Manual for self-installation of autonomous charging stations

SENECA green

Sector Network

COOPERATE TO INNOVATE

Ivano-Frankivsk National Technical University of Oil and Gas

SECTOR NETWORKS

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Table of contents

List of Acronyms

AcB - accumulator battery
CoABO - organization of co-owners of apartment buildings
AC - alternating current
DC - direct current
PV Solar panels - photovoltaic modules
CT - current transformer

1 Introduction. About this guide

This manual was developed by experts from Ivano-Frankivsk National Technical University of Oil and Gas (IFNTUOG). The Department of Information and Measurement Technologies and Energy Management, as well as the Center for Energy Transition Studies were involved in the preparation process. This manual was commissioned by GIZ SENECA Green Network of Europe, Caucasus, Central Asia and Afghanistan as an internal document.

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This manual contains information on how to build autonomous charging stations on your own.

1.1 How to use this manual

Before performing any operations, read this manual and other related documents (instructions for working with individual elements of the system) in detail. All documents must be kept in a safe place.

1.2 General information about the manual

This manual is a detailed, step-by-step guide designed to be understandable and accessible to the maximum number of people with basic electrical knowledge who are able to safely and competently recreate such a system. After reviewing this manual, you will have an understanding of how this system is assembled and operates, as well as how to adapt it to your specific needs. It also contains safety precautions that must be followed during the assembly, installation and operation of such a station. The manual describes and demonstrates in detail what elements the system consists of, step-by-step instructions for assembling all the elements into a working station, the sequence of connections, the technical parameters of each element, and the necessary safety measures both during installation and in the course of further use.
The main target audience of this manual is the administrations of condominiums, municipal or other institutions, small organizations that, due to force majeure, military operations or disasters, need autonomous power supply but are not able to use industrial-scale equipment.
This manual shows how to create an autonomous power station with a modular system that can be used for common public spaces and can be scaled up or down depending on the needs of each specific situation.

2 Purpose of the autonomous charging station

The autonomous charging station described in this manual is designed to provide electricity primarily to common spaces. In particular, such a station can be used to meet the energy needs of common areas of condominiums, utilities, or public organizations. It can be used to provide power for both lighting of common spaces and video surveillance systems, burglar and fire alarms, electromagnetic door locks, intercoms, network equipment, etc. for a typical entrance of a 9-10-storey building.

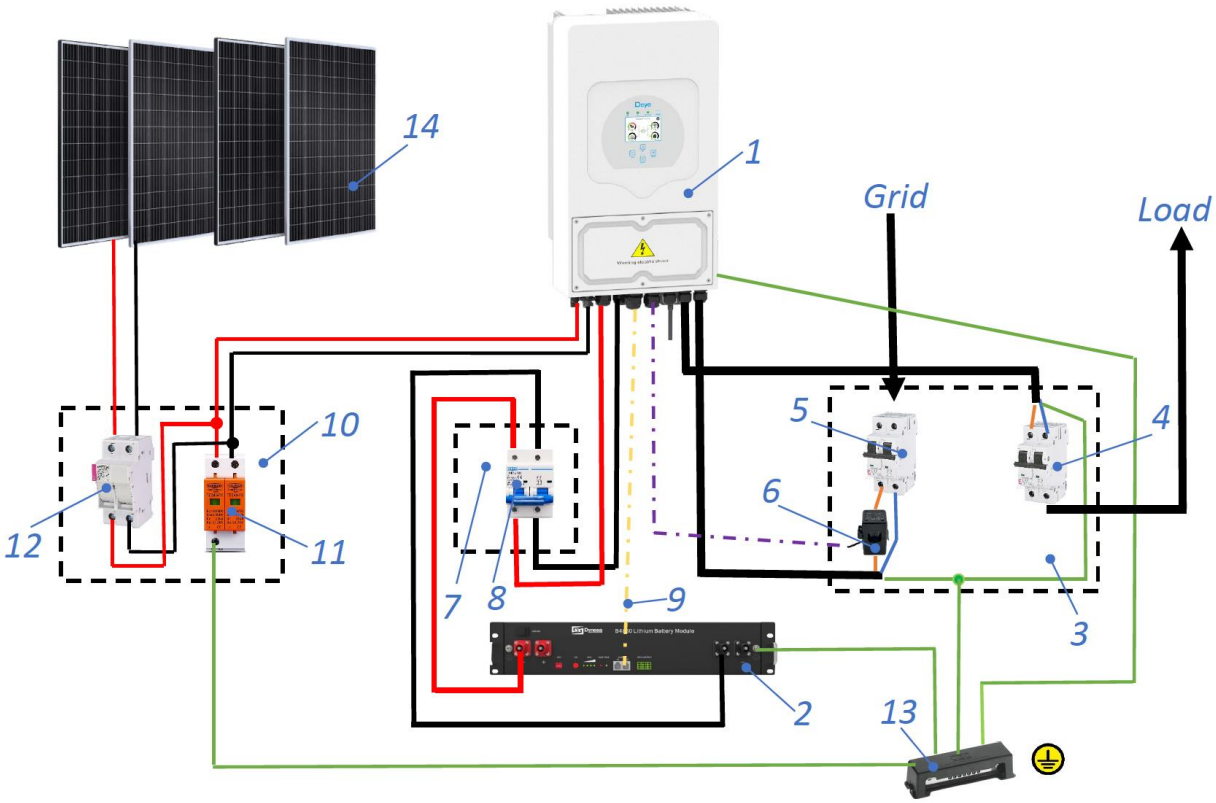
3 Pre-assembly requirements. List of required tools and equipment

This section provides information about the general structure of the system, as well as a list of the necessary equipment and tools that will be used in the process of assembling the system.

3.1 System structure

In general, the system consists of:
-- Photovoltaic modules that convert solar radiation into direct current electricity;
-- A 6 kW single-phase hybrid inverter designed to operate from lithium-iron-phosphate batteries with a nominal voltage of 48 V. It converts direct current into alternating current from batteries or an array of photovoltaic modules, provides both backup power for equipment and compensation for the consumption of electrical energy for this equipment;
-- A lithium-iron-phosphate battery with a capacity of 50 Ah (nominal energy consumption 2.4 kWh) that stores electrical energy for further use;
-- AC and DC protective panels equipped with circuit breakers, fuse disconnectors and surge protection devices;
-- A mounting rack with a set of fasteners;
-- A set of power cables with a cross-section of 25 mm² and a length of 2050 mm for connecting the battery, connecting the hybrid inverter to the grid and load, and a communication cable required to connect the inverter to the battery;
-- An array of 12 polycrystalline photovoltaic modules with a total power of 3.4 kW;
-- A WiFi adapter.

Below is a general scheme for connecting the system.



General scheme of system connection:
1 - hybrid inverter; 2 - battery; 3 - AC switchboard; 4 - circuit breaker (load); 5 - circuit breaker (mains); 6 - current transformer; 7 - DC switchboard (battery); 8 - DC circuit breaker; 9 - communication cable of the battery BMS; 10 - DC panel (photovoltaic modules); 11 - surge arrester; 12 - disconnector with fuses; 13 - main grounding bus; 14 - photovoltaic modules

Note: The type and cross-section of the connecting cables is selected in accordance with the recommendations of the manufacturers of the equipment to be used in the system. The type and rating of circuit breakers, fuses, and surge arresters are selected depending on the type of equipment used and the manufacturers' recommendations.

The following figures show photos of individual elements of the system.

Figure - Array of photovoltaic modules

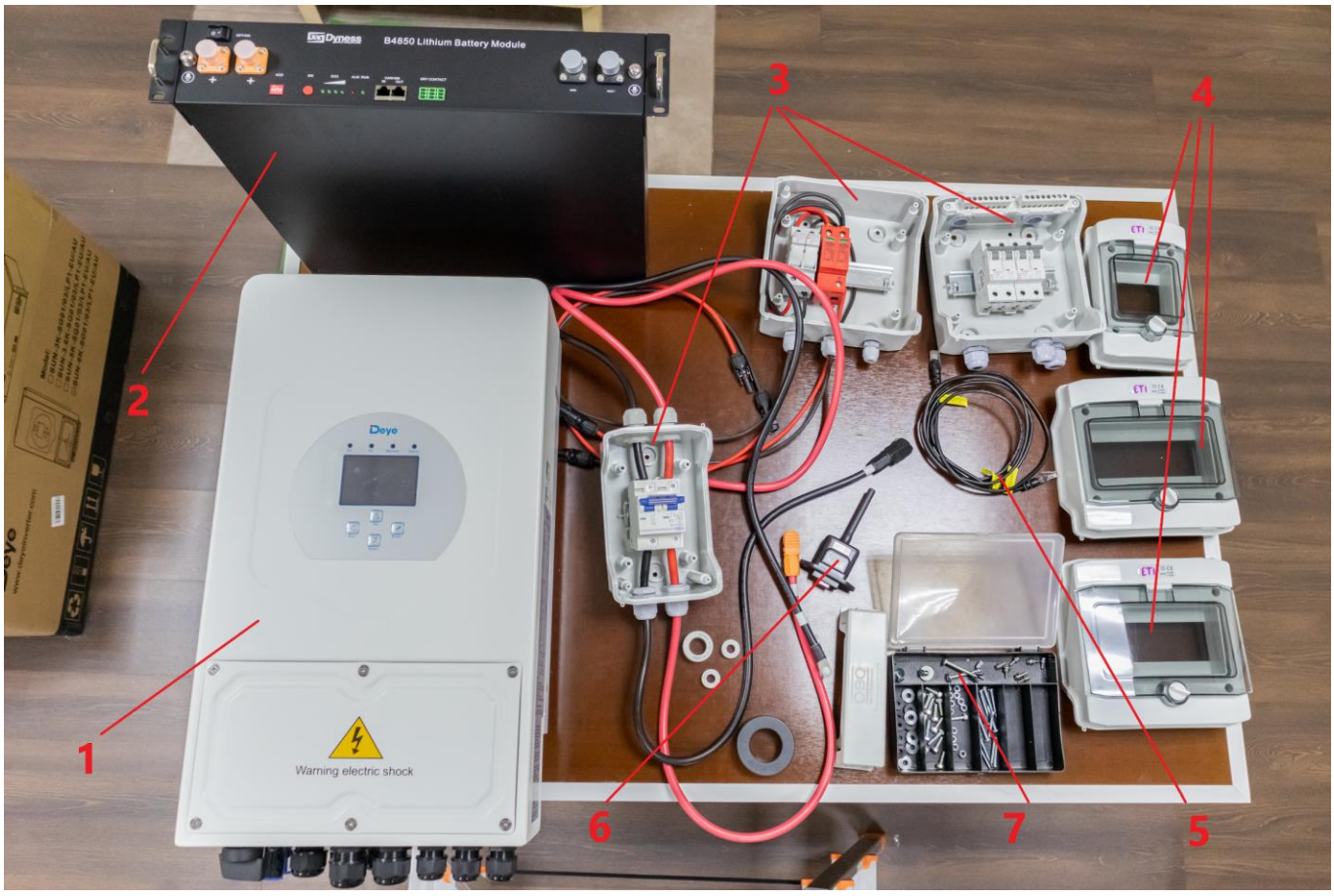


Figure - The main parts of the system:
1 - Hybrid inverter; 2 - Battery; 3, 4 - DC and AC electrical panels, their covers; 5 - Communication cable; 6 - WiFi adapter; 7 - Set of fasteners

The general view of the finished assembled system placed on the rack is shown below.

