IANOS

SUSTAINABLE SOLUTIONS

for islands' decarbonisation

D6.5 Terceira system integration report

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Table of Contents

List of Figures 3

List of Tables 3

1. Introduction 4

1.1. Purpose and Scope of the Deliverable 4
1.2. Structure of the Deliverable 4
1.3. Relation to Other Deliverables 5

2. Technologies to be deployed in each pilot site 6

2.1. Residential pilot sites 6
2.2. Non-residential pilot sites 7

3. Installation, integration, and commissioning procedures 8

3.1. HEMS (Cleanwatts) 8
3.1.1. Installation procedures 8
3.1.2. Integration and commissioning procedures 9
3.1.3. Check list 9
3.2. PV Panels and MicroInverter Kit (BeON) 10
3.2.1. Installation procedures 10
3.2.2. Integration and commissioning procedures 11
3.2.3. Check list 11
3.3. Heat Batteries (SunAmp) 12
3.3.1. Installation procedures 12
3.3.2. Integration and commissioning procedures 13
3.3.3. Check list 14
3.4. Electrochemical Batteries (EDP New) 15
3.5. Non-intrusive characterization and use of energy flexibility in water heating systems (UNINOVA) 16
3.6. FEID-Plus (CERTH) 16
3.6.1. Installation procedures 16
3.6.2. Integration and commissioning procedures 17
3.6.3. Check list 17
3.7. Hybrid Transformer (EFACEC EN) 18
3.8. Smart Energy Router (UNINOVA) 18
3.9. V2G Chargers (EFACEC EM) 19
3.9.1. Installation procedures 19
3.9.2. Integration and commissioning procedures 19
3.9.3. Check list 20
3.10. Flywheel (Teraloop) 20

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 957810

3.10.1. Installation procedures 20
3.10.2. Integration and commissioning procedures 21
3.10.3. Check list 21
3.11. System Operator Platforms (Cleanwatts) 22

4. Annex 23

4.1. Annex 1 – Installation, integration, and commissioning documents & software tools for HEMS (Cleanwatts) technology 23
4.1.1. Cloogy Hub and Smart Plugs 23
4.1.2. WiFi Energy Meter (Shelly meter) 25
4.1.3. Software for final installation check 30
4.1.4. Check list table 32
4.2. Annex 2 – Installation, integration, and commissioning documents & software tools for FEID-Plus (CERTH) technology 33
4.2.1. FEID-Plus Gateway and Smart Plugs 33
4.2.2. WiFi Energy Meter (Shelly meter) 34
4.2.3. WiFi Smart Plug (Shelly plug) 40
4.2.4. Check list table 43
4.3. Annex 3 – Check list table for PV Panels and MicroInverter Kit (BeON) 44
4.4. Annex 4 – Check list table for Heat Batteries (SUNAMP) 45
4.5. Annex 5 – Check list table for V2G Chargers (EFACEC EM) 46
4.6. Annex 6 – Check list table for Teraloop technology 47

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List of Figures

Figure 1 – Relation of other tasks to task 6.3. 5

Figure 2 – Components of the BeON system and PV panels mounting possibilities. 11

List of Tables

Table 1 – Technologies to be installed in each residential pilot site. 6

Table 2 – Technologies to be installed in each non-residential pilot site. 7

Table 3 – Check list table for HEMS (Cleanwatts). 9

Table 5 – Check list table for SUNAMP heat battery. 14

Table 6 – Check list table for FEID-Plus (CERTH). 17

Table 7 – Check list table for V2G Chargers (EFACEC EM). 20

Table 8 – Check list table for flywheel (Teraloop). 21

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1. Introduction

1.1. Purpose and Scope of the Deliverable

The first version of this deliverable aims to provide a comprehensive guide to be used by the involved parties, including local installers, for the correct *"installation, integration, and commissioning"* of the technologies to be deployed on the Terceira pilot.

The initial scope in the Grant Agreement (GA) for this first version of the deliverable did not foresee the installation and commissioning procedures to be conducted locally. It was discussed among the partners that it would make sense to include it at this project phase, since that no other deliverable was referring to these important aspects that must be performed by local installers.

This first document version describes the individual procedures for each one of the technologies to be deployed, since that their integration as part of overall iVPP system is being discussed on other tasks. Since that there was a delay on the activities related with the pilot site surveys and audits, some of the described procedures may have to be reviewed afterwards and be included on the second version of this document. This second version will also include more details about the integration tests of the technologies into the iVPP and several remarks regarding the operationality and functional maintenance of the deployed systems after the end of the project.

1.2. Structure of the Deliverable

This deliverable is structured as follows:

- Chapter 2: Identification of the different pilot sites that compose the Terceira pilot and the technologies to be deployed in each one of them is provided.
- Chapter 3: Each technology provider establishes the instructions for the correct *"installation, integration and commissioning procedures"* to be followed by the involved parties, including local installers, that may include remote or local training. More concrete local procedures during the installation phase are to be provided in the annexes, whenever possible. These further instructions are to be translated into Portuguese if required by the local installers.
- Chapter 4: The annexes are provided, adding more detail, and complementing some of the information included in the other sections of the deliverable (e.g., manuals or installation documents, software, and other tools).

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1.3. Relation to Other Deliverables

The Work Package 6 (WP6) relates solely to the lighthouse island of Terceira and aims to prepare the demonstration of the several Use Cases (UCs) and technologies defined for this island and detailed in *T2.1 – Islands Requirements engineering and use case definitions*.

The present deliverable is included in task T6.3, under WP6 - *Deployment, Use Cases Realization and Monitoring at LH#2 (Terceira)*.

The task T6.1 defines the specifications of all systems and equipment to be commissioned within the T6.3. It is also responsible for the identification of the pilot site requirements and constraints, by assessing existing infrastructures and feasibility of installing the different systems and equipment.

The task T6.2 aims at detailing Terceira's deployment plan (D6.4), and includes: the reference timelines; transportation, site deployment and commissioning requirements, according to the demo physical ecosystems and solutions' specifications; relevant stakeholders' engagement, including end-users; and risk management strategy.

This deliverable will also feed other Work Package tasks with relevant information. The pilot site identification (pilot ID) and equipment to be installed in each one of them, are to be used on the interpretation of the data arriving at the Enterprise Service Bus (ESB – T4.1), on the Common Data Model being developed and on the Centralized Dispatcher developments (T4.3) under the scope of WP4.

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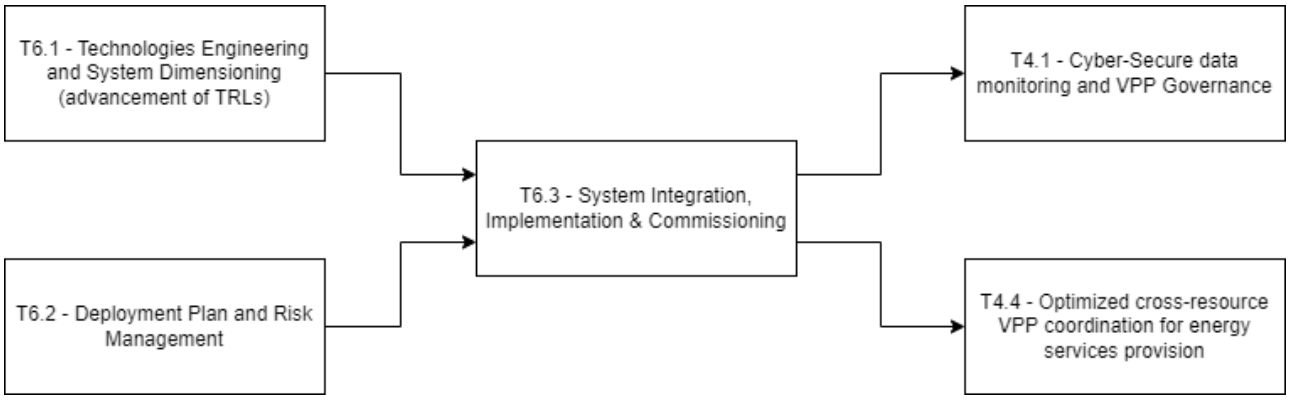

Figure 1 – Relation of other tasks to task 6.3.

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2. Technologies to be deployed in each pilot site

This Chapter presents the preliminary list of the pilot sites that compose the Terceira pilot and the technologies to be deployed in each one of them.

Due to delays on the pilot site audits and surveys, it was not possible to provide further details and characteristics of each one of the pilot sites. This information is important for the installation procedures and will be considered after all the onsite audits and surveys are conducted. In the second version of this deliverable the main information collected will be provided (e.g., identification of potential flexible loads, working hours, restriction for comfort).

On the next two subsections the different technologies to be deployed for each pilot sites are provided. The pilot sites are identified with a "Pilot ID" and divided by their building category (i.e., residential and non-residential). The "Pilot ID" is an identification for each pilot site that will be followed during IANOS implementation. This identification ID as an internal correspondence to the individual physical pilot installation, that is only known for a restricted number of IANOS partners.

2.1. Residential pilot sites

The next table presents the preliminary list of technologies to be deployed in each one of the identified residential pilot sites. This list will be updated, if necessary, after the pilot site audits and surveys is concluded.

Table 1 – Technologies to be installed in each residential pilot site.

Pilot ID	Number and equipments to be installed per household
T-R-01 to T-R-08	1 x HEMS (Cleanwatts) 1 x PV Panels and MicroInverter Kit (BeON) 1 x Heat Batteries (SunAmp) 1 x Electrochemical Batteries (EDP New)
T-R-09 to T-R-16	1 x FEID-Plus (CERTH) 1 x PV Panels and MicroInverter Kit (BeON) 1 x Heat Batteries (SunAmp) 1 x Electrochemical Batteries (EDP New)
T-R-17 to T-R-20	1 x HEMS (Cleanwatts) 1 x PV Panels and MicroInverter Kit (BeON) 1 x Heat Batteries (SunAmp)
T-R-21 to	1 x FEID-Plus (CERTH) 1 x PV Panels and MicroInverter Kit (BeON)

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T-R-24	1 x Heat Batteries (SunAmp)
T-R-25 to T-R-32	1 x HEMS (Cleanwatts) 1 x PV Panels and MicroInverter Kit (BeON)
T-R-33 to T-R-40	1 x FEID-Plus (CERTH) 1 x PV Panels and MicroInverter Kit (BeON)
T-R-41 to T-R-45	1 x Non-intrusive characterization and use of energy flexibility in water heating systems (UniNova)
T-R-46 to T-R-47	1 x Smart Energy Router (UniNova)

2.2. Non-residential pilot sites

The next table presents the preliminary list of technologies to be deployed in each one of the identified non-residential pilot sites. This list will be updated, if necessary, after the pilot site audits and surveys is concluded.

Table 2 – Technologies to be installed in each non-residential pilot site.

Pilot ID	Number and equipments to be installed in each non-residential site
T-NR-01	1 x Hybrid Transformer (EFACEC EN)
T-NR-02	1 x V2G Chargers (EFACEC EM)
T-NR-03	1 x V2G Chargers (EFACEC EM)
T-NR-04	1 x Flywheel (Teraloop)

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3. Installation, integration, and commissioning procedures

In the next subsections and annexes, each one of the technology providers that will deploy their equipment in the Terceira Island pilot sites, describes the main procedures for the installation, integration and commissioning of it. This is not meant to be an exhaustive description of the procedures, but to summarize the main aspects to be considered during the deployment of each technology. Some of the equipment is more complex than other and will require the adequate training of local installers, the provision of technical manuals, remote or on-site assistance and the use of software tools.

