occurrences of circuit breaker overload
- Calculation of the power and voltage unbalance ratio
- Calculation of the ratio of neutral current to average current
- Calculation of the maximum average current
- Calculation of the harmonic distortion rate
- Up to 12 single-phase feeders, and 6 three-phase feeders in expert license
- Voltage measurement range (three-phase or single-phase): 100-240V~
- Current measurement range: 0-7000A (depending on current sensor)
- Active energy accuracy: IEC 62053-21 Class 1
- Reactive energy accuracy: IEC 62053-23 Class 2

Communication :

1. Wi-Fi direct
2. Ethernet Modbus TCP
3. RS485 Modbus RTU
4. Ethernet BACnet/IP
5. Radio on 868 MHz ISM band according to LoRaWAN specification

10. Appendix

Choice of surge protector

In order to guarantee the integrity of the Power-Elec-6 meter, the upstream surge suppressor must be sized for an installation in overvoltage category III and reduce the transient overvoltages to the level of category II (i.e. 2500V). More specifically, it must have the following characteristics:

- Have common mode and differential protection
- Integrate a protection for each phase connected to the meter (L1 or L1, L2, L3), as well as neutral (N) and earth (PE)
- Maximum residual overvoltage Up: 2.5kV AC
- Rated discharge current In: 5kA
- Flow capacity Imax: greater than the maximum short-circuit current defined at the installation site
- In the case of a surge suppressor operating by ignition (gas discharge), the rated interrupting value of the follow-up current must be higher than the maximum short-circuit current defined at the installation point

10. Appendix

Current transformers and Rogowski coil of the Power-Adapt range

The Power-Elec 6 meter must be used exclusively with the following measuring equipment:

- Current transformer :
  - 3TC-10-5A : kit of 3 split core CTs, diameter 10mm, rated current 5A
  - 3TC-10-32A : kit of 3 split core CTs, diameter 10mm, rated current 32A
  - 3TC-10-70A : kit of 3 split core CTs, diameter 10mm, rated current 70A
  - 3TC-16-100A : kit of 3 split core CTs, diameter 16mm, rated current 100A
  - 3TC-24-200A : kit of 3 split core CTs, diameter 24mm, rated current 200A
  - 3TC-36-400A : kit of 3 split core CTs, diameter 36mm, rated current 400A

If you wish to modify the length of the cable supplied with a 3 CT kit, the pinout to respect is the following :

RJ45 (8p/8c) pin	*wire color*	*CT*	*CT connector*
1	white	3	S1
2	black	3	S2
3	red	2	S1
4	green	2	S2
5	yellow	1	S1
6	blue	1	S2

- Rogowski coil :
  - 3TS-105 : Kit of 3 rogowski coils, diameter 105mm, rated current 3500A
  - 3TS-180 : Kit of 3 rogowski coils, diameter 180mm, rated current 3500A


POWER-ADAPT