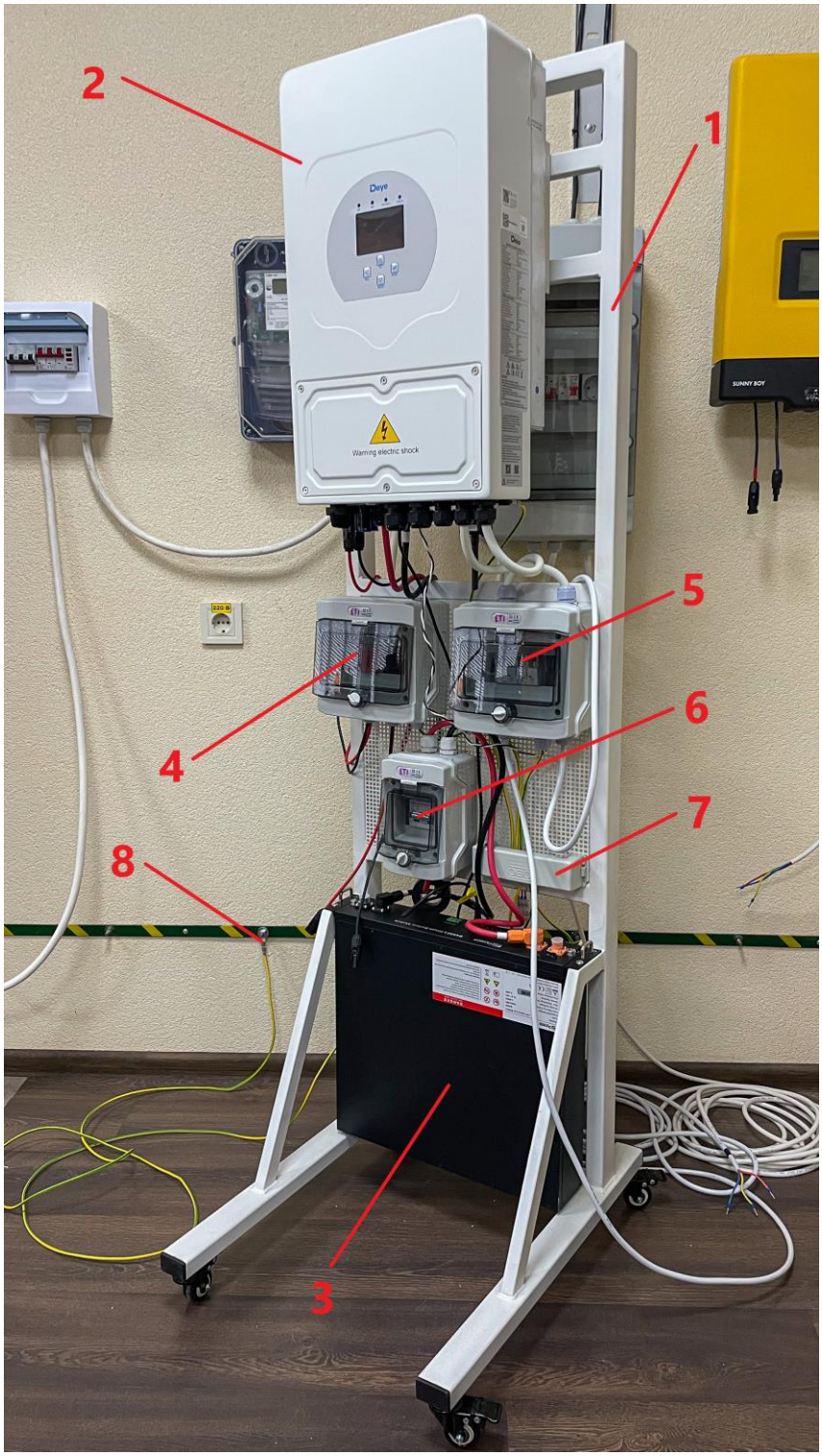
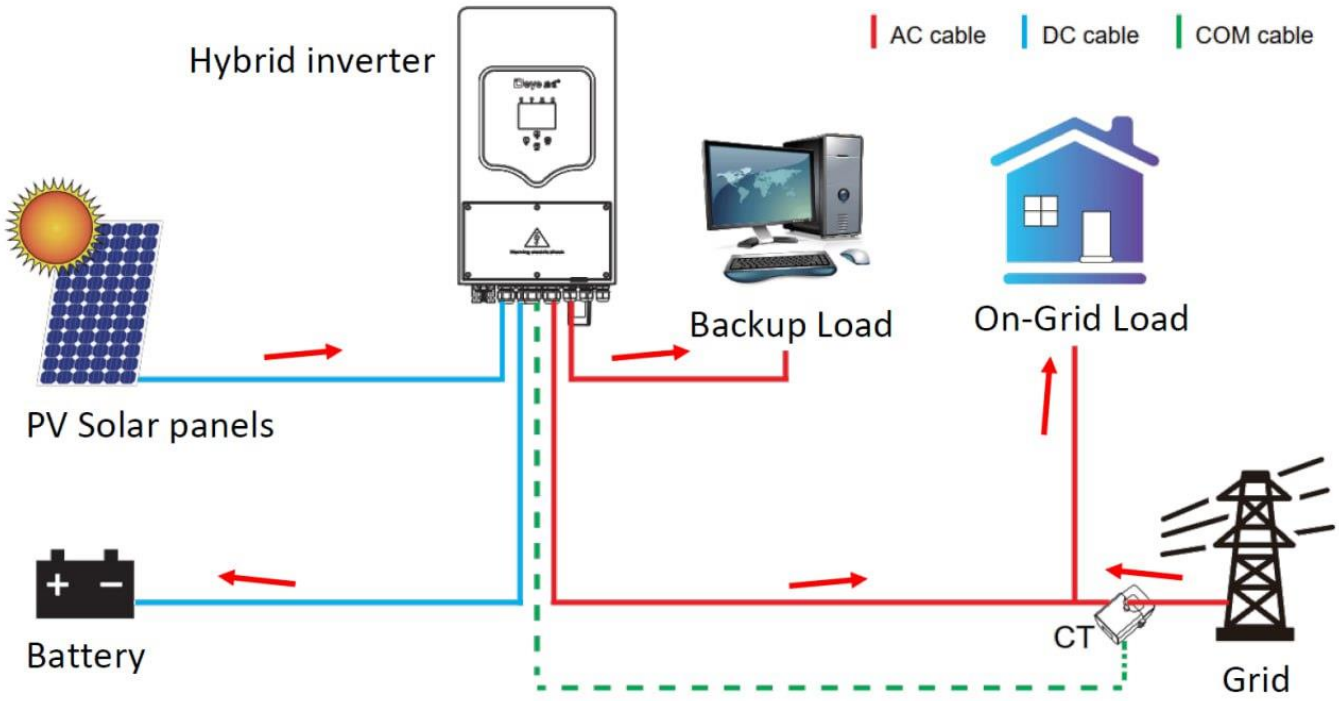


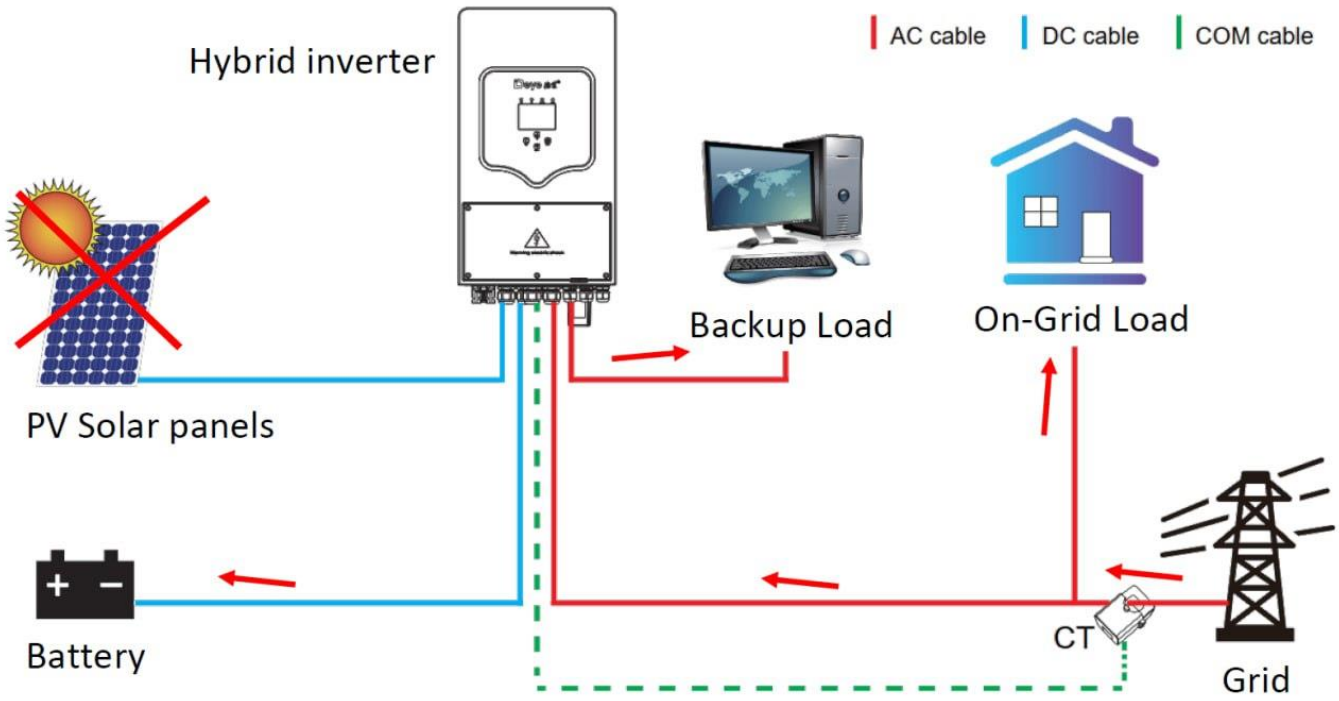
Figure - General view of the assembled system on the mounting rack:
1 - Mounting rack; 2 - Hybrid inverter; 3 - Battery; 4 - DC panel (photovoltaic modules); 5 - AC panel (mains + load); 6 - DC panel (battery); 7 - Main grounding bus; 8 - Grounding circuit

The peculiarity of the system is as follows.
The hybrid inverter allows the station to operate in several modes.

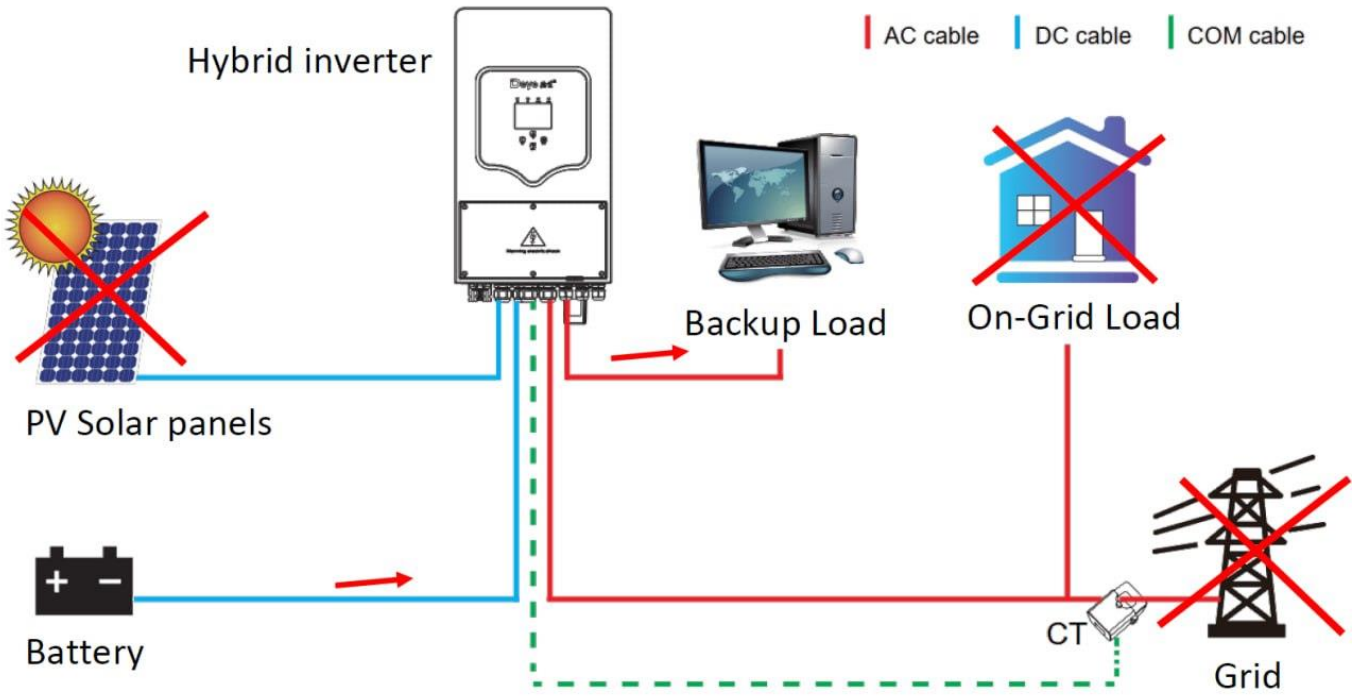
First mode: From the photovoltaic modules that generate direct current (DC), the hybrid inverter converts it into alternating current (AC). It is then used to power electrical devices in the house, compensating for the consumption of electrical energy from the grid. Additionally, the battery is charged.



Second mode: In the event that the PV modules do not generate enough electricity, the hybrid inverter switches to the input grid to ensure stable and uninterrupted operation. Additionally, the battery pack is charged. This process is automatically managed by the built-in controller of the hybrid inverter.



Third mode: The hybrid inverter can be powered by batteries connected to it, which store the electricity generated by the PV modules. This allows the generated electricity to be used at any time, including at night or in cloudy weather when the PV modules are not active.
When the PV modules generate more power than required, the hybrid inverter charges the connected batteries. At the same time, the built-in controller automatically regulates the battery charge level to ensure their efficient operation.
In the absence of grid power, and if the solar panels do not generate enough energy, the hybrid inverter automatically switches to the batteries. In this mode, only the critical load connected to the system is powered.



Before performing any operations, read the manual and other related documents (instructions for working with individual elements of the system) in detail.

3.2 List of basic tools required

The following tools are recommended for installation of the system:
1) Set of dielectric screwdrivers; 2) Cable cutter; 3) Tool for removing the sheath from the cable;
4) Stripper; 5) Crimping tool for cable lugs; 6) Set of socket heads with ratchet collar;
7) Set of box-end wrenches; 8) Set of hex wrenches; 9) Multimeter; 10) Ruler; 11) Pliers and wire cutters.

Figure - General view of the tools required for system assembly:
1) Set of dielectric screwdrivers; 2) Cable cutter; 3) Tool for removing the sheath from the cable; 4) Stripper; 5) Crimping tool for cable lugs; 6) Set of socket heads with a ratchet collar; 7) Set of box-end wrenches; 8) Set of hex keys; 9) Multimeter; 10) Ruler; 11) Pliers and wire cutters.

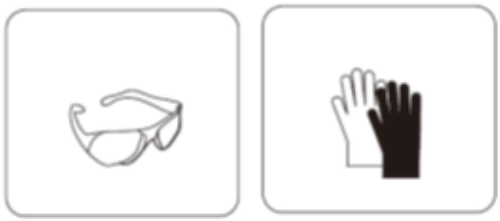
Note. The tools shown in the figure above are not the only solution. Similar tools can be used. Also, additional tools may be used in the process of assembling the system for convenience, as well as additional instruments if provided for in the relevant instructions for the equipment used.