The local installers will be provided with all the necessary information to adequately deploy the technological solutions. In some cases, the information provided in the annexes will have to be translated into Portuguese, if not already. Also, a separated folder for each technology was setup so that each technology provider can include all the documentation and software tools required for the deployment of the solutions.

3.1. HEMS (Cleanwatts)

The HEMS from Cleanwatts will be installed in 20 households and each kit is composed by the following equipment:

- 1 x Cloogy Hub/Gateway;
- 2 x Smart Plugs
- 1 x WiFi Energy Meter

The equipment will be shipped in kits prepared for each pilot site, with several pre-configurations and pairing established at the Cleanwatts lab.

3.1.1. Installation procedures

Local installers must follow the installation and pre-configuration procedures presented in Annex 4.1.

All the required instructions for the correct installation and pre-configuration of the devices are provided on the referred documents, but the installer needs also to download and make use of dedicated software tools to perform some significant actions.

Locally required tools for the installation:

- Electrician tools;
- Internet access;

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- Laptop/ computer;
- Installation manuals in Annex 1 and software application “Install checker”;
- Download the Google/Apple APP of Cloogy®/Kiome® for end users’ registration and utilization.

The installations will be scheduled with Cleanwatts team so that remote assistance can be done.

3.1.2. Integration and commissioning procedures

All the equipment that composes the HEMS, before shipping to the local sites will be pre-configured and paired, so that the local integration and commissioning can be “plug and play”.

After following the local installation and pre-configuration procedures presented in Annex 1, the equipment will be ready to acquire and send the collected data to the Cleanwatts platform, that will then deliver them to the Enterprise Service Bus (ESB), as defined on the Terceira Island simplified diagram. The integration and commissioning procedures with the IANOS iVPP components will be done remotely by the Cleanwatts team.

In the integration with other iVPP components, special attention will be taken to the “tag names” of the measurement data acquired from the devices, to be accordingly to the IANOS Common Data Model.

Using the “Install Checker” software, the local installer can perform tests to verify the installation and commissioning of the equipment. After this procedure concluded, the Cleanwatts staff will perform several remote procedures to check that the system is fully integrated and commissioned. Among others, it must be checked if the local equipment is being monitored and communicates adequately, if the smart plugs receive control commands, and if both the heat battery and electrochemical battery inverter are fully integrated with the local gateway.

3.1.3. Check list

The local installers will be provided with the following check list table, for fast acknowledgment that all required steps have been followed and with data required for other IANOS tasks or iVPP components (e.g., device ID for each pilot site).

Table 3 – Check list table for HEMS (Cleanwatts).

Installation, integration, and commissioning procedures check list table for HEMS (Cleanwatts)			
ID	Procedure	Insert comment / Data	Check box
1	Register here the “pilot site ID”		☐
3	Register here the “Cloogy Hub ID”		☐

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3	"Cloogy Hub" installed and ethernet connector is blinking green slowly		☐
4	Register here the WiFi Energy Meter "WiFi network with SSID"		☐
5	Participant account has been created on Cloogy portal/APP and Cloogy Kit activated		☐
6	Register here the participant "email address"		☐
7	"WiFi Energy Meter" has been installed and configured		☐
8	Double check that the clamps direction of the "WiFi Energy Meter" are according to the convention on the manual		☐
9	Run the "Install Checker" software application and check if all devices are correctly installed		☐

3.2. PV Panels and MicroInverter Kit (BeON)

3.2.1. Installation procedures

The BeON Solar Kits are a house complete and easy to install solution composed by:

- Tier 1 polycrystalline solar panel;
- BeON plug-in microinverter;
- Aluminium structure;
- Wiring and all the accessories.

The kits will be shipped to Terceira fully packed and ready to install. The installation will be performed by local installers with all the manuals and procedures being provided by BeON. Although the system is fully plug and play, with a unique system that uses a plug-in inverter that can be connected to any household power outlet, the installer must be certified to perform the installation of a PV system.

The next figure shows the main components of the system, the main connections and PV panel mounting possibilities.

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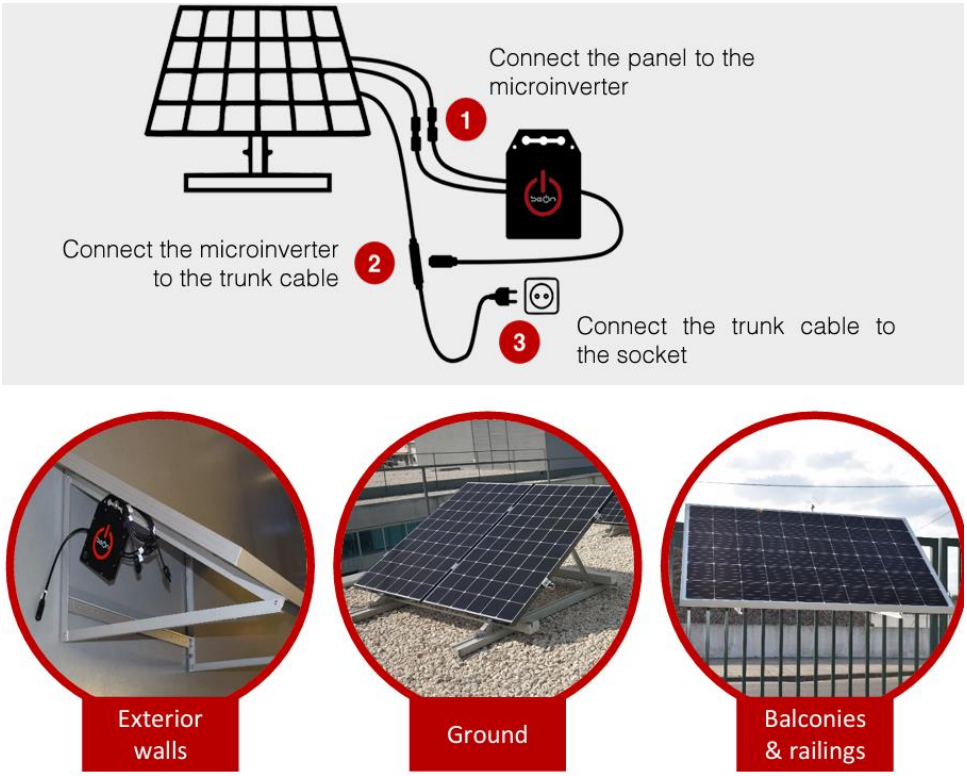

Figure 2 – Components of the BeON system and PV panels mounting possibilities.

3.2.2. Integration and commissioning procedures

The integration and commissioning procedures will be followed upon the system installation finalisation. The local installers will guarantee that the system is connected to the internet via WiFi or Ethernet and BeON staff will remotely test the system connectivity and if it is sending the collected data to the Enterprise Service Bus (ESB). After this check the system is fully integrated and can be controlled by the IANOS iVPP.

3.2.3. Check list

The operations that are necessary for the installation, integration and commissioning are summarized on the next table.

Table 4 – Check list table for BeON energy PV system

Installation, integration, and commissioning procedures check list table for BeON energy PV system			
ID	Procedure	Insert comment / Data	Check box
1	Install support structure		☐
2	Fix PV panels on the structure		
3	Install Pluginverters		☐

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4	Install cabling and connect to the closest wall socket		
5	Inspection and verification		☐
6	Install communication interface		
7	Install BeON application on a mobile device (APP store)		☐
8	Communication setup and interface verification		
9	Commissioning Report		☐

3.3. Heat Batteries (SunAmp)

Local installers must follow the Sunamp installation guide for the Thermino ePV Heat battery. The model being installed is a Thermino ePV 70, in which the "70" denotes a 70 litres equivalent water tank capacity.

Always read the safety instructions in section 1 of the manual before installing Thermino ePV Heat Batteries.

3.3.1. Installation procedures

Please note this product is for indoor use only and must not be installed outside. It must not be tilted more than 45 degrees angle during transportation, unpacking and installation. It is required to be installed on a hard, solid and level surface that can support it owns weight. Do not use detachable hose sets to connect the system to water mains. Any soldering, welding, and brazing must be performed on tubes that are detached from the heat battery a minimum of 1 meter away.
Tools generally required for installation are as follows:

Hand tools

- 22mm pipe cutters
- 15mm pipe cutters
- Measuring tape
- Allen keys
- 2mm Flat head screwdriver
- Stanley knife
- Adjustable spanners x 2 (40mm jaws)
- Water pump pliers

Testing equipment

- Flow cup
- Digital thermometer/temperature clamps
- Multi meter
- Water pressure test gauge & adaptor to fit on to tap

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- Amp meter clamp

Accessories and parts required. These will be provided by Sunamp.

C5388	Tempering Valve
C5407	Expansion Vessel 0.5L

Install according to installation manual section by section, this starts at section 3.1 in the installation manual.

3.3.2. Integration and commissioning procedures

The integration and commissioning procedures are divided in two groups: preparation and process/procedure.

3.3.2.1 Preparation

The following two bullet points are the preparation steps that must be fulfilled in order to start the commissioning procedure:

1. Make sure that all the packaging material has been removed
2. Ensure all components are clean and undamaged

3.3.2.2 Process

The following steps define the procedure that must be followed by the installer in order to commission the thermal store to make sure that the operation in the future will work properly. Procedure:

1. Ensure that the temperature sensor of the Heat Battery is fully inserted into its pocket. The white marker should be sitting on top of the blue cable gland.
2. Turn on the water supply and ensure that there are no leaks.
3. Fully open any hot water taps in the dwelling and allow to run for a minimum time of 2 minutes. This is for any air to leave from the system. This may vary depending on the Heat Battery model size.
4. Switch ON the power supply of the Heat Battery, via the Double pole isolating Switch, Min 16A.
5. If applicable, ensure the off-peak times are set correctly to the desired tariff, on the time switch.
6. If available press the BOOST button on the time switch (if the time-switch is fitted).
7. Continue to run the tap for 2 more minutes, then close.
8. Check the front of the Heat Battery to ensure that the 'power' and 'heating element' LED''s are lit (see Table 17 in the Manual).
9. Allow the Heat Battery to charge for approximately 30 minutes with the hot water tap closed.

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10. Please note that on first charge or when the Heat Battery has been deep discharged, the heating element will cycle ON and OFF for up to one hour, depending on the Heat Battery size. This is normal operation. If heating element cycling persists for more than one hour, please refer to Table 18 & 19 in the Manual.
11. After 30 minutes open the hot water tap and check for hot water.
12. Adjust the Hot Water Tempering Valve, so that the output temperature is between 45 °C and 55 °C.
13. Check hot water temperature at all hot water outlets in the dwelling with the customer and advise on temperature settings.
14. Ensure that the Heat Battery charges to half charge and that there are no lights flashing (which may otherwise indicate an error, see Table 17 in the Manual).
15. Leave all product information and literature with the customer/ end user.
16. Fill in and return the Sunamp Ltd commissioning certificate, provided with the product. These documents must be compiled and returned to Sunamp after installation.

3.3.3. Check list

Table 5 – Check list table for SUNAMP heat battery.

Installation, integration, and commissioning procedures check list table for SUNAMP heat battery			
ID	Procedure	Insert comment / Data	Check box
1	Installation instructions and Commissioning Certificate are available.	Do not unpack unit until instructions have been read	☐
2	Safety, mechanical, electrical and water checks	Chapter 1 performed	☐
3	Accessories Tempering valve, 0.5 litre expansion vessel are present. These accessories will come delivered with each unit.	Accessories and parts (Chapter 2.4 installation guide) are available.	☐
4	Follow installation instructions	Mains cold water connects into port D. Hot water outlet connected to port A.	☐
5	Water supply requirements	The heat batteries are designed for 1.0 MPa (10 bar) maximum working pressure, it is recommended that if the incoming mains pressure is greater than 0.5MPa (5 bar) an approved pressure regulator set at 0.5PMa (0.5 bar) should be fitted. Check incoming water pressure is more than 0.15MPa (1.5 bar).	☐

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6	Hard Water and Limescale Where mains water hardness can exceed 150 ppm	Limescale control check	☐
7	Free space around the heat battery	Ensure there is 15cm around the sides and back and 45cm space about the battery to remove the lid if necessary	☐
8	Hydraulic checks. All connected tubes and work inside the battery casing must be 22mm copper tube	Check chapter 3.4 of the installation document	☐
9	Temperature and Insulation check	Chapter 3.5 within manual	☐
10	Electrical wiring check	Chapter 3.6 within manual	☐
11	Controller wiring Thermino ePV	Chapter 3.6.2 and 3.7 within manual wiring diagram check	☐
12	Wiring setup of solar power diversion controller	Chapter 3.9 within manual	☐
13	Commissioning checks	Chapter 4 within manual	☐
14	Operation – switch on	Chapter 5 LED status and charging	

3.4. Electrochemical Batteries (EDP New)

The energy storage system will be composed by an ion-lithium electrochemical battery pack of 3kW/3kWh and the interconnected inverter. The system will work in a standalone mode, with the control being performed by the IANOS iVPP, that will send the setpoints and scheduling to the inverter that must be properly integrated. The local gateways will provide this integration providing the local communication with the inverter. The electrochemical batteries charging and discharging is controlled by a coupled off-the-shelf solution inverter, the Victron MultiPlus-II GX. This inverter has embedded communication and remote-control capabilities after being connected to an ethernet cable.

The installation and initial commissioning procedures will be executed by the awarded vendor, with no interference from other project partners apart from EDP NEW, that is buying the equipment and will check the compliancy of the service provided. All the manufacturer instructions will be followed to make sure that the asset is fully functional.

Cleanwatts and CERTH will integrate and communicate locally with this asset using their local gateway using the Modbus TCP/IP communication protocol. The desirable parameters such as dis/-charge power will be retrieved and then forwarded via the local gateways to the ESB.

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3.5. Non-intrusive characterization and use of energy flexibility in water heating systems (UNINOVA)

UNINOVA will characterize and use the energy flexibility provided by five electrical water heaters. A set of sensors will be installed in each electrical water heater to acquire temperature and power consumption data that will be used to provide the referred energy flexibility characterization and allow the respective use through actuators managed by a local microcontroller. Installation procedures will be carried out by local installers (an electrician, certified by DREn – Direção Regional de Energia, and a plumber) together with UNINOVA personnel. Therefore, installation, integration and commissioning procedures will be carried out according to UNINOVA's internal recommendations to be shared with local installers on-site.

In terms of local requirements, the following needs should be considered:

- A cubic space with 30X30X30 (in cm) at the water heater electric socket (only accessible to UNINOVA personnel and local installers);
- A cubic space with 20X20X20 (in cm) at the water heater's hot water output (only accessible to UNINOVA personnel and local installers);
- Wi-fi connection;
- Regular electrician and plumber tools.

3.6. FEID-Plus (CERTH)

The FEID-Plus from CERTH will be installed in 20 households and each kit is composed by the following equipment:

- 1 x FEID-Plus (Gateway);
- 1 x Wi-Fi Smart Plug
- 1 x Wi-Fi Energy Meter

The equipment will be shipped in kits prepared for each pilot site, with several pre-configurations and pairing established at the CERTH premisses.

3.6.1. Installation procedures

Local installers must follow the installation and pre-configuration procedures presented in Annex 2.

All the required instructions for the correct installation and pre-configuration of the devices are provided on the referred documents.

Locally required tools for the installation:

- Electrician tools;
- Internet access;

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- Laptop/computer;
- Installation manuals in Annex 24.1;

The installations can be scheduled with CERTH team so that remote assistance can be provided.

3.6.2. Integration and commissioning procedures

All the equipment that composes the FEID-Plus, before shipping to the local sites will be pre-configured and paired, so that the local integration and commissioning can be almost "plug and play".

After following the local installation and pre-configuration procedures presented on Annex 24.1, the equipment is ready to acquire and send the data collected to the Enterprise Service Bus (ESB). The integration and commissioning procedures with the IANOS iVPP components will be done remotely by CERTH team.

In the integration with other iVPP components, special attention will be taken to the "tag names" of the measurement data acquired from the devices, to be accordingly to the IANOS Common Data Model.

3.6.3. Check list

The local installers will be provided with the following check list table, for fast acknowledgment that all required steps have been followed and with data required for other IANOS tasks or iVPP components (e.g., device ID for each pilot site).

Table 6 – Check list table for FEID-Plus (CERTH).

Installation, integration, and commissioning procedures check list table for FEID-Plus (CERTH)			
ID	Procedure	Insert comment / Data	Check box
1	Double check that the clamps direction of the "WiFi Energy Meter" are according to the convention on the manual		☐
2	Check in the FEID appears in the network (use a free tool, e.g., "Advanced IP Scanner")		☐
3	Open a "Browser" software on the laptop and check if the devices are correctly installed (use the url "http://feidPlus_ip/info")		☐
4	Write down the WiFi SSID and password, and Shelly devices names in order to forward them, afterwards to CERTH team		☐

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3.7. Hybrid Transformer (EFACEC EN)

Innovative distribution transformer, with low losses, sustainable design and with the capacity to perform on-load dynamic (stepless) voltage compensation. This hybrid transformer is able to implement a dynamic voltage regulation actuation, in each phase, with unlimited number of operations, considering as well complementary features such as the contribution to reactive power compensation, phase voltage unbalance correction and improvement in the overall voltage profile quality. In addition to these innovative features, the transformer control unit will integrate advanced sensoring and diagnostic function blocks for the processing of the status and the condition of the transformer and the grid that is fed by this asset.

Due to the nature and complexity of the work involved, Efacec EN will not delegate the installation, integration, and commissioning procedures of the Hybrid Transformer to third parties. All the procedures will be performed according to the appropriate Efacec EN internal guidelines, that will also include verification check lists.

3.8. Smart Energy Router (UNINOVA)

Two Smart Energy Routers (SER) will be installed at residential or services buildings (behind the meter) in Terceira. SER is a power electronic device that manages the energy transfer from/to different sources (distribution grid, RES-based distributed generators), loads and electricity storage systems. It collects data from various energy assets, like PVs (generation profile) and batteries (charge state) and will receive higher level instructions from the iVPP to control individual assets accordingly.

Installation procedures will be carried out by local installers (an electrician, certified by DGEG – "Direção Geral de Energia e Geologia") together with UNINOVA personnel. Therefore, installation, integration and commissioning procedures will be carried out according to UNINOVA's internal recommendations to be shared with local installers on-site. In IANOS project, the Smart Energy Routers will replace existing inverters.

In terms of local requirements, the following needs should be considered:

- Residential or services buildings must have three phase power supply;
- All equipment will be installed behind-the-meter;
- Existence of PV system for self-consumption;
- An indoor cubic space with 1x1x1 (in meters), which should be available to IANOS personnel but not for the buildings' users;
- Local Wi-Fi connection;
- Regular electrician tools.

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3.9. V2G Chargers (EFACEC EM)

The exploration of uses cases related with the electric mobility will be supported by the installation of V2G 10 kW EV chargers in two locations.

3.9.1. Installation procedures

The V2G chargers can be installed in two modes, as a wall mount assembly or in pole mount installation. The Installation Manual, that will be provided to the installer, contains detailed requirements and instructions for the installation of the chargers.

The power supply of the charger, that should consider a bidirectional power flow, should be fed by dedicated feeder. This line should be protected by an adequate short circuit breaker, with a rating compatible with the cable and installation type and considering the applicable regulations. The charger maximum current on the AC port is 22 A.

3.9.2. Integration and commissioning procedures

The integration must be carried out after the installation, as described in the manual. In this phase the communication and interface with the backend and the Enterprise Service Bus will also be addressed and tested.

The equipment setup and the commissioning can be done by a service team or by local personnel with remote assistance by Efacec (in this case it is necessary to setup previously a remote connection to a computer connected to the Charger). The integration and commissioning can be divided in the following steps:

1. Verification of the installation, safety conditions
2. Power supply verification and equipment inspection;
3. Communication setup and interface verification;
4. Power sup and unidirectional charging with a CHAdeMO electric vehicle or simulator.
5. Bidirectional charging session with a real electric vehicle.
6. Testing of the smart-charging and grid support features.

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3.9.3. Check list

The operations that are necessary for the installation, integration and commissioning are summarized on the next table.

Table 7 – Check list table for V2G Chargers (EFACEC EM).

Installation, integration, and commissioning procedures check list table for V2G Chargers (EFACEC EM)			
ID	Procedure	Insert comment / Data	Check box
1	Charger placement and installation		☐
2	Installation of the feeder and power supply		☐
3	Inspection and verification		☐
4	Communication setup and interface verification		☐
5	Unidirectional charging session with a CHAdeMO electric vehicle or simulator		☐
6	Verification of the actuation of the internal protections		☐
7	Commissioning Report		☐

3.10. Flywheel (Teraloop)

The flywheel from Teraloop will be installed at Pronicol's industrial pasteurizing facility as a single "plug and play" containerised solution. The containerised solution will be shipped to the pilot site, following a validation procedure at Teraloop's lab, and a site preparation at the Pronicol facility.

3.10.1. Installation procedures

Local installers must follow the installation procedures presented on Annex 3 and its possible amendments as relevant. All the required instructions for the correct installation of the solution will be refined with Teraloop and the local installers ahead of time.

Locally required tools for the installation:

- Internet connection;
- Electrician tools;
- Means of transportation of heavy equipment.

The installation will be overseen by Teraloop's technical team and Pronicol's electrical installation supervisor.

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3.10.2. Integration and commissioning procedures

The containerised solution, before shipping to Pronicol's location, will be pre-configured, so that the local integration and commissioning can be "plug and play".

After following the local installation, the containerised solution is ready to acquire and send the data to the Enterprise Service Bus (ESB) through Siemens HMI. The integration and commissioning procedures with the IANOS iVPP components will be done locally by the Teraloop team.

In the integration with other iVPP components, special attention will be taken to the "tag names" of the measurement data acquired from the containerised solution, to be accordingly to the IANOS Common Data Model.

3.10.3. Check list

The local installers will be provided with the following check list table, for fast acknowledgment that all required steps have been followed and with data required for other IANOS tasks or iVPP components (e.g., device ID for each pilot site).

Table 8 – Check list table for flywheel (Teraloop).

Installation, integration, and commissioning procedures check list table for local installer			
ID	Procedure	Insert comment / Data	Check box
1	Verification of suitability of local physical environment	Foundation should be a concrete slab able to withstand 1500kg/m2 load, with dimensions of 4 x 4 x 0.5m (length x width x depth preferable underground).	☐
2	Verification of availability of electrical connection for flywheel	3 x 250A, 400VAC (MCMK 4x95+50)	☐
3	Verification of availability of electrical connection for auxiliary systems	3x16 A, 400V (MCMK 4x2,5+2,5)	☐
4	Ensure availability of Ethernet connection with internet access	High reliability is key.	☐
5	Physical installation of containerised solution	Ensure container attachment to the concrete slab.	☐
6	Electrical installation of containerised solution		☐

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3.11. System Operator Platforms (Cleanwatts)

The System Operator Platforms will be integrated in the iVPP by Cleanwatts. This integration will be required so that the IANOS iVPP can perform the monitoring and control of the network available energy assets (e.g., wind and PV, BESS). After several discussions with the Terceira island System Operator (EDA), the approach is to integrate their telemetry system that at the time of writing this document it was being updated/upgraded. Therefore, very few details were available to be provided on this first version of the deliverable. However, Cleanwatts has already integrated several telemetry systems from different providers and will ensure that this operation will run smoothly.