4 Safety instructions and precautions. Preparing the site

This section contains important safety and operating instructions. Be sure to read and retain this manual for future reference. The following are general safety requirements, as well as typical safety requirements for working with the component equipment used to assemble the system as a whole.

4.1 General requirements

The general safety requirements are as follows:
- When installing the system, always observe the safety regulations for handling the installation tools and workplace organization.
- The installation must be carried out in a room that meets fire safety standards, is adequately ventilated (with forced ventilation, at least one air exchange) and equipped with fire extinguishers. The room must also be equipped with a first aid kit.
- Be sure to use personal protective equipment: appropriate work gloves, goggles and overalls.
- Do not work under voltage, check its presence with a multimeter.
- Properly organize the workplace for efficient and safe installation work. The system assembly area should be free of unnecessary items and equipment that is not used for system assembly.
- When selecting equipment, always check the compatibility of the parameters of such equipment.
- If you use equipment that does not meet the specifications given in this manual, the safe start-up and safe operation of the system as a whole cannot be guaranteed.



Protective glasses Work gloves

Figure - Basic personal protective equipment for system assembly

Figure - First aid kit and fire extinguisher, which must be present in the room where the system will be assembled

4.2 Basic safety requirements for system components

Further, the manual provides safety requirements for the main components of the system, namely the inverter and the battery. In particular, the manual describes the specific requirements for the DEYE 6 kW hybrid inverter and the Dyness B4850 50 Ah battery, which are directly used for the practical assembly illustrated in this manual.

Please note that these inverter and battery models are not the only ones that can be used. These system parts are selected in accordance with the requirements described in section 3 of this manual.

Basic safety requirements for using a hybrid inverter:

- Before using the inverter, please read the instructions and warning signs on the battery and the relevant sections in the operating instructions;
- Do not disassemble the inverter. If you need service or repair, take it to a professional service center;
- Improper reassembly may result in electric shock or fire;
- To reduce the risk of electric shock, disconnect all wires before performing any maintenance or cleaning. Turning off the device will not reduce this risk;
- Caution: Only qualified personnel should install this battery operated device;
- Never charge batteries in temperatures below freezing;
- For optimum performance of this inverter, follow the required specifications to select the appropriate cable size. It is very important to operate this inverter correctly;
- Use caution when working with metal tools on or near the batteries. Dropping (touching) a metal tool can cause a spark or short circuit in the batteries and even lead to an explosion;
- Please follow the installation instructions when disconnecting or connecting the AC or DC terminals;
- For more information, please refer to the manufacturer's instructions;
- Grounding instructions: This inverter must be connected to a permanently grounded wiring system;
- Be sure to comply with local requirements and regulations for the installation of this inverter;
- Never short-circuit the AC output and DC input. Do not connect to the grid if the DC input is short-circuited.

Basic safety requirements for the use of the battery pack:

- Please do not throw the battery into water or fire, it will cause an explosion or any other situation that may endanger your life.
- Please connect the wires correctly during installation, do not mix up the connection.
- To avoid short circuit, do not connect the positive and negative poles to the same device.
- Please avoid any damage to the battery, especially stabbing, bumping, blunt objects.
- Please completely disconnect the power when removing the device or reconnecting the wires during daily use, otherwise it may cause electric shock.
- In case of fire hazard, use a dry powder fire extinguisher, liquid fire extinguisher may cause an explosion.
- For your safety, never disassemble any components yourself.

- Technical maintenance should be performed by authorized technicians or our company's technical support service. Device failure due to unauthorized operation is not covered by the warranty.

- The battery has been strictly tested before shipment. Please contact the manufacturer or its authorized representative if you find any abnormalities, such as bulging of the device case.

- To ensure your safety, the product should be properly grounded before use.

- To ensure proper use, make sure that the parameters of the respective device are compatible and match.

- Please do not mix batteries from different manufacturers, different types and models, or old and new batteries together.

- The environment and storage method may affect the product's service life, please follow the instructions for the operating conditions to ensure proper operation of the device.

- For long-term storage, the battery should be recharged once every 6 months, and the electrical charge level should exceed 80% of the rated capacity.

- Please recharge the battery within 18 hours after it is completely discharged or the over-discharge protection mode is activated.

- Formula for theoretical standby time: T=C/I (T - standby time, C - battery capacity, I - total current of all loads).

Important! When selecting each component of the system (in particular, the inverter, the battery), be sure to use the instructions that came with the equipment. Follow the safety precautions and rules specified in the instructions.

5 Step-by-step assembly guide

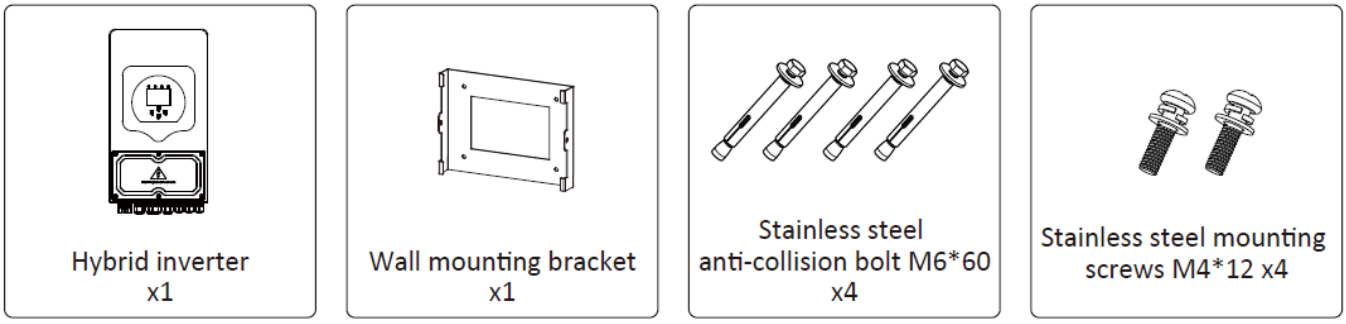
Below are clear and organized instructions with labeled diagrams/photos that detail the installation process of the autonomous charging station system.

5.1 Technical part of the installation

The first part of the installation is to mount the inverter to a mounting stand or wall. This manual will discuss the use of a mounting rack for mounting the system. A schematic representation of a mounting rack that can be used in a particular assembly, as well as a design with dimensions, is provided in Appendix A.

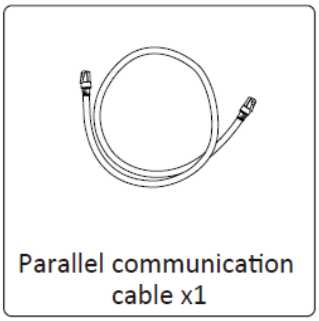
Note: This manual describes the basic structure of the DEYE 6 kW hybrid inverter. If you are using other inverter models, including those from other manufacturers, be sure to follow the manufacturer's instructions.

The basic configuration of the hybrid inverter includes the following main components, listed below.



1 2 3 4

1 - Hybrid inverter (1 pc.);
2 - Wall mounting bracket / hanging plate (1 pc.);
3 - Stainless steel anti-collision bolt M6x60 (4 pcs.);
4 - Stainless steel mounting screws, M4x12 screws (4 pcs.);



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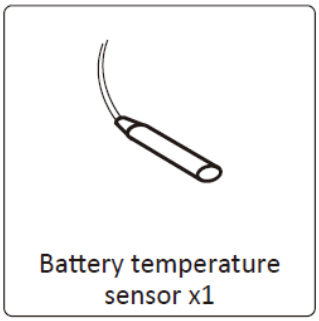

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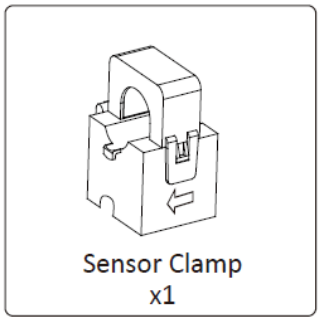

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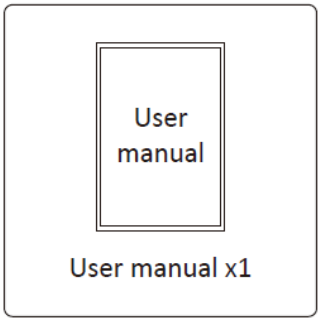
5 - Parallel communication cable (1 pc.);
6 - L-type hexagon key (1 pc.);
7 - Battery temperature sensor (1 pc.);
8 - Sensor clamp (current transformer, 1 pc.);



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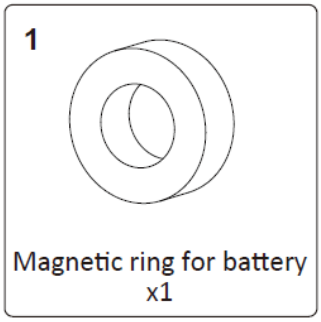

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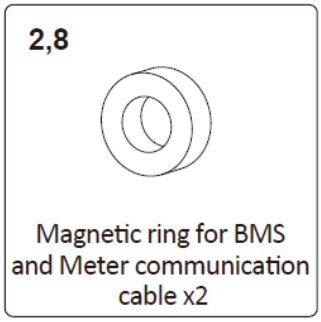

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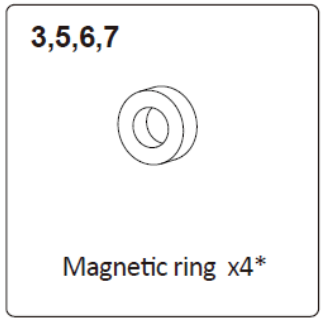

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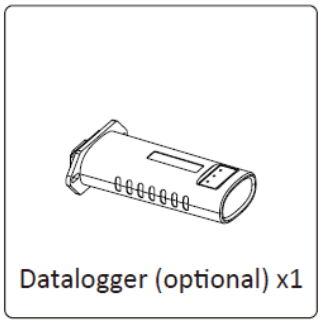
9 - User manual (1 pc.);
10 - Magnetic ring for battery (1 pc.);
11 - Magnetic ring for BMS and Meter communication cable (2 pcs.);
12 - Magnetic ring (4 pcs.: one for the current transformer input wire and three more for the AC wires);



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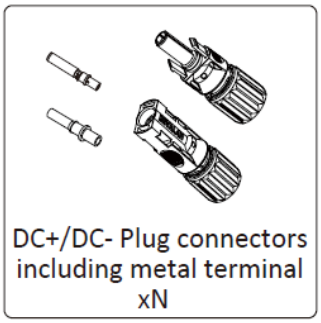

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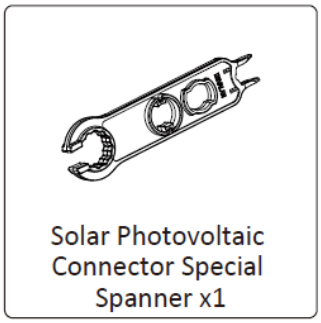

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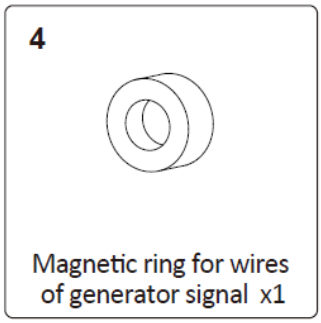

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13 - Data logger (optional, 1 pc.);
14 - DC+/DC- Plug connectors, including metal terminal xN;
15 - Solar PV connector, Special Spanner (1 pc.);
16 - Magnetic ring for wires of generator signal (1 pc.)

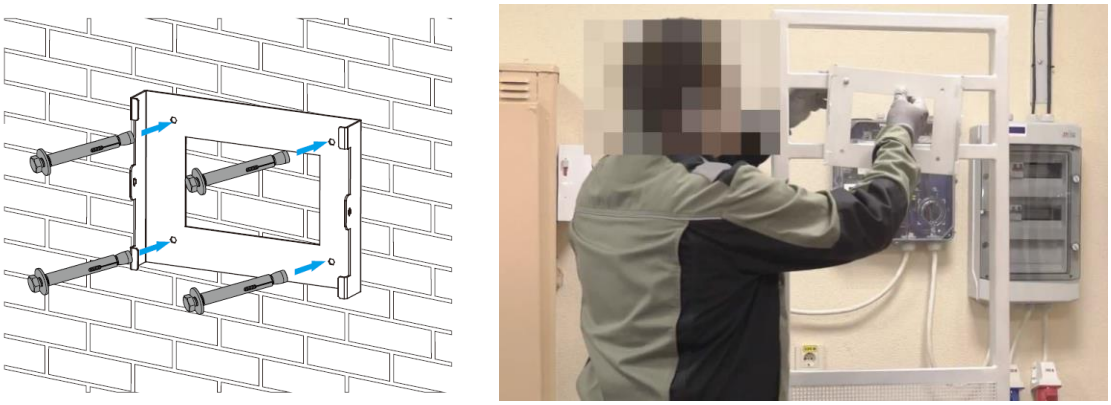
Note. The stainless steel shockproof bolts shown are used to mount the inverter on the wall. For mounting the inverter on a mounting rack, use a conventional bolted connection (according to the design of the mounting rack).

First, mount the inverter on a mounting rack. For this purpose, use the special fasteners provided in the package. The inverter can be mounted either on a wall or on a vertical mounting stand. To do this, it is important to choose a rack that can support the weight of the mounted equipment (Appendix A shows an example of a mounting rack design for the equipment described in this manual).

a) b)

Figure - Mounting options for the inverter: a) - on a mounting rack; b) - on a wall

Attach the inverter hanging plate to the mounting stand using a bolted connection.