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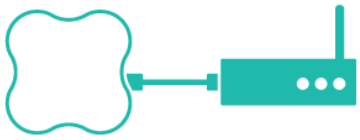
4. Annex

4.1. Annex 1 – Installation, integration, and commissioning documents & software tools for HEMS (Cleanwatts) technology

4.1.1. Cloogy Hub and Smart Plugs

Step 1:



Connect the Hub with internet router using the provided Ethernet cable.

Step 2:

Connect the Hub to the AC adapter and then to an electric socket.

Step 3:

In a few seconds, the corner of the Hub, close to the ethernet connector should blink green slowly.

Step 4:

Connect the Smart Plugs to the desired socket, to the appliance you wish to monitor, control and/or schedule will be connected.

One of the Power Plugs must be used with the fridge as a flexible load. This power plug is identified with a frontal image.

Please don't forget to associate the right appliance image and name at Cloogy Platform.

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Step 5:

Access the portal: http://innov.vps.energy/

Ask the participant to create an account. Insert username and password and follow the instructions on the portal.

After entering on participant account, it is necessary to activate Cloogy Kit. To do so enter Hub's ID, located at the bottom of it.

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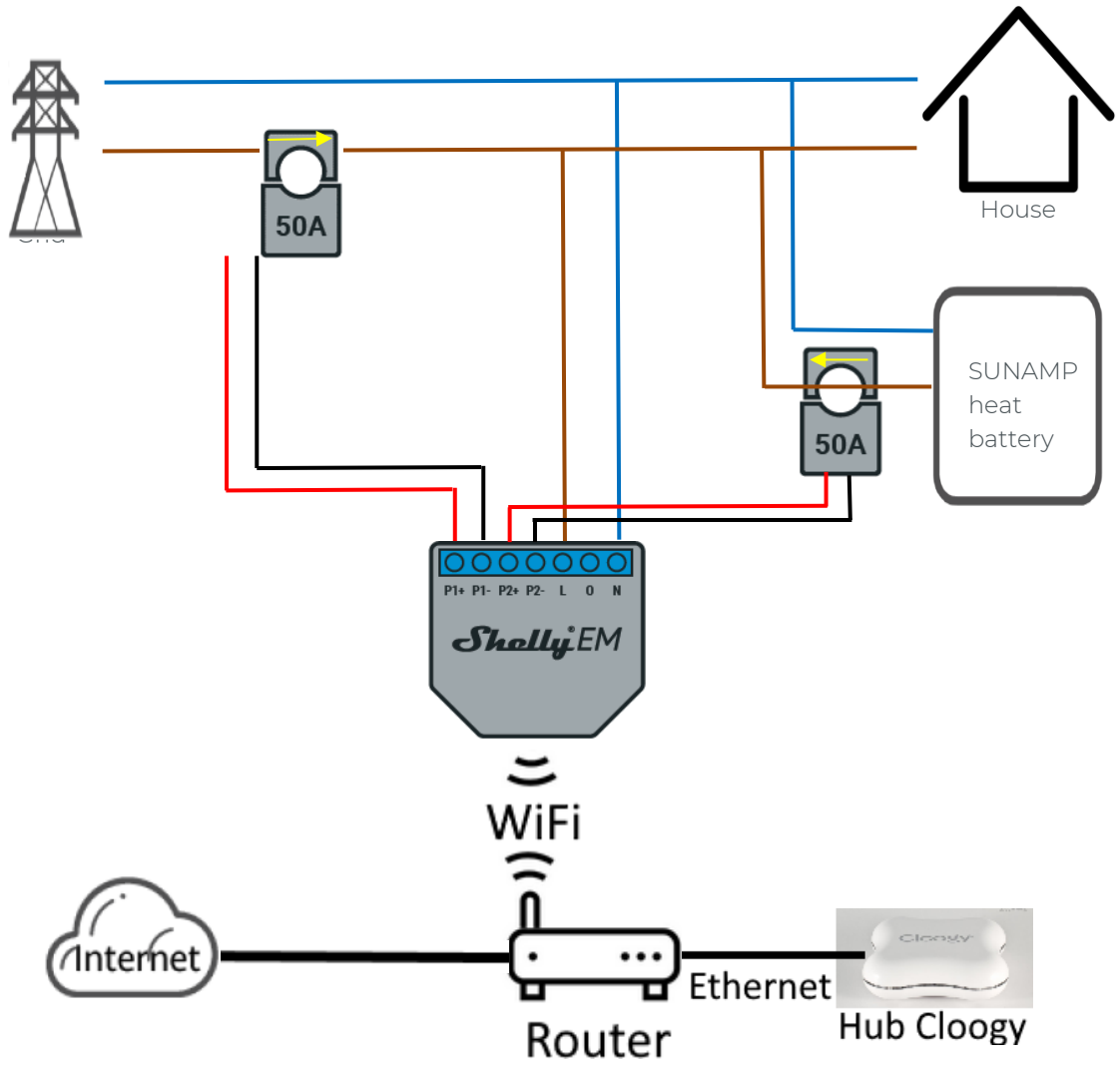
4.1.2. WiFi Energy Meter (Shelly meter)

Shelly EM Installation



LEGEND:
N - Neutral input (110-230V AC);
L - Line input (110-230V AC);
P1+ - Positive connection of current transformer 1
P1- - Negative connection of current transformer 1
P2+ - Positive connection of current transformer 2
P2- - Negative connection of current transformer 2

1) Install the Shelly EM following the provided schematic.
1.1) The installation may not have an inverter in which case only one current transformer is provided.
1.2) The current transformer with the highest current is always installed in the connection to the grid.
1.3) The necessary safety and protection equipment's (if required by the client or local legislation) are not shown.
2) Check the current flow in the current transformers and their connection to the Shelly EM.

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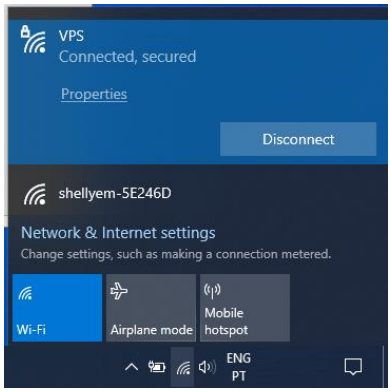
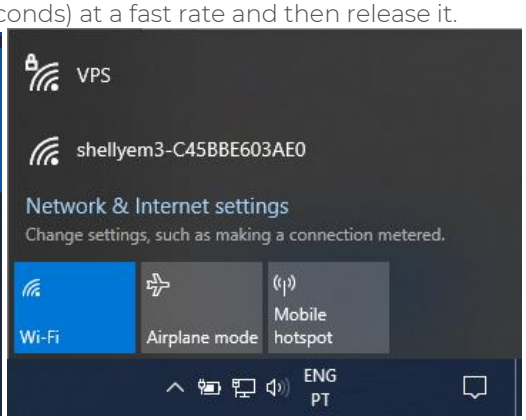
Configuration

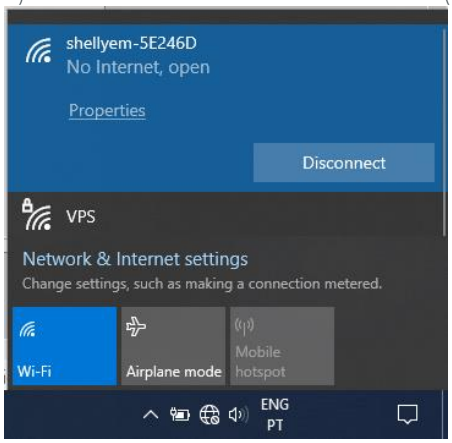
Wifi Network

1) Power the Shelly EM / Shelly 3EM.
2) By default, the Shelly acts as an Access Point and creates a WiFi network with SSID of type “shellyem-5E246D” / “shellyem3-C45BBE603AE0”.
3) Take note of the SSID. This will be referenced, from now on, as the “Shelly Name”.
4) If the network isn’t visible or the device was wrongly configured, press the button on the Shelly till the LED blinks (approximately 10 seconds) at a fast rate and then release it.

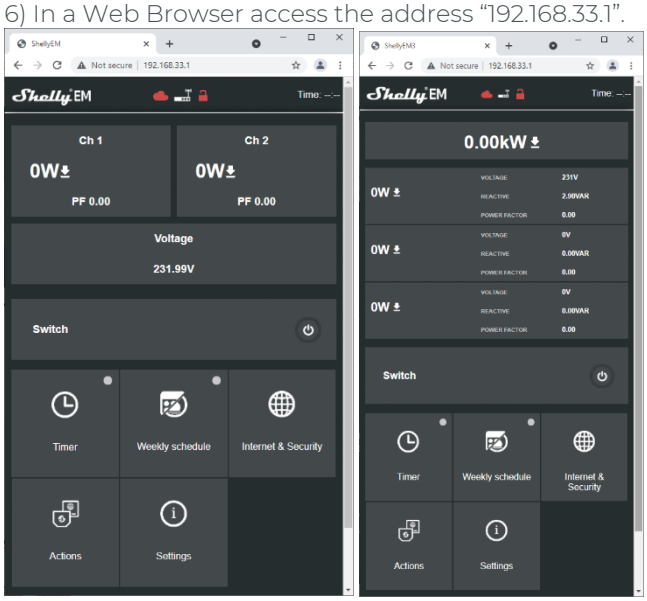




5) Connect a PC to the WiFi network (no password is required).



6) In a Web Browser access the address “192.168.33.1”.



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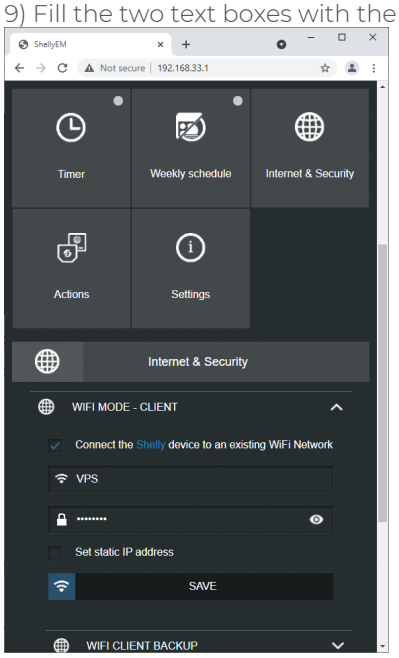
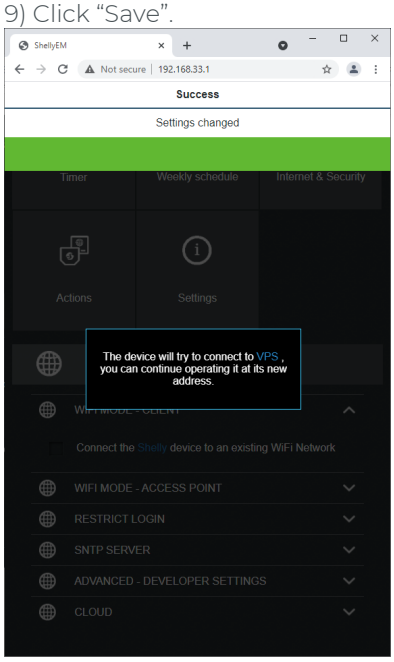
7) Click “Internet & Security”, “WiFi Mode – Client”.
8) Select “Connect the Shelly device to an existing WiFi network”.
9) Fill the two text boxes with the WiFi SSID and password from the client network.



9) Click “Save”.



10) The WiFi network created by the Shelly device should disappear (it may take some time do Windows to update de network list).
11) Connect a PC to the client network using a cabled Ethernet connection (shutdown the WiFi interface).
12) In a Web Browser access the address “http://shellyem-5e246d.local/“ / “http://shellyem3-C45BBE603AE0.local/” (substitute the “Shelly EM Name”).
If this doesn’t work:

13) Press Win Key and R Key (+ R).
14) Type “cmd” in the text box and press the Ok button.

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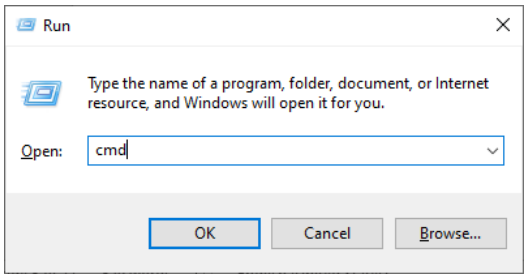
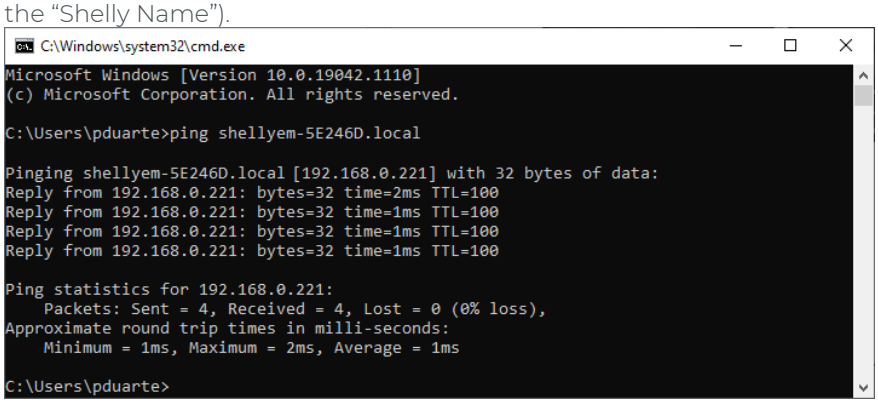
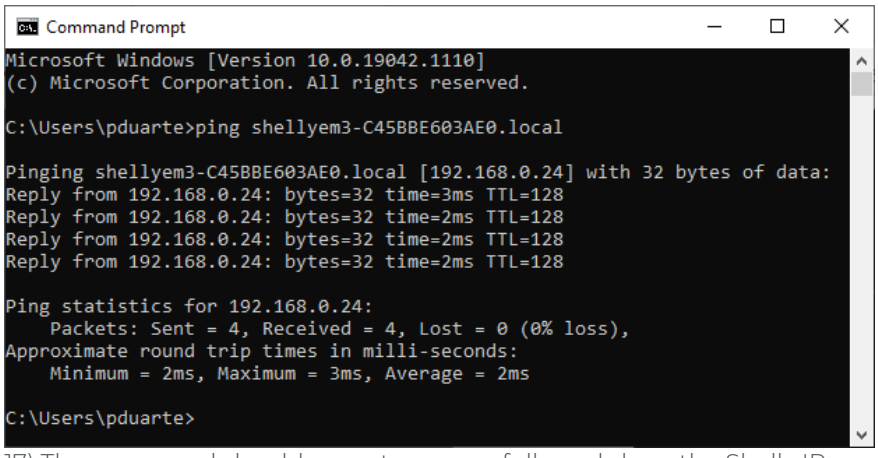


15) A Command Window is open.
16) Type “ping shellyem-5E246D.local” / “ping shellyem3-C45BBE603AE0.local” and press Enter (substitute the “Shelly Name”).





17) The command should execute successfully and show the Shelly IP.
18) In a Web Browser access the address of the Shelly.

Firmware Update

1) Click “Settings”, “Firmware Update”, “Update Firmware” and “Update Firmware” if available.

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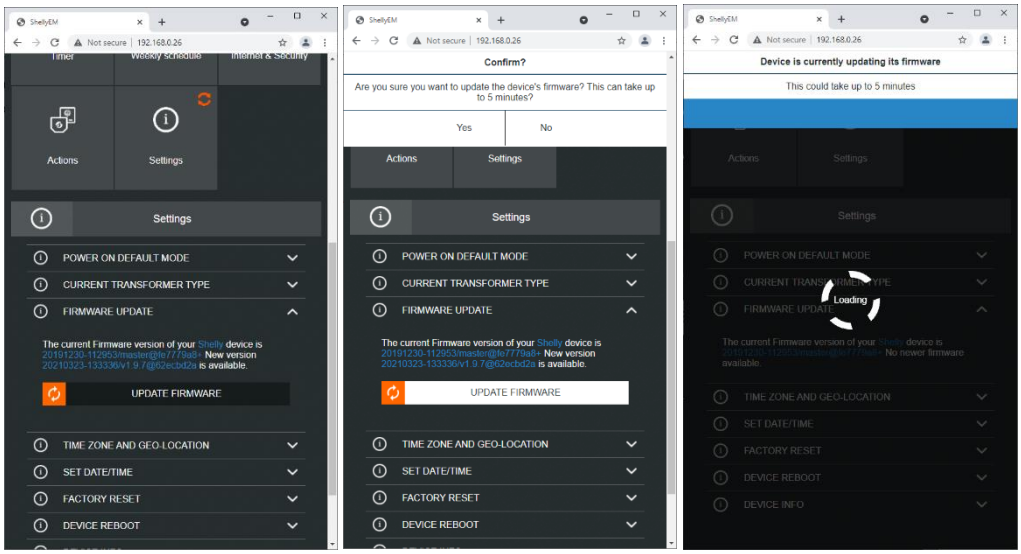
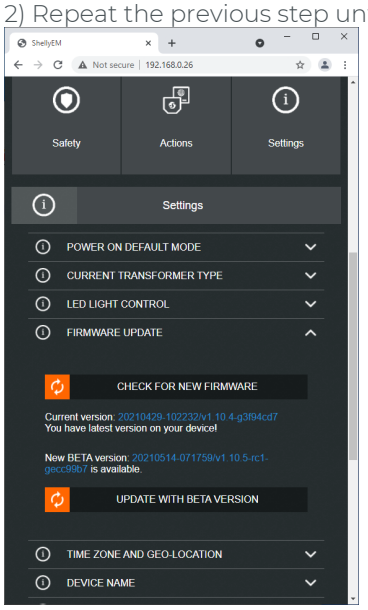


2) Repeat the previous step until “Check For New Firmware” is shown instead of “Update Firmware”.



Current Transformers (Shelly EM only)

1) Click “Settings”, “Current Transformer Type” and select the maximum current accordingly to the installed current transformers.

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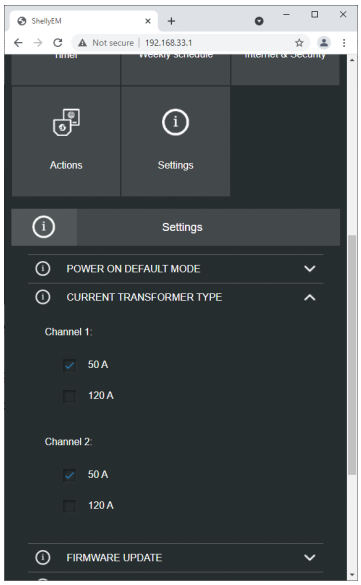
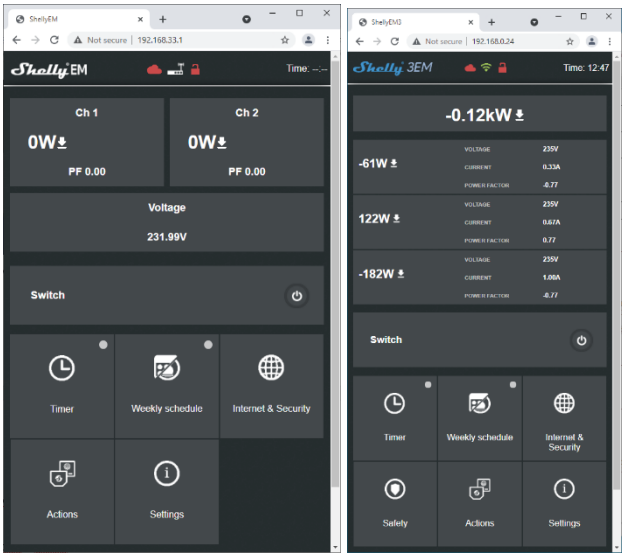


Test

1) In the main webpage check that the Power and Voltage values shown for the channels are correct.



For Shelly EM:

Channel 1: Positive for energy flowing from the Grid to the House.

Channel 2: Positive for energy flowing from the heat battery inverter to the House.

4.1.3. Software for final installation check

"Install Checker" is a Cleanwatts app that allows the installer to check all the devices installed. The application is inside the "Debug" folder with the name: "InstallCheck.exe".

Open the "Install Checker" software provided on the folder by Cleanwatts.

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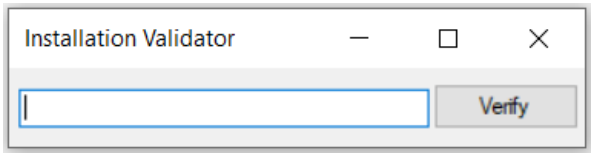
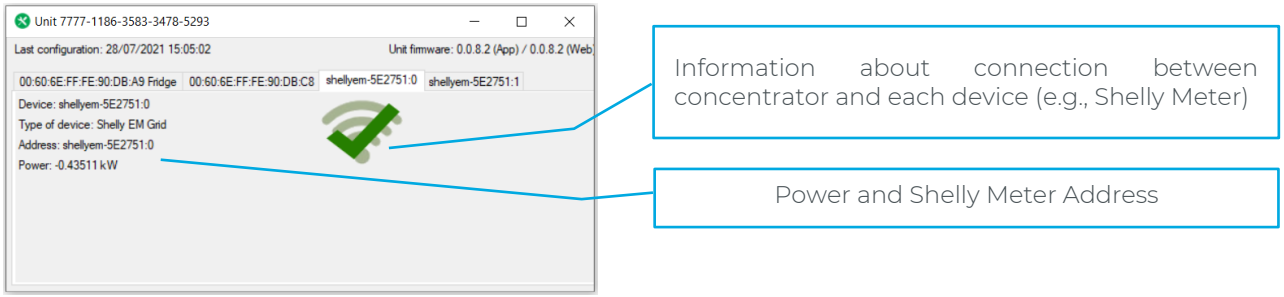
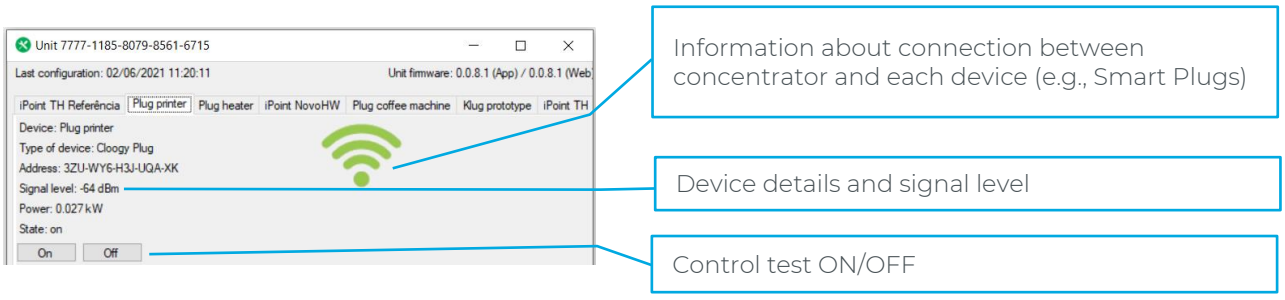
Just insert the serial number located at the bottom of the “Cloogy Hub” and consult the results per installed equipment.