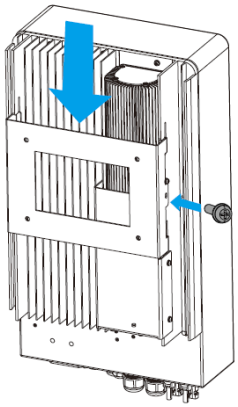
a) b)

Figure - Mounting options for the inverter suspension plate: a) - on the wall; b) - on the mounting stand

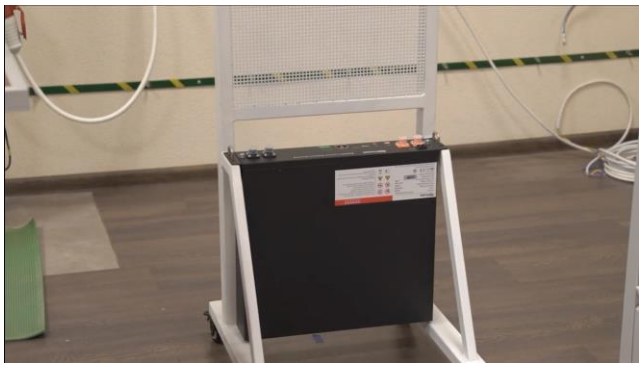
Secure the bolted connection with a socket head wrench and an adjustable spanner.

Hang the hybrid inverter on the suspension plate.

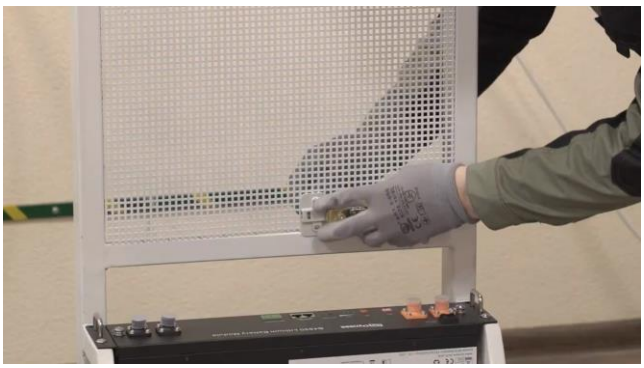
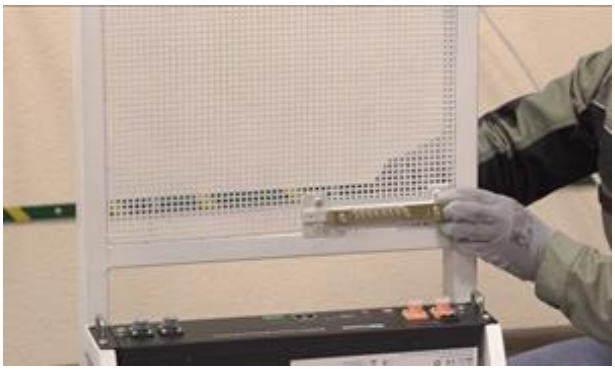
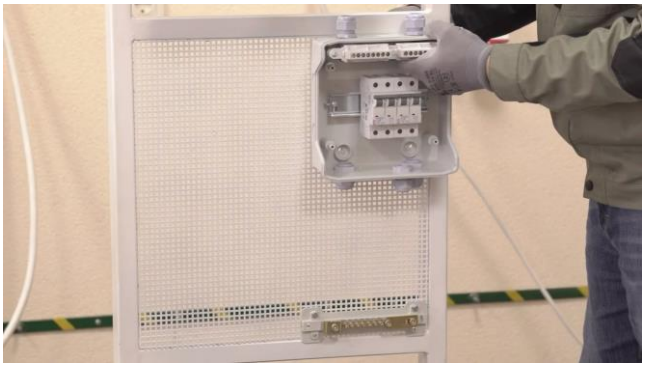
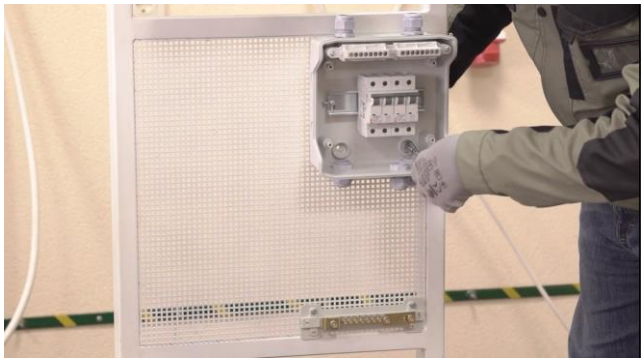
Secure the inverter with screws at the ends of the suspension plate using a screwdriver.

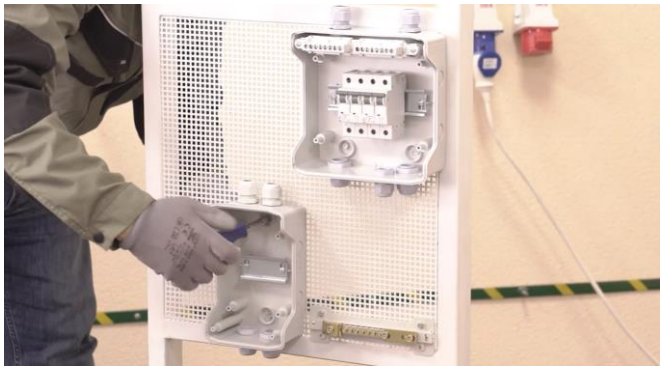
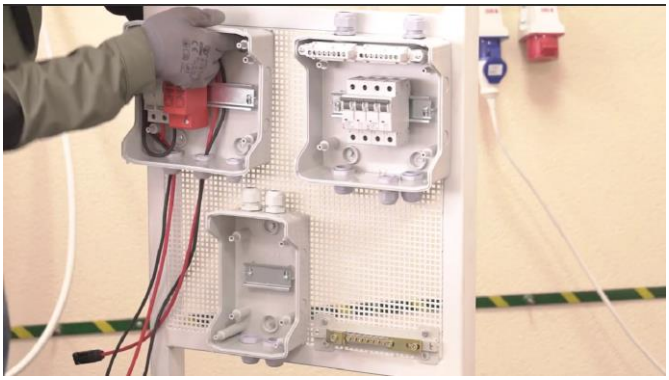
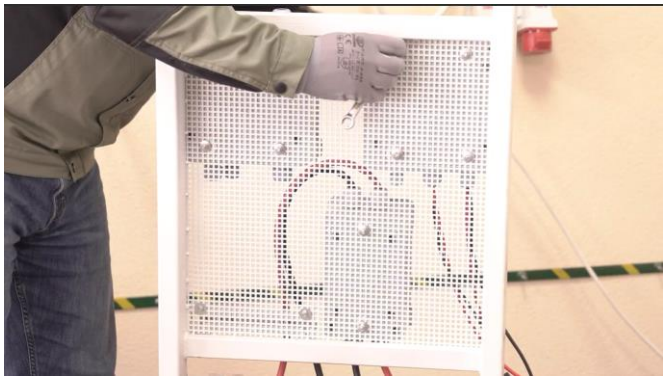


Install the battery pack. Make sure that the battery pack is turned off before installing it. Install the battery pack in the specialized seat on the mounting stand and secure it with the combination screws and a screwdriver.

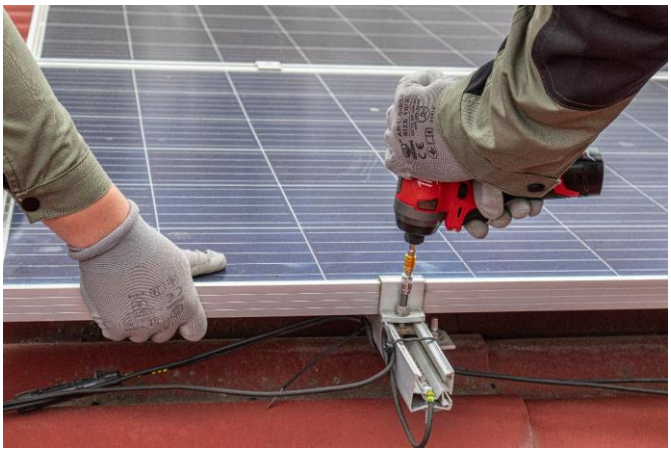


Using the bolted connection and special seats on the mounting rack, secure the main grounding bus and the AC and DC electrical panels with a socket head and a box-end wrench.

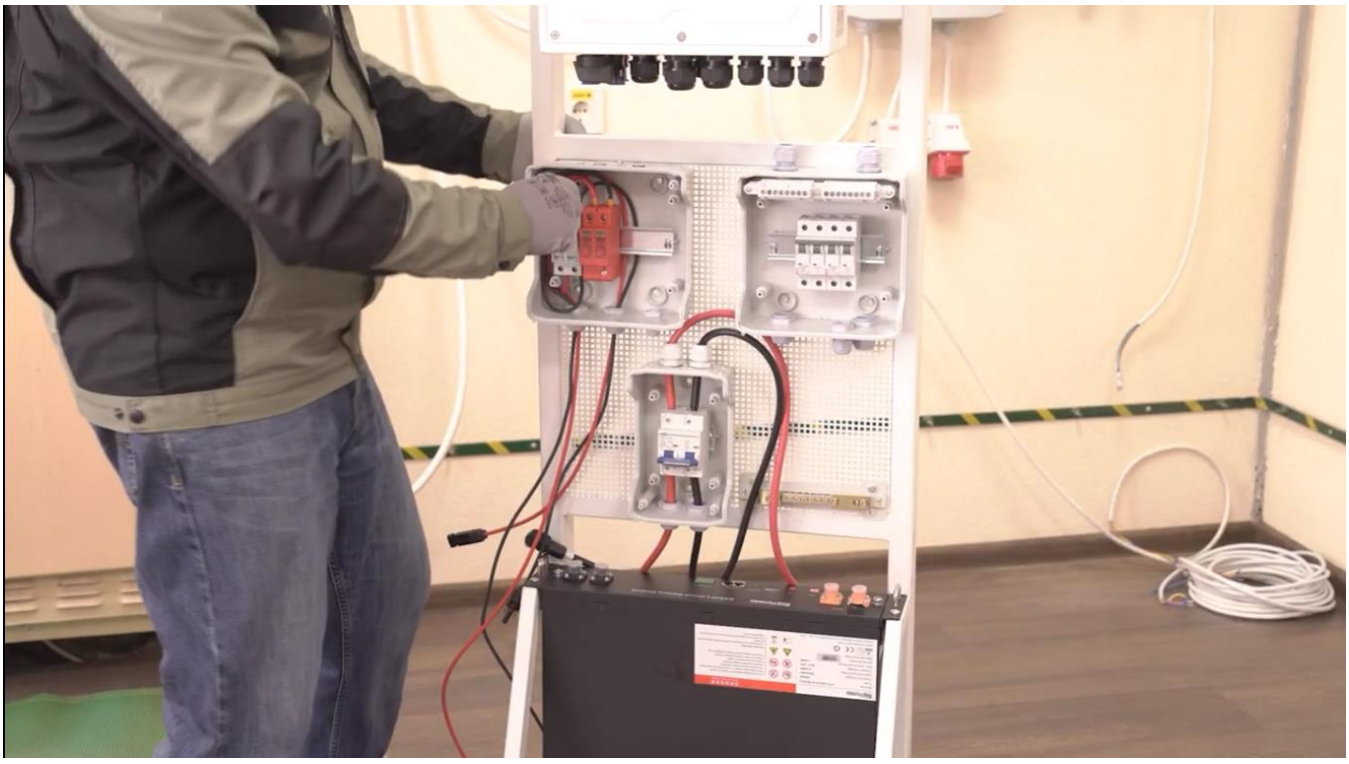





Photovoltaic modules are mounted on a surface (e.g., the roof of a building) using a special mounting system (in accordance with the manufacturer's requirements).



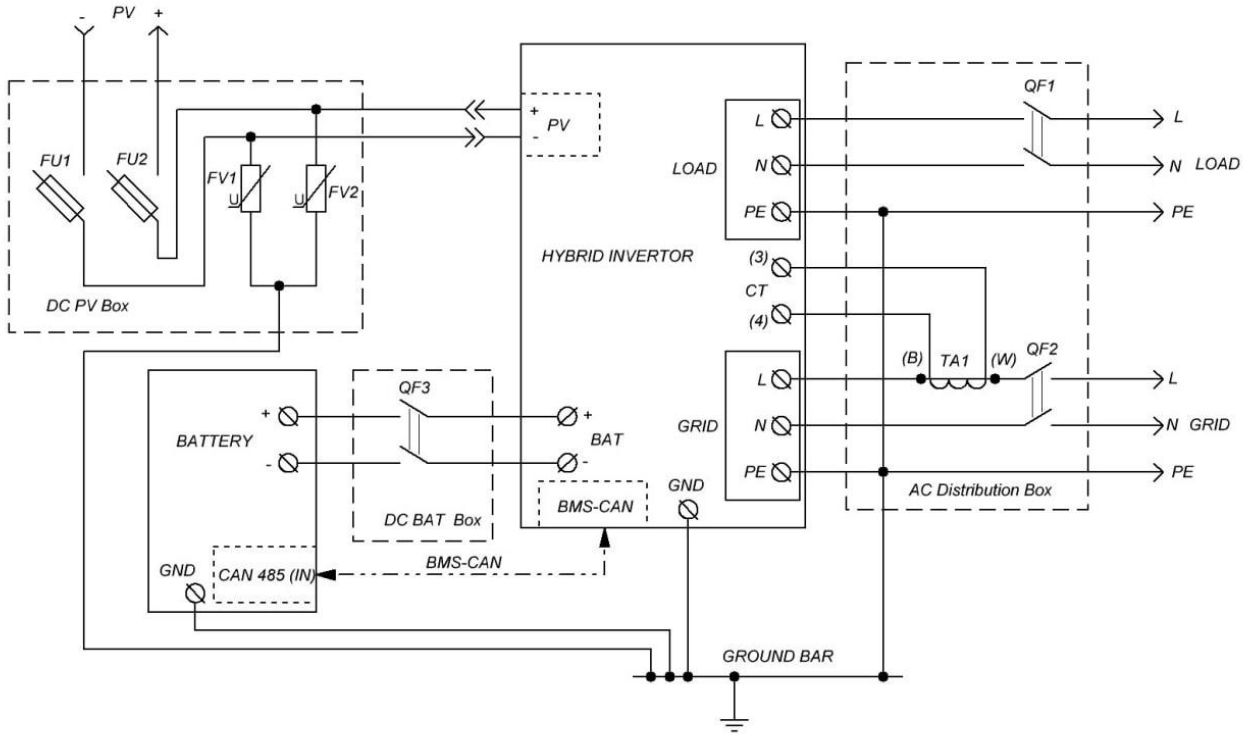
Make sure that all connections are securely fastened.