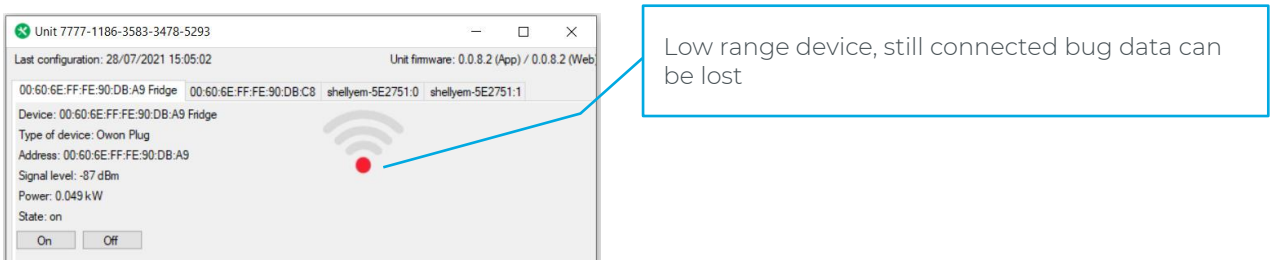


Note: Verify if the Unit firmware version is 0.0.8.3, this supports Shelly Meter 3EM and the 0.0.8.2 only supports Shelly Meter EM. The firmware update is required if the version is smaller than mentioned versions. Please contact Cleanwatts and request a Cloogy Hub firmware update.

After clicking “Verify”, each page presented will display in detail the relevant information per device. The following images are some examples of usage:







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4.1.4. Check list table

Installation, integration, and commissioning procedures check list table for HEMS (Cleanwatts)			
ID	Procedure	Insert comment / Data	Check box
1	Register here the “pilot site ID”		☐
3	Register here the “Cloogy Hub ID”		☐
3	“Cloogy Hub” installed and ethernet connector is blinking green slowly		☐
4	Register here the WiFi Energy Meter “WiFi network with SSID”		☐
5	Participant account has been created on Cloogy portal/APP and Cloogy Kit activated		☐
6	Register here the participant “email address”		☐
7	“WiFi Energy Meter” has been installed and configured		☐
8	Doble check that the clamps direction of the “WiFi Energy Meter” are according to the convention on the manual		☐
9	Run the “Install Checker” software application and check if all devices are correctly installed		☐

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4.2. Annex 2 – Installation, integration, and commissioning documents & software tools for FEID-Plus (CERTH) technology

4.2.1. FEID-Plus Gateway and Smart Plugs

Step 1:

Connect the FEID-Plus with the internet router using an ethernet cable.

Step 2:

Connect the FEID-Plus to the provided AC adapter with the provided USB cable and then to an electric socket.

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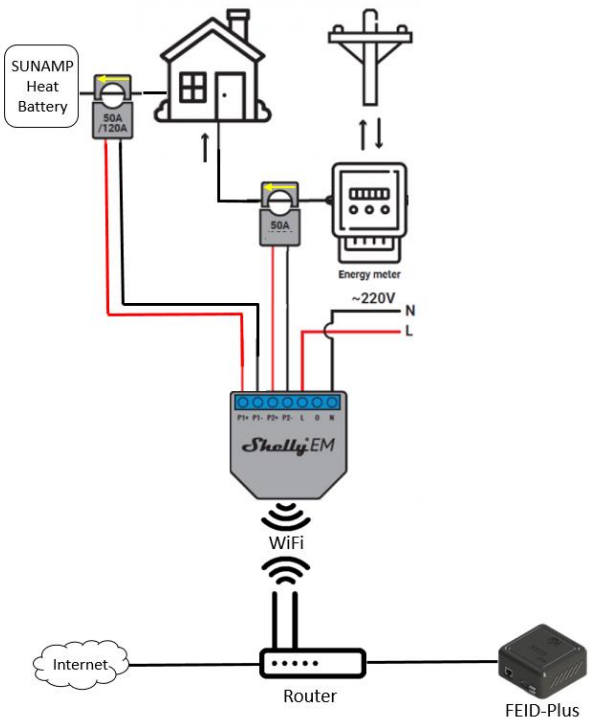
4.2.2. WiFi Energy Meter (Shelly meter)

Shelly EM Installation



LEGEND:
N - Neutral input (110-230V AC);
L - Line input (110-230V AC);
P1+ - Positive connection of current transformer 1
P1- - Negative connection of current transformer 1
P2+ - Positive connection of current transformer 2
P2- - Negative connection of current transformer 2

- Install the Shelly EM following the provided schematic.
- The necessary safety and protection equipment's (if required by the client or local legislation) are not shown.
- Check the current flow in the current transformers and their connection to the Shelly EM.

Configuration

Wifi Network

1. Power the Shelly EM.
2. By default, the Shelly acts as an Access Point and creates a WiFi network with SSID of type "shellyem-XXXXXX".
3. Take note of the SSID. This will be referenced, from now on, as the "Shelly Name".
4. If the network isn't visible or the device was wrongly configured, press the button on the Shelly till the LED blinks (approximately 10 seconds) at a fast rate and then release it.

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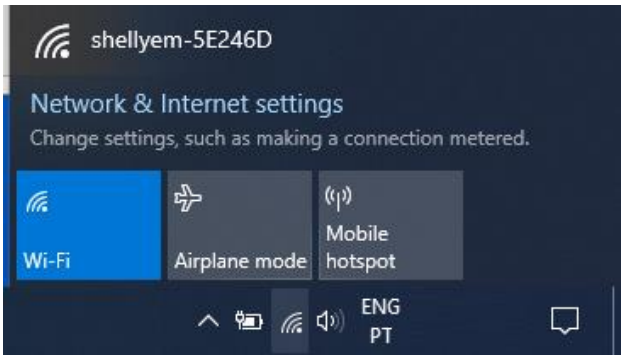
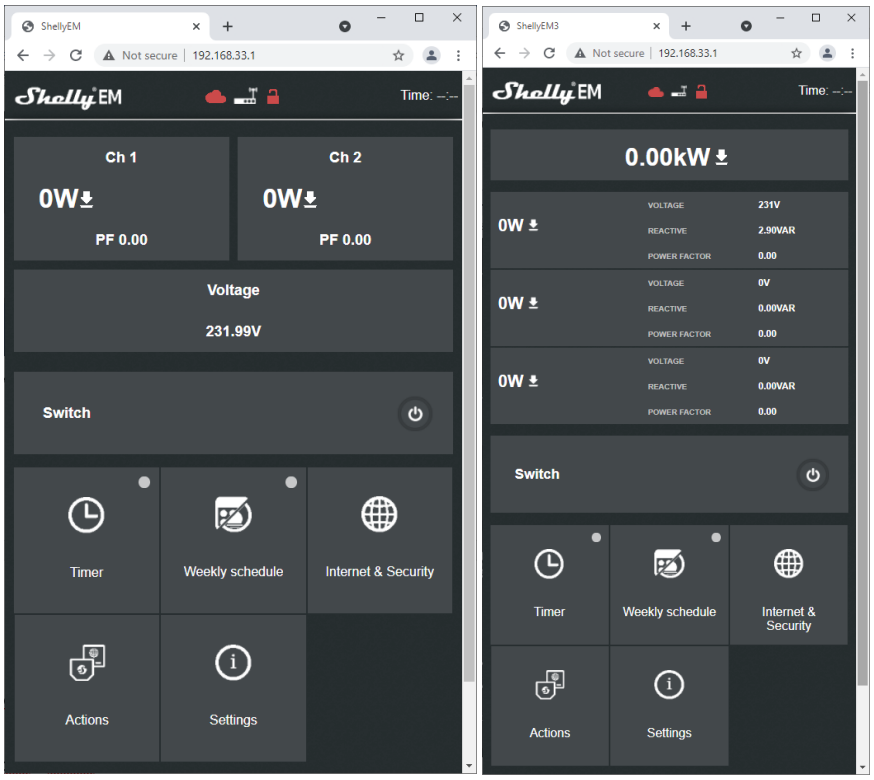


5. Connect a PC to the WiFi network (no password is required).
6. In a Web Browser access the address “192.168.33.1”.



7. Click “Internet & Security”, “WiFi Mode – Client”.
8. Select “Connect the Shelly device to an existing WiFi network”.
9. Fill the two text boxes with the WiFi SSID and password from the client network.

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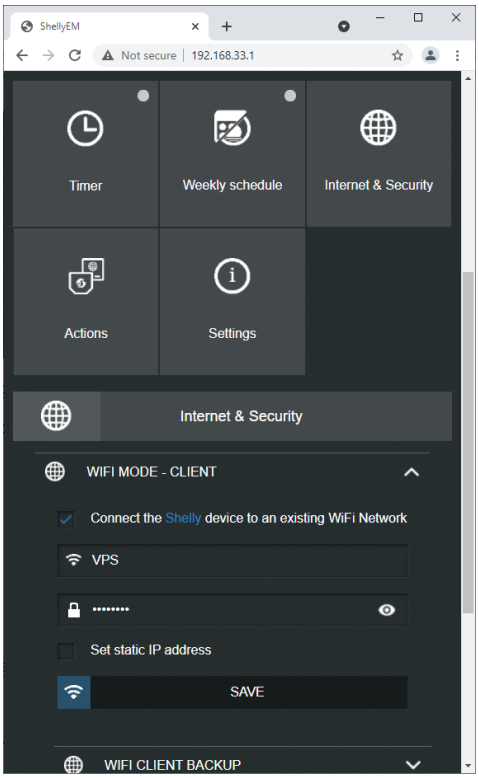
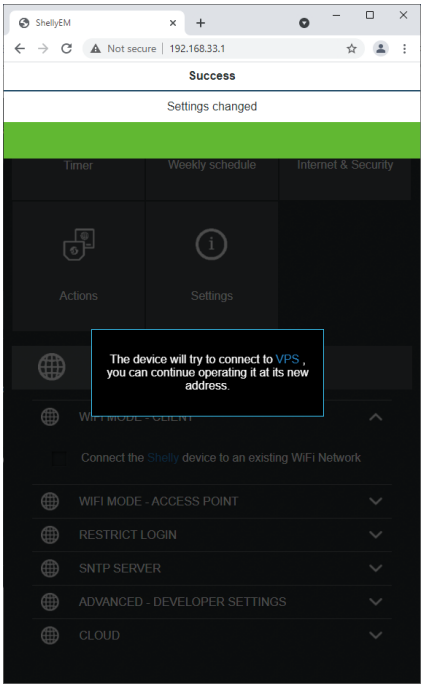


10. Click “Save”.



11. The WiFi network created by the Shelly device should disappear (it may take some time do Windows to update the network list).
12. Connect a PC to the client network using a cabled Ethernet connection (shutdown the WiFi interface).
13. In a Web Browser access the address “http://shellyem-5e246d.local/“ (substitute the “Shelly EM Name”).

<u>If this doesn’t work:</u>

14. Press Win Key and R Key (+ R).
15. Type “cmd” in the text box and press the Ok button.

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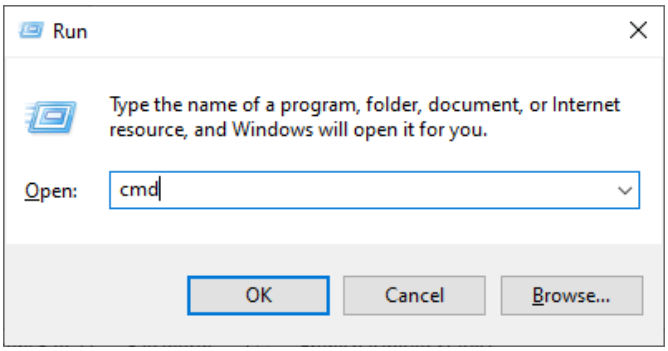
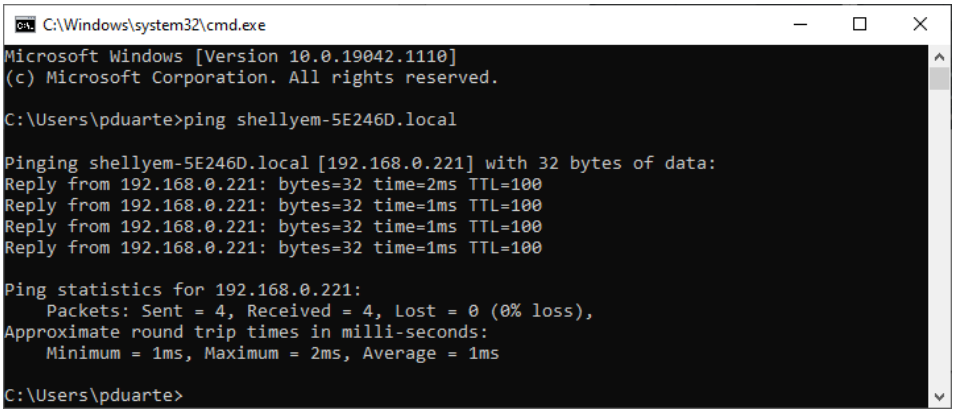
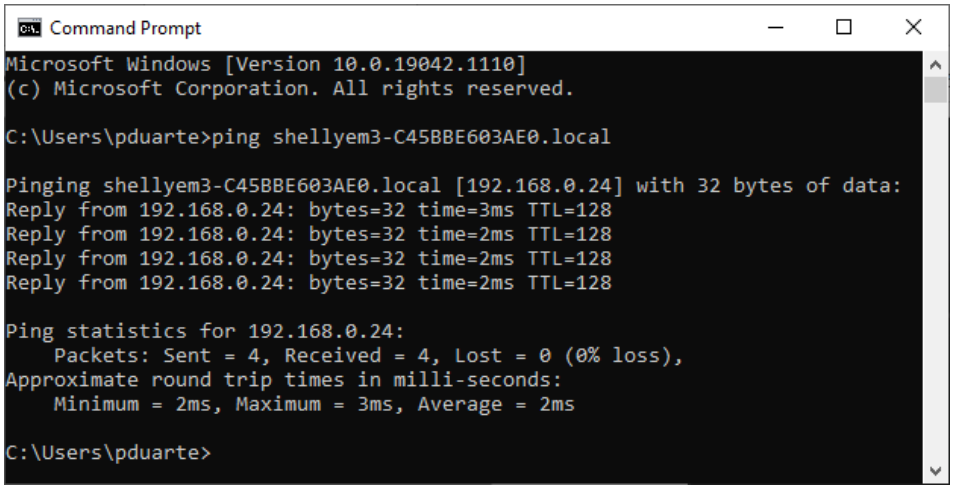


16. A Command Window is open.
17. Type “ping shellyem-5E246D.local” and press Enter (substitute the “Shelly Name”).





18. The command should execute successfully and show the Shelly IP.
19. In a Web Browser access the address of the Shelly.

Firmware Update

1. Click “Settings”, “Firmware Update”, “Update Firmware” and “Update Firmware” if available.

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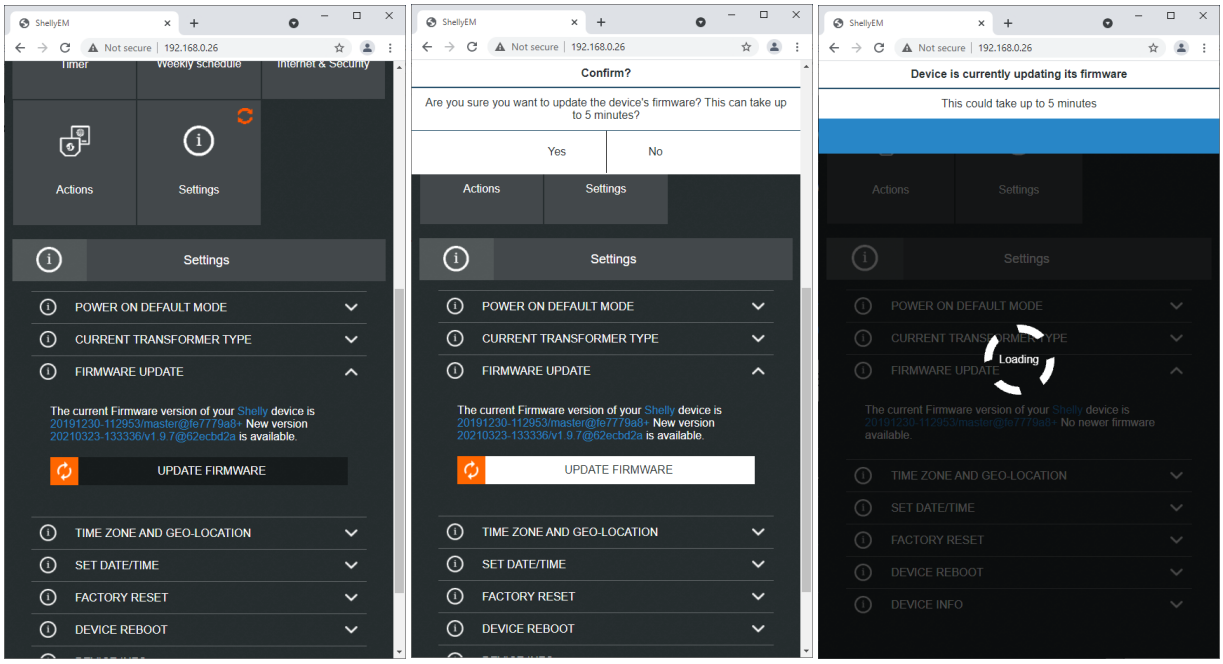
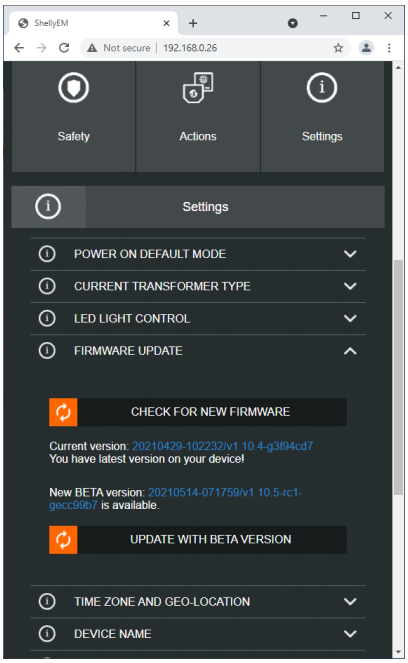


2. Repeat the previous step until “Check For New Firmware” is shown instead of “Update Firmware”.



Current Transformers (Shelly EM only)

1. Click “Settings”, “Current Transformer Type” and select the maximum current accordingly to the installed current transformers.

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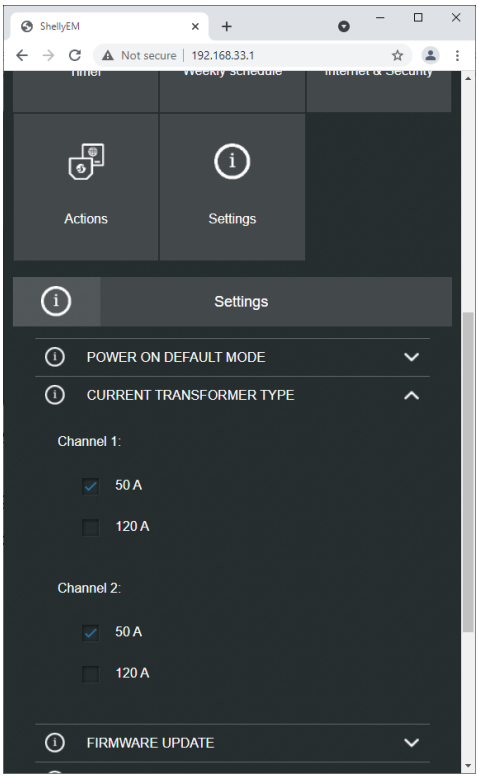
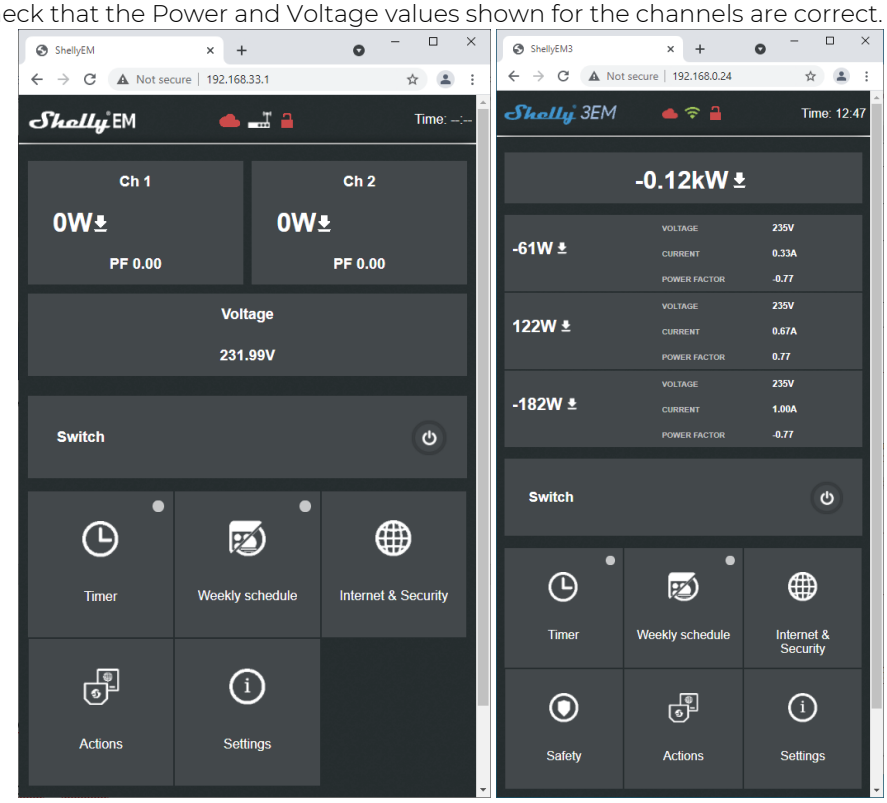


Test

1. In the main webpage (use the IP address that was assigned to the plug after connecting to the local network) check that the Power and Voltage values shown for the channels are correct.



For Shelly EM:

Channel 1: Positive for energy flowing from the Grid to the House.

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4.2.3. WiFi Smart Plug (Shelly plug)

Shelly Smart Plug Installation

1. Place Shelly into the power socket without any device/load connected to the Shelly.
2. Press the Power Button. The LED should flash red/blue. This means that Shelly is in AP mode.