Next, let's move on to the electrical part of the installation.

5.2 Electrical part of the installation

We make electrical connections of all system elements according to the diagram.

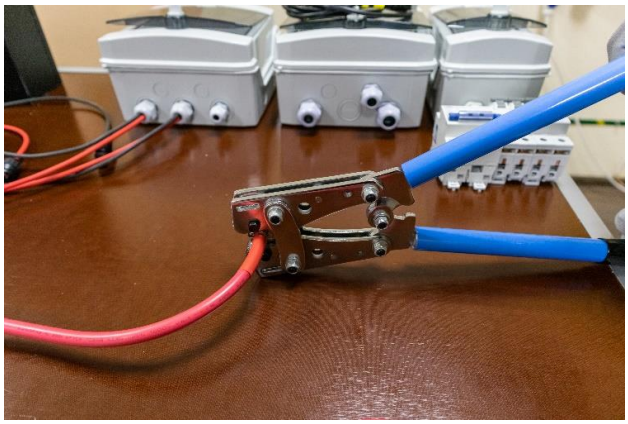


Electrical diagram of the system

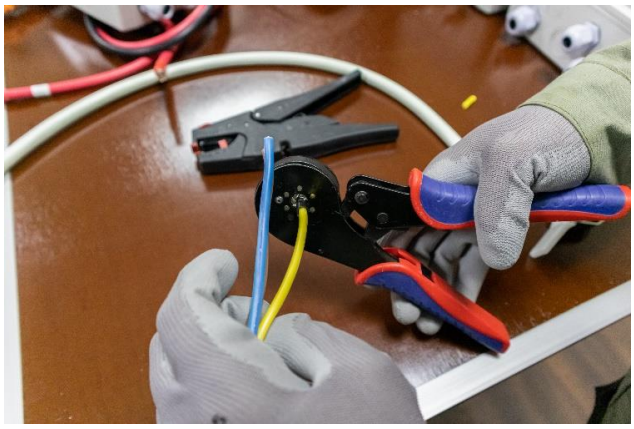
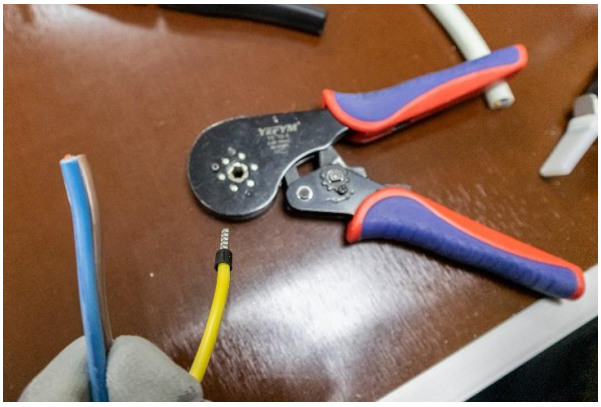
This is an important step to ensure that everything works correctly and safely. It is important to use a multimeter to check the polarity and record the presence of voltage to avoid connection errors.

Prepare the power cable for connecting the battery. Use a cable cutter to cut the battery cables to the required length to connect the DC circuit breaker installed in the panel.

Use the cable stripper to prepare the cable ends for crimping with the cable lugs. Mount and crimp the cable lugs using the crimping tool.





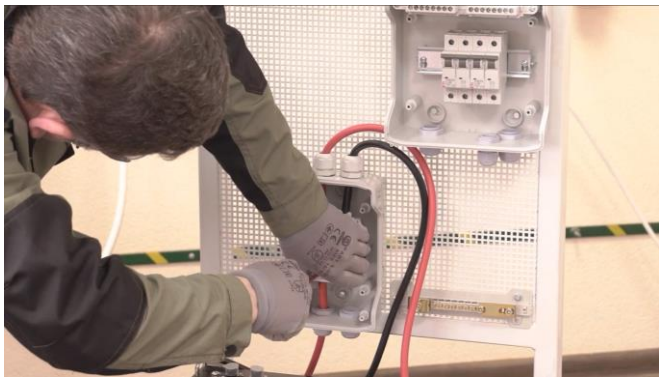






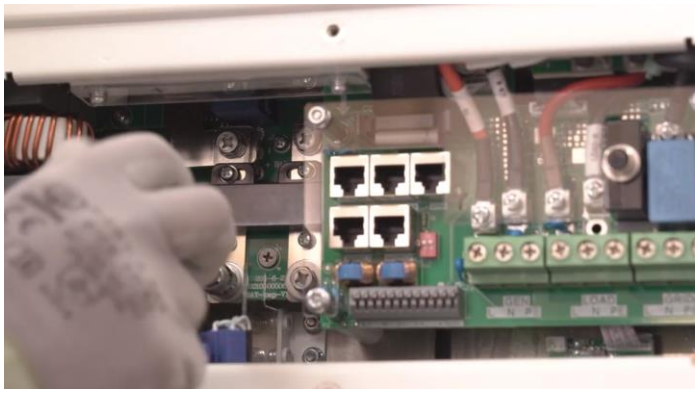
Use a hexagonal key to open the protective plate on the front panel of the inverter.

In accordance with the electric diagram, connect the power cables from the battery to the DC panel and from the DC panel to the inverter.


Use a screwdriver to secure the ends of the cables in the circuit breaker sockets.

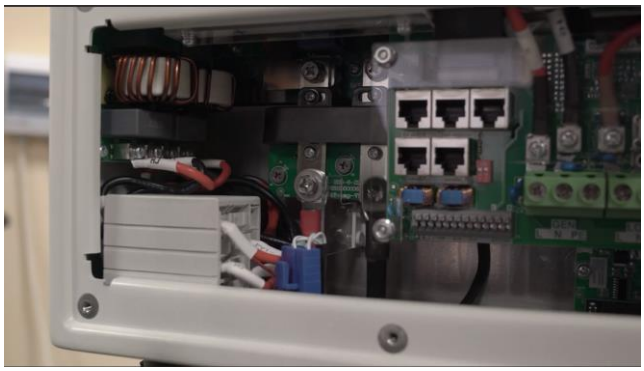



Using a screwdriver, unscrew the bolts on the inverter terminals and secure the ring lugs of the power cables with them.



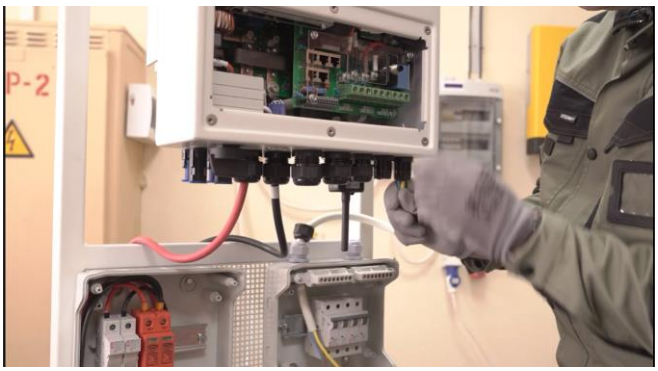
Pull the cables into the inverter through the cable glands.


Using a screwdriver, secure the ring lugs of the power cables on the inverter terminals with bolts.

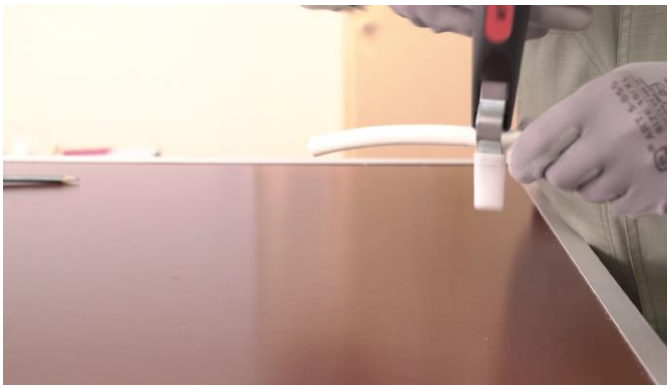
Important! During installation, control and observe the polarity of the connection.

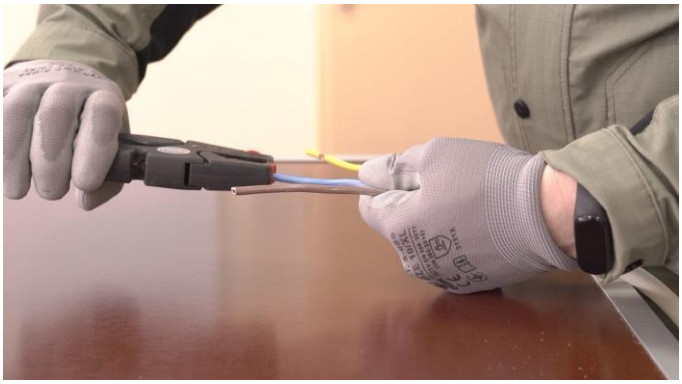
Prepare power jumper cables for connecting the hybrid inverter to the AC panel, the system to the power grid and the load.

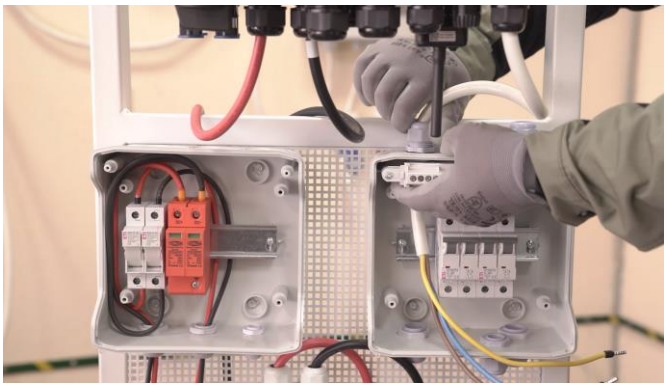
Using a ruler, we secure the required length of the jumper cable between the hybrid inverter and the AC panel.

To prepare the jumper cables, use a cable cutter, a tool for removing the sheath from the cable, and a stripper, which strips individual cable conductors to a length of 10 mm for further crimping with cable lugs.

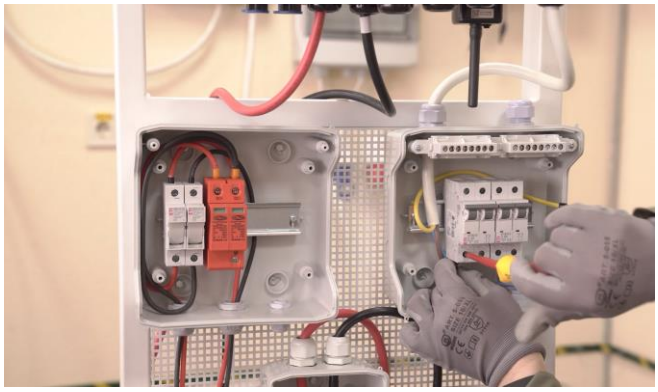




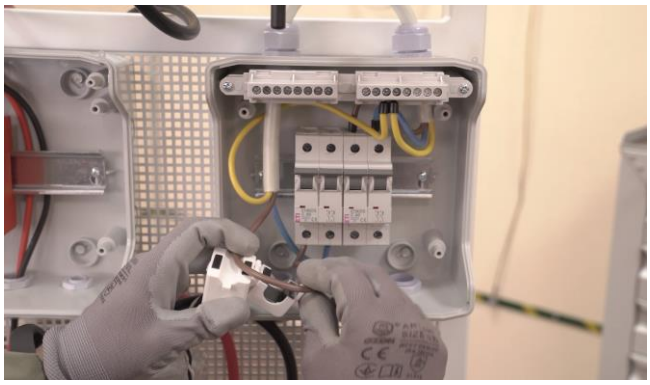
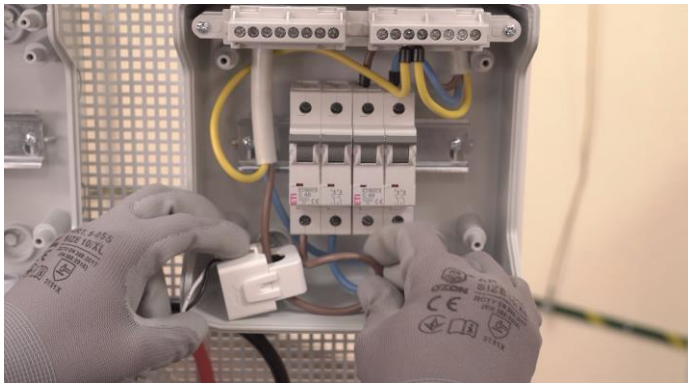
The prepared jumper cables are inserted into the inverter and the AC panel. Make the appropriate connections to the mains and load terminals of the inverter and to the appropriate protection devices in the AC panel.



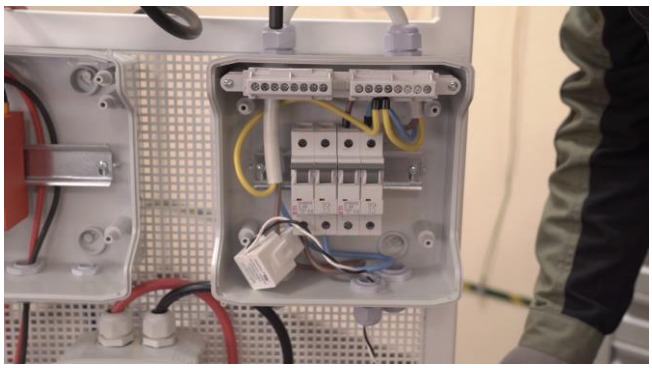
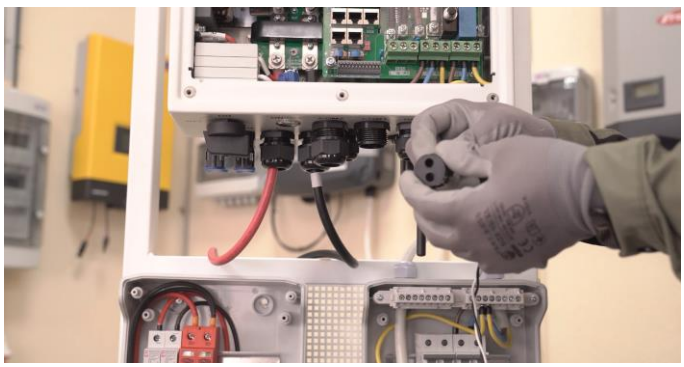
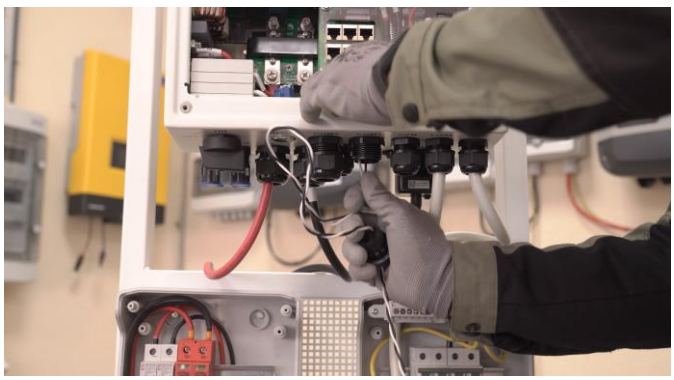
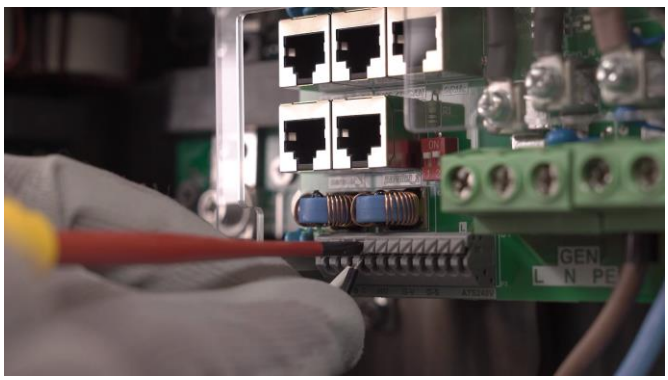
Use screwdrivers with appropriate tips to secure the contacts.

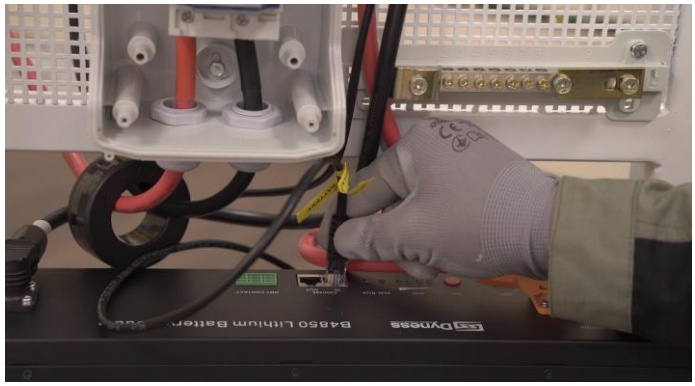
The current transformer supplied with the grid-tied inverter is attached to the phase conductor after the mains input circuit breaker in the AC panel using a latch.
The current transformer is attached to the conductor so that the arrow on its body points in the direction of current flow to the inverter.

The conductors from the current transformer are routed into the inverter through the cable gland and connected to the appropriate terminals according to the markings.

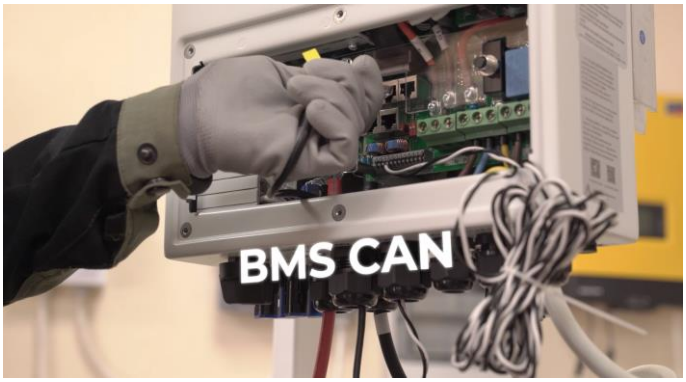





The communication cable is connected to the battery.

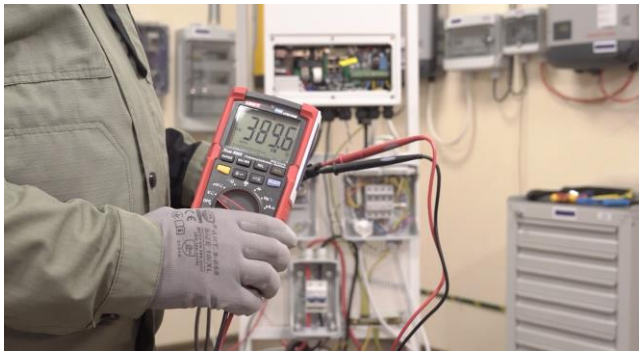


Use the switches on the front panel of the battery pack to select the compatibility mode with the DEYE inverter.
Note. Select the compatibility mode depending on the type of inverter in accordance with the manufacturer's instructions.

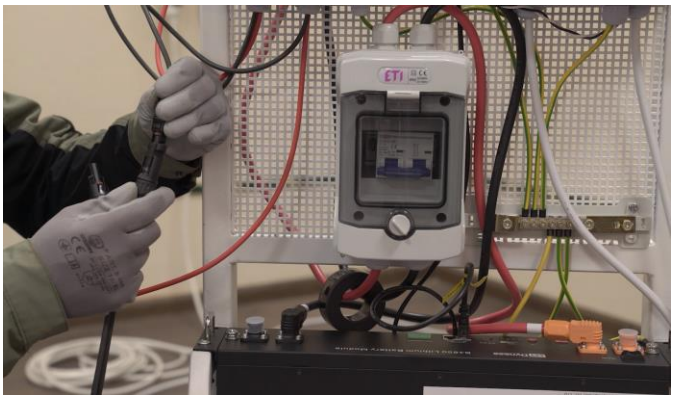
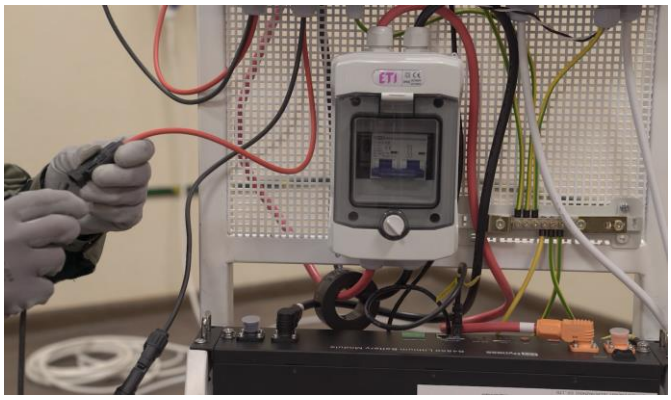
The communication cable is routed through the appropriate cable gland in the inverter and connected to the “BMS CAN” connector.



Using a multimeter, make sure that there is a proper voltage at the MC4 connectors of the solar cable coming from the array of photovoltaic modules.



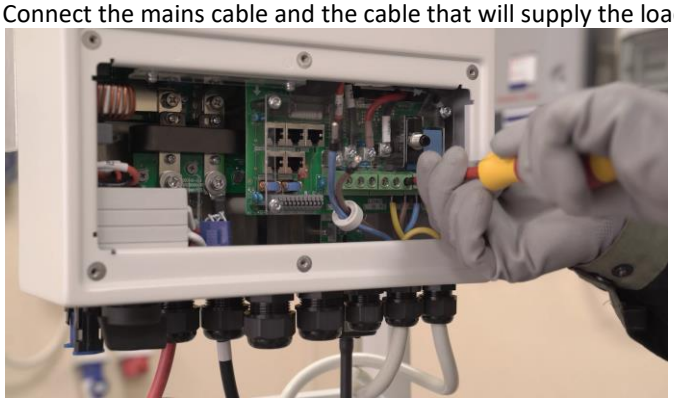
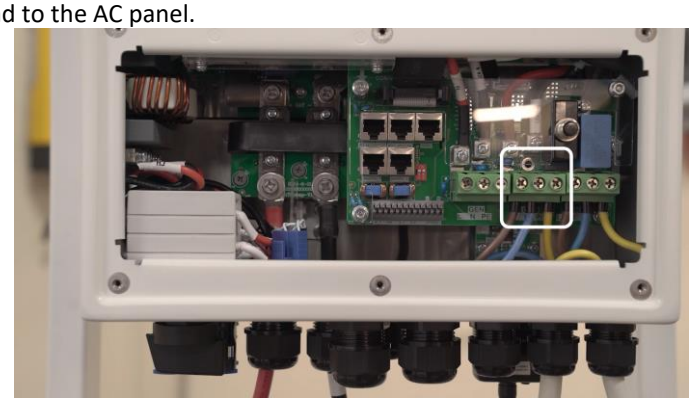
Connect the cables from the array of PV modules to the corresponding DC panel to its input using MC4 connectors.

The disconnector in this panel must be in the off position.

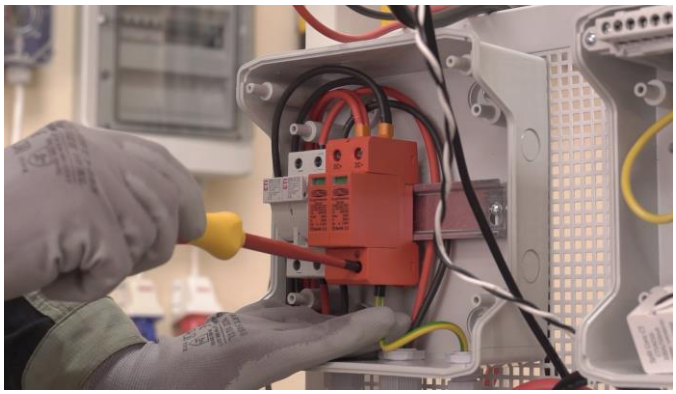
Uuse a solar cable from the DC panel to connect to the hybrid inverter using MC4 connectors, which are available on the solar cable and the grid-tied inverter.

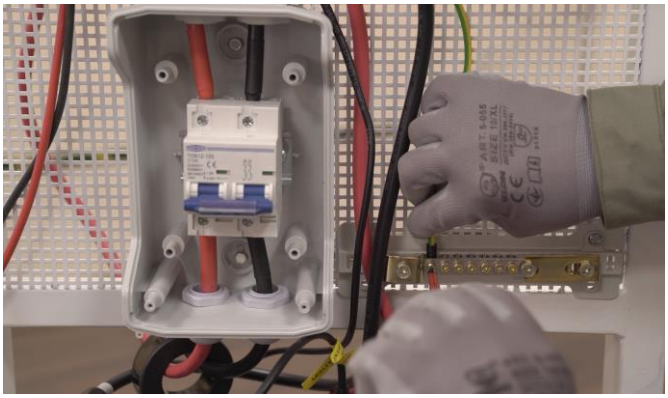

Connect the mains cable and the cable that will supply the load to the AC panel.

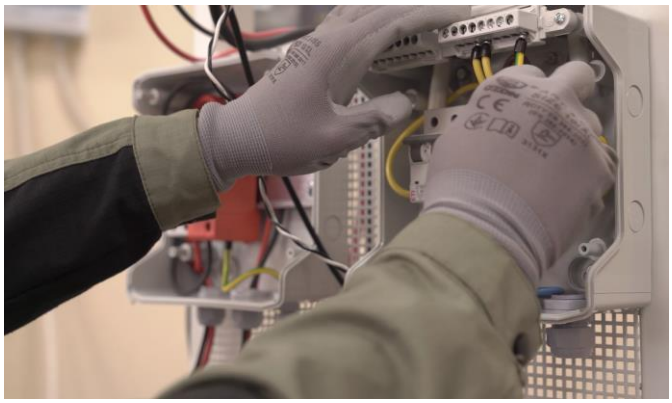



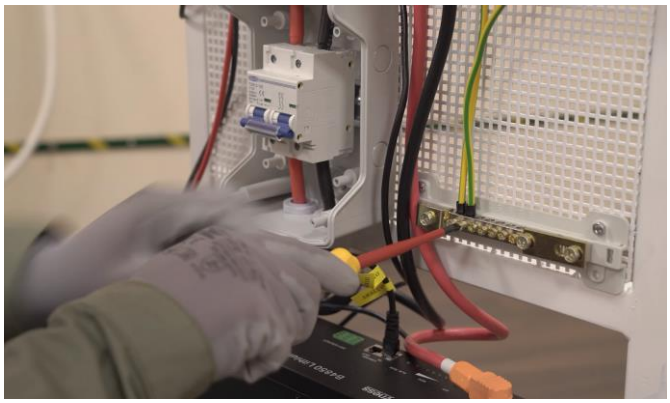
The AC input and output circuit breakers must be in the off position.