Notes:

LED States:

- Blue flashing quickly - AP Mode
- Blue flashing slowly - STA Mode (no cloud)
- Blue still - STA Mode (connected to cloud)
- Red still - Relay On
- Red & Blue flashing quickly - FW Update

Factory Reset:

You can return the Shelly Plug to its Factory Settings by pressing and holding the button for 10 secods. Upon succesful factory reset Shelly's WiFi LED will flash Red/Blue

Wifi Network

1. Power the Shelly Plug.
2. By default, the Shelly acts as an Access Point and creates a WiFi network with SSID of type "shellyplug-s-XXXXXX".
3. Take note of the SSID. This will be referenced, from now on, as the "Shelly Name".
4. If the network isn't visible or the device was wrongly configured, press the button on the Shelly till the LED blinks (approximately 10 seconds) at a fast rate and then release it.
5. Connect a PC to the WiFi network (no password is required).

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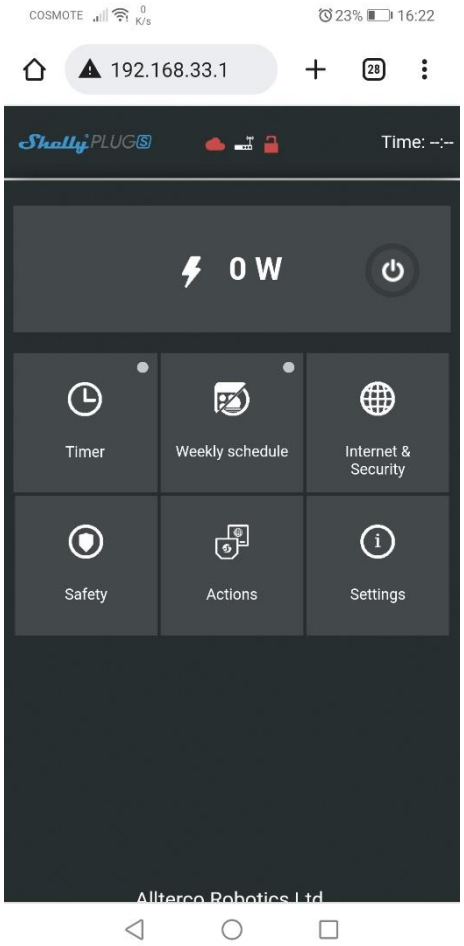
6. In a Web Browser access the address “192.168.33.1”.



7. Click “Internet & Security”, “WiFi Mode – Client”.
8. Select “Connect the Shelly device to an existing WiFi network”.

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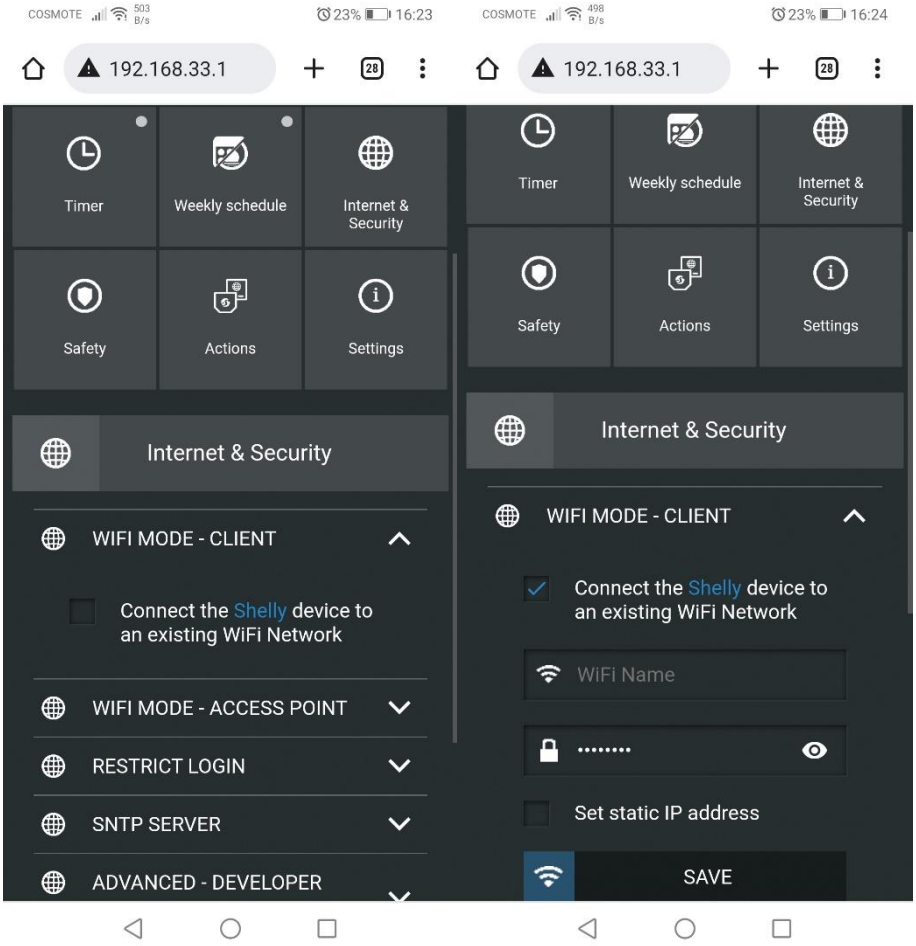
9. Fill the two text boxes with the WiFi SSID and password from the client network.
10. Click “Save”



11. The WiFi network created by the Shelly device should disappear (it may take some time do Windows to update the network list).
12. Connect a PC to the client network using a cabled Ethernet connection (shutdown the WiFi interface).

In a Web Browser access the address “http://shelly-s-XXXXX.local/h“ (substitute the “Shelly EM Name”).

Test

1. In the main webpage (use the IP address that was assigned to the plug after connecting to the local network) check that the Power value shown is correct and that the load can be switched on & off.

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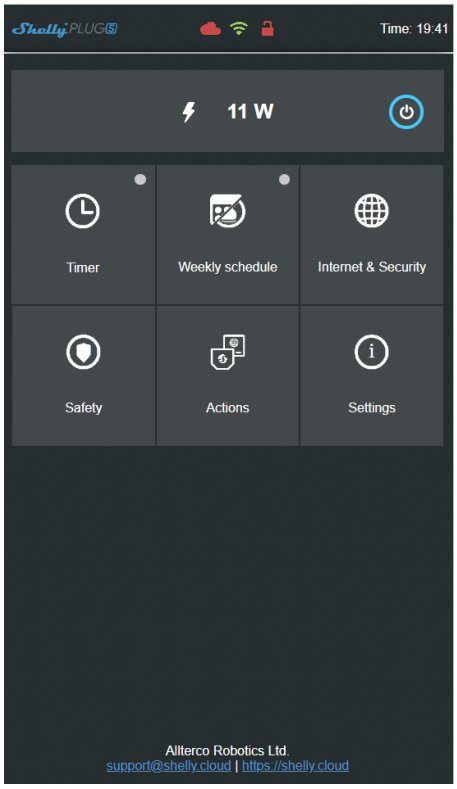

4.2.4. Check list table

Installation, integration, and commissioning procedures check list table for FEID-Plus (CERTH)			
ID	Procedure	Insert comment / Data	Check box
1	Double check that the clamps direction of the "WiFi Energy Meter" are according to the convention on the manual		☐
2	Check in the FEID appears in the network (use a free tool, e.g. "Advanced IP Scanner")		☐
3	Open a "Browser" software on the laptop and check if the devices are correctly installed (use the url "http://feidPlus_ip/info")		☐
4	Write down the WiFi SSID and password, and Shelly devices names in order to forward them, afterwards to CERTH team		☐

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4.3. Annex 3 – Check list table for PV Panels and MicroInverter Kit (BeON)

The operations that are necessary for the installation, integration and commissioning are summarized on the next table.

Table 9 – Check list table for BeON energy PV system

Installation, integration, and commissioning procedures check list table for BeON energy PV system			
ID	Procedure	Insert comment / Data	Check box
1	Install support structure		☐
2	Fix PV panels on the structure		
3	Install Pluginverters		☐
4	Install cabling and connect to the closest wall socket		
5	Inspection and verification		☐
6	Install communication interface		
7	Install BeON application on a mobile device (APP store)		☐
8	Communication setup and interface verification		
9	Commissioning Report		☐

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4.4. Annex 4 – Check list table for Heat Batteries (SUNAMP)

Installation, integration, and commissioning procedures check list table for SUNAMP heat battery			
ID	Procedure	Insert comment / Data	Check box
1	Installation instructions and Commissioning Certificate are available.	Do not unpack unit until instructions have been read	☐
2	Safety, mechanical, electrical and water checks	Chapter 1 performed	☐
3	Accessories Tempering valve, 0.5 litre expansion vessel are present. These accessories will come delivered with each unit.	Accessories and parts (Chapter 2.4 installation guide) are available.	☐
4	Follow installation instructions	Mains cold water connects into port D. Hot water outlet connected to port A.	☐
5	Water supply requirements	The heat batteries are designed for 1.0 MPa (10 bar) maximum working pressure, it is recommended that if the incoming mains pressure is greater than 0.5MPa (5 bar) an approved pressure regulator set at 0.5PMa (0.5 bar) should be fitted. Check incoming water pressure is more than 0.15MPa (1.5 bar).	☐
6	Hard Water and Limescale Where mains water hardness can exceed 150 ppm	Limescale control check	☐
7	Free space around the heat battery	Ensure there is 15cm around the sides and back and 45cm space about the battery to remove the lid if necessary	☐
8	Hydraulic checks. All connected tubes and work inside the battery casing must be 22mm copper tube	Check chapter 3.4 of the installation document	☐
9	Temperature and Insulation check	Chapter 3.5 within manual	☐
10	Electrical wiring check	Chapter 3.6 within manual	☐
11	Controller wiring Thermino ePV	Chapter 3.6.2 and 3.7 within manual wiring diagram check	☐
12	Wiring setup of solar power diversion controller	Chapter 3.9 within manual	☐
13	Commissioning checks	Chapter 4 within manual	☐
14	Operation – switch on	Chapter 5 LED status and charging	

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4.5. Annex 5 – Check list table for V2G Chargers (EFACEC EM)

Installation, integration, and commissioning procedures check list table for V2G Chargers (EFACEC EM)			
ID	Procedure	Insert comment / Data	Check box
1	Charger placement and installation		☐
2	Installation of the feeder and power supply		☐
3	Inspection and verification		☐
4	Communication setup and interface verification		☐
5	Unidirectional charging session with a CHAdeMO electric vehicle or simulator		☐
6	Verification of the actuation of the internal protections		☐
7	Commissioning Report		☐

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4.6. Annex 6 – Check list table for Teraloop technology

Installation, integration, and commissioning procedures check list table for local installer			
ID	Procedure	Insert comment / Data	Check box
1	Verification of suitability of local physical environment	Foundation should be a concrete slab able to withstand 1500kg/m2 load, with dimensions of 4 x 4 x 0.5m (length x width x depth preferable underground).	☐
2	Verification of availability of electrical connection for flywheel	3 x 250A, 400VAC (MCMK 4x95+50)	☐
3	Verification of availability of electrical connection for auxiliary systems	3x16 A, 400V (MCMK 4x2,5+2,5)	☐
4	Ensure availability of Ethernet connection with internet access	High reliability is key.	☐
5	Physical installation of containerised solution	Ensure container attachment to the concrete slab.	☐
6	Electrical installation of containerised solution		☐

Further instructions are:

- Teraloop's user manual which will be provided ahead of time;

- Guidance session with Teraloop's technical team.

This information will be provided ahead of the installation, integration and commissioning, following Teraloop's established timeline.

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