Install the grounding conductor system.
The grounding conductor must be connected to the enclosures of all devices and the main grounding bus, which in turn must be connected to the protective grounding circuit.

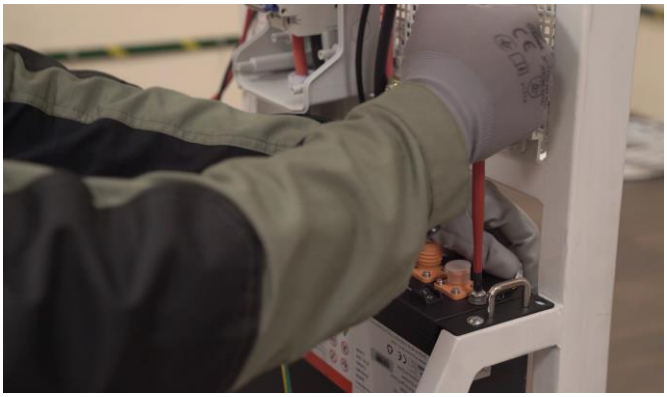
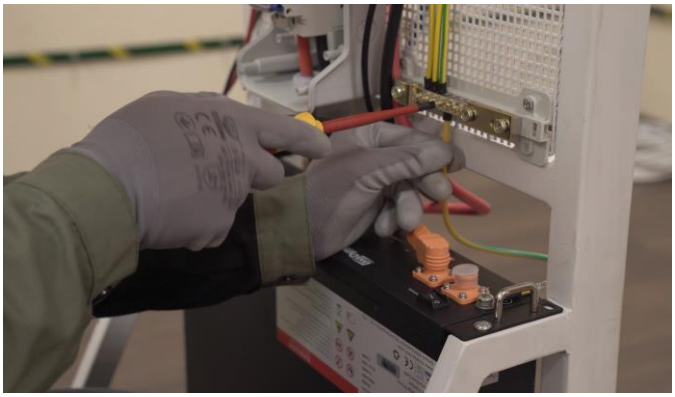




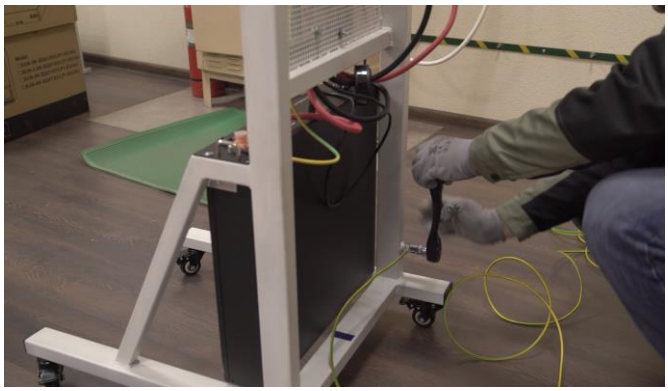




The hybrid inverter and battery enclousers are connected to the mounting rack using special jumper wires that are included in the package.

In turn, the mounting rack is connected to the protective grounding circuit of the building using a flexible conductor with a cross-section of at least 6 mm^2.




On the underside of the hybrid inverter, use a screwdriver to remove the protective plate of the WiFi adapter port.

Insert the WiFi adapter into the corresponding socket of the inverter and secure it with screws.

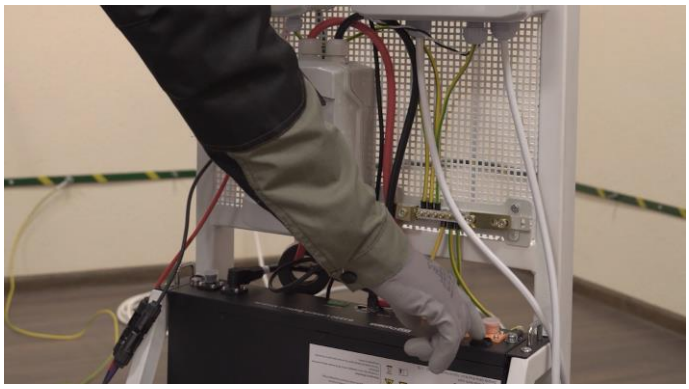
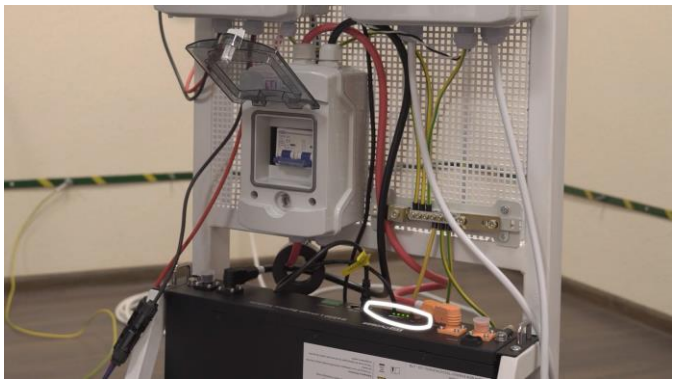
Appendix B shows a detailed view of the elements of the installed system.

6 Checking and configuring system operation

This section provides information on how to check the operation of the assembled system in action. The chapter also describes how to turn on the system for the first time and set up the hybrid inverter for further operation.

6.1 Checking the system operation

First of all, let's carry out the necessary checks.
Using a multimeter, carry out the necessary system checks. Apply voltage to the AC input of the panel and record its presence accordingly. Turn on the battery, wait for a certain time for the battery indicators to light up, and then record the voltage value on the battery circuit breaker.

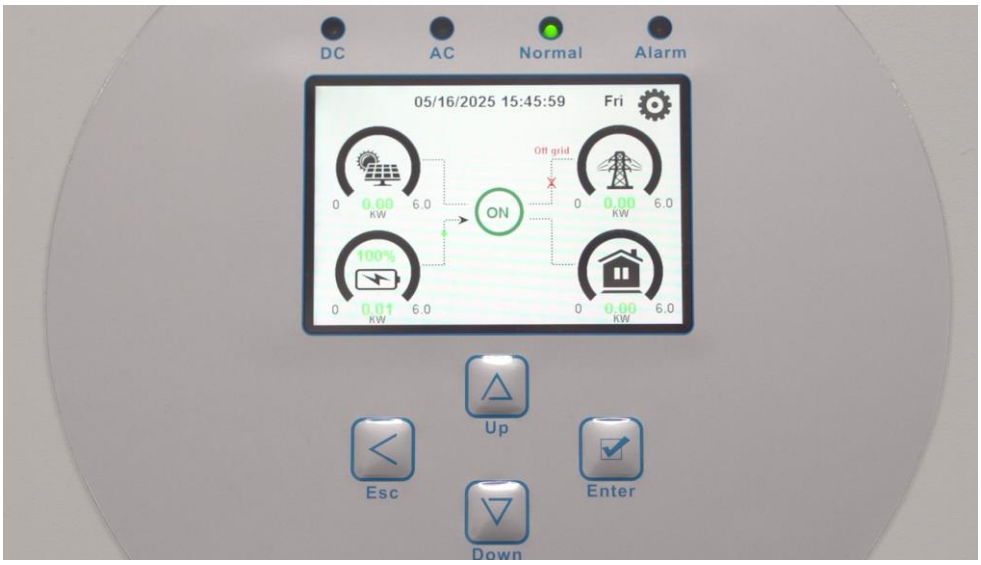

After checking, close the covers of the AC and DC panels.
Close the protective cover on the front panel of the hybrid inverter and secure it with screws and an Allen key.

6.2 Switching on and setting up the hybrid inverter

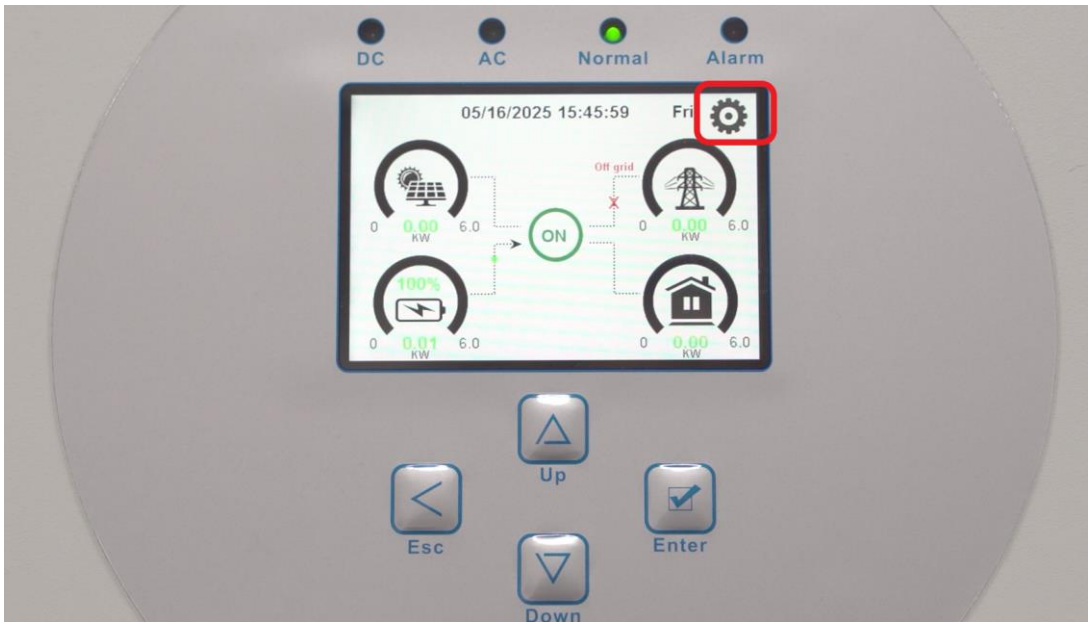
After the inspection, turn on the system for the first time and configure the hybrid inverter.

- Turn on and activate the battery pack in accordance with the relevant operating instructions.
- Turn on the battery circuit breaker on the DC panel and apply voltage to the hybrid inverter.

- Turn on the hybrid inverter. Wait for it to start up and be ready for operation, as evidenced by the “Normal” indicator and the display of system information on the inverter dashboard. You can monitor the status of the hybrid inverter and configure its operation from this dashboard.



-- Configure the inverter - set the date and time, select the battery type (Lithium), set the battery capacity and the corresponding values of the charging and discharging current (according to the operating instructions), select the inverter operating mode, which provides only compensation for own consumption without transferring the generated or stored electricity to the grid.



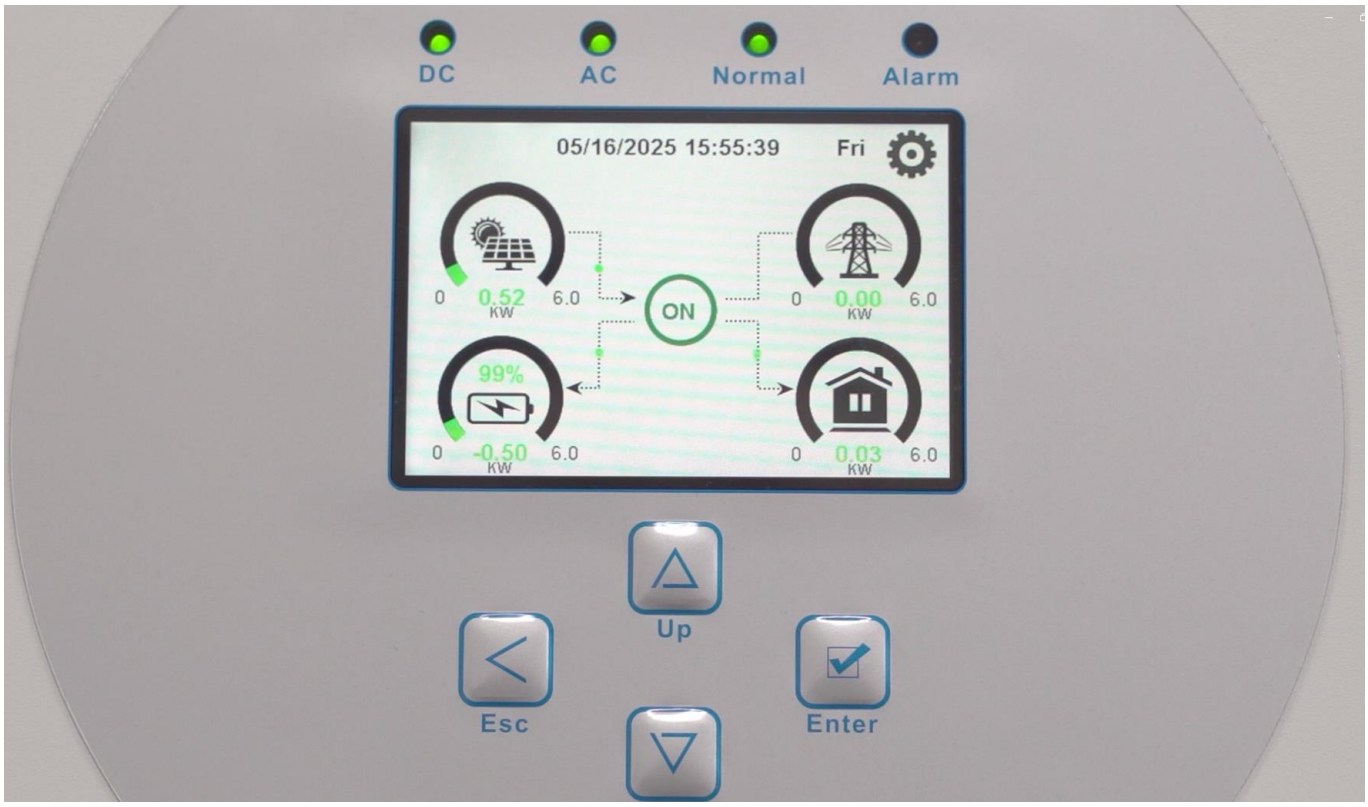
-- Turn on the load circuit breaker in the AC panel. Check the voltage at the inverter output in the offline mode.

-- Now connect a small load to the inverter - a light bulb.

-- Switch the inverter to grid operation. The “AC” indicator lights up when the inverter is connected to the grid.

- To check how the system operates in offline mode, turn off the main circuit breaker at the entrance to the system. The lamp continues to light up because the inverter has switched to battery operation, gradually discharging the battery.

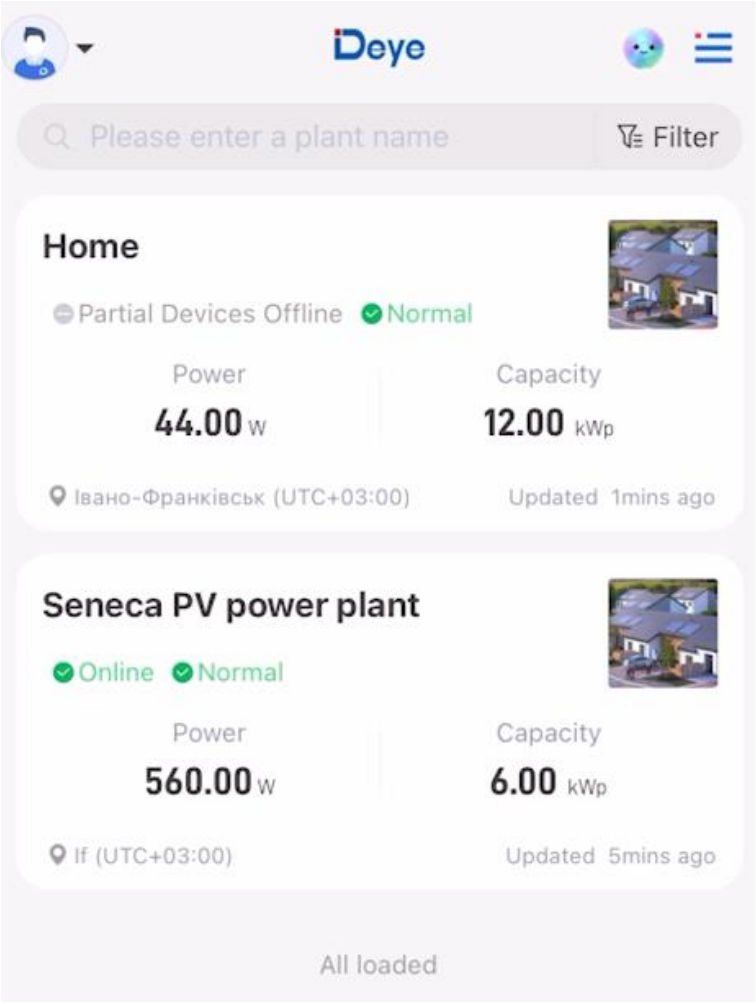
- Turn on the disconnector in the DC panel of the PV module array, turn on the DC voltage supply from the PV modules to the inverter. When the PV array is connected to the inverter, the “DC” indicator on the information panel lights up. Monitor the supply of generated energy from the PV modules to charge the battery and compensate for load consumption. Turn on the power grid and simulate a situation where there is no consumption from the grid and the load is powered by the energy coming from the photovoltaic modules.



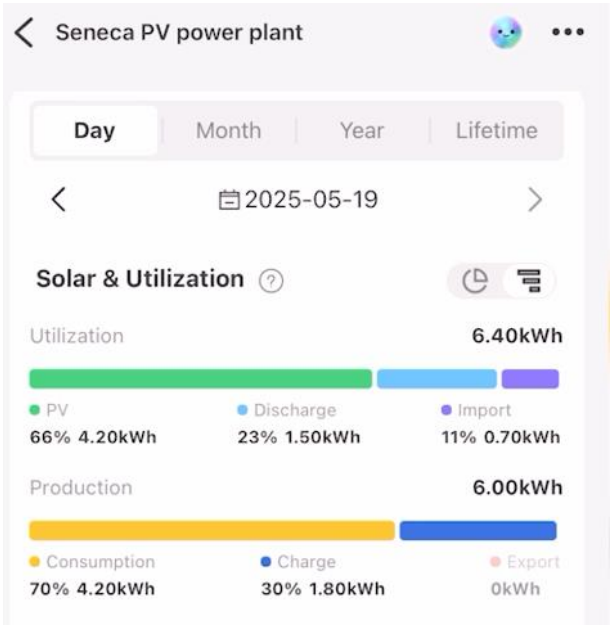
6.3 Using the mobile application

To track the parameters of the implemented system, use an existing mobile application that can be downloaded through the Play Market or App Store.

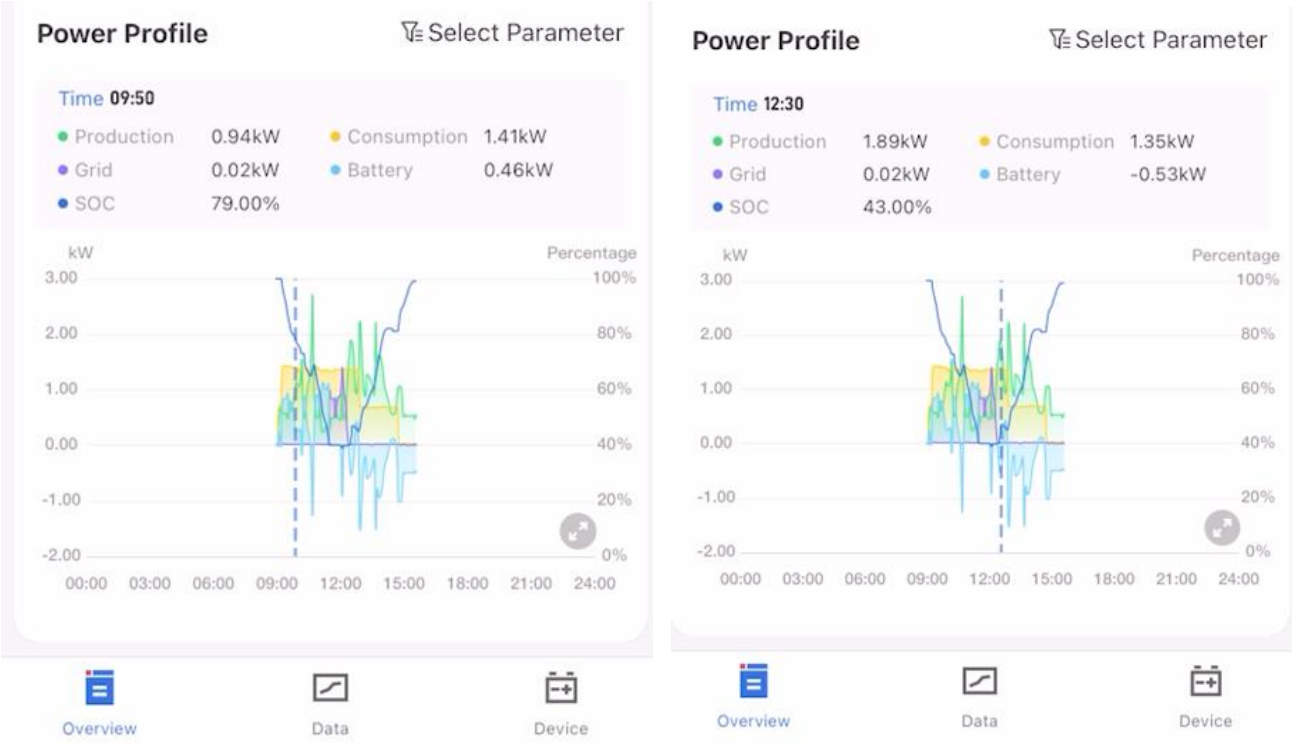
Using a mobile application through the online monitoring system, can monitor in real time:
-- Flowchart of the station's operation: it shows the direction of movement of electricity from photovoltaic modules to the hybrid inverter, bilateral movement (discharge-charging of the battery) from the battery to the hybrid inverter; consumption of electricity at the load and from the grid;



-- Self-use coefficient: displayed in the daily statistics chart as a percentage and in units of consumed electricity (kWh). It indicates the source of energy, including power generation, battery discharge, and energy purchased from the grid, as well as the level of power generation used for consumption (both for the load and for charging the battery);



-- Power profile: real-time display of the system operation in terms of generating power, power consumed from the grid, power consumed by the load, power used to charge or discharge the battery, and additionally indicates the remaining battery charge as a percentage.



Using such an application allows you to monitor the level of electricity consumption, the level of battery charge, and the efficiency of photovoltaic modules in real time. This will help to optimize energy consumption and detect emergencies in advance.

7 Ways to adapt the solution to specific needs

The system under consideration has a modular principle of operation. If your needs grow, it can be scaled up.
If you need to increase the system's capacity, this can be easily solved by involving the required number of additional hybrid inverters for joint operation. Accordingly, additional arrays of photovoltaic modules are connected to each of the inverters. Also, if necessary, the capacity of the battery assembly connected to the hybrid inverters can be changed by adding additional battery cells that also work together.
The need to increase capacity arises when additional building entrances are added or when new consumers are connected to ensure the functioning of common areas. For example, a shelter is being equipped in a house, which necessarily requires a backup power system that must meet its minimum needs for several days.

Figure - Scalable system using 4 batteries (high voltage system)

Note. It is also possible to provide autonomous operation of the elevator. But these are very case-specific options, as elevators require special equipment and it differs depending on the type of a particular elevator. For this reason, we do not consider such options in this manual.

Also, the hybrid inverter can automatically start the generator as a backup power source when the battery charge level drops to a predetermined level after a power outage.

Note 2. This system allows the use of multiple batteries in a modular approach. The number of batteries that can be connected in parallel to the inverter depends on the capacity of the selected inverter and the recommendations of the battery manufacturer.

Note 3. It is possible to increase the output power of the system and the amount of electric energy storage by combining clusters (consisting of an inverter and batteries) into one system. The number of such clusters will also depend on the recommendations of the manufacturers of this equipment.


Figure - Specific equipment of the elevator system in an apartment building

8 Maintenance instructions

This section provides basic brief instructions for maintaining the finished system, divided by its main components.

Solar PV modules:
They require monthly visual inspection, namely:
- checking mechanical integrity (no damage, cracks);
- checking the validity of the installation (no looseness in the fasteners);
- checking electrical connections and cables for corrosion, oxidation, and burning.

Hybrid inverter:
Requires a monthly visual inspection, checking the display and event log, in particular:
- absence of visible damage and defects;
- checking the presence of input/output voltage and current;
- analysis of the error log (for a detailed analysis, use the user manual from the equipment manufacturer);
- firmware update (if necessary);
- checking the operational protection (circuit breakers, etc.).

Battery:
Monitor the state of charge, voltage level, and temperature as needed. A visual inspection is also required for the following things
- no deformation, swelling, or damage;
- voltage control on each module;
- temperature control.

If necessary, a battery capacity test can be performed (in case of rapid discharge or other abnormal operating conditions).

System of connections, control and automation:
It is mandatory to visually check the integrity of the existing connections of the system elements, as well as the integrity of the connection of the developed system to the grounding circuit.

Be sure to use the manufacturer's instructions that came with each system element. They contain detailed instructions for maintaining the individual system components.

9 Conclusions and recommendations

This section summarizes the main conclusions and recommendations for operating the system.

9.1 Main conclusions

The system proposed in the manual will be useful for communities affected by the hostilities in Ukraine, as well as communities in other countries that have problems with uninterrupted power supply, emergency outages, or insufficient power grid capacity.
For example, these may include remote villages in hard-to-reach regions, locations regularly affected by natural disasters (floods, snowfalls, forest fires), and regions in developing countries. It will provide power to common spaces, security systems, Internet networks, etc. At the same time, thanks to its modular design, it can be easily modified to meet individual needs in different situations.

9.2 Recommendations

Remember!
It is important that the installation area is properly prepared, has adequate ventilation, a first aid kit, and meets safety requirements.
Always keep safety in mind! Check that the cables are connected correctly and avoid short circuits. In case of emergency, use a fire extinguisher.
Do not work under voltage, check its presence with a multimeter.
Wear overalls, goggles and gloves when performing installation work.
Properly organize the workplace for efficient and safe installation work.
If you use equipment that does not meet the specifications shown in the video, we cannot guarantee safe startup and safe operation of the system as a whole. Check the compatibility of the equipment parameters.

10 References

1. https://www.deye-ukraine.com.ua/manual
2. https://dyness.com/download

11 Appendices

Appendix A
Schematic representation of the mounting stand that can be used to assemble the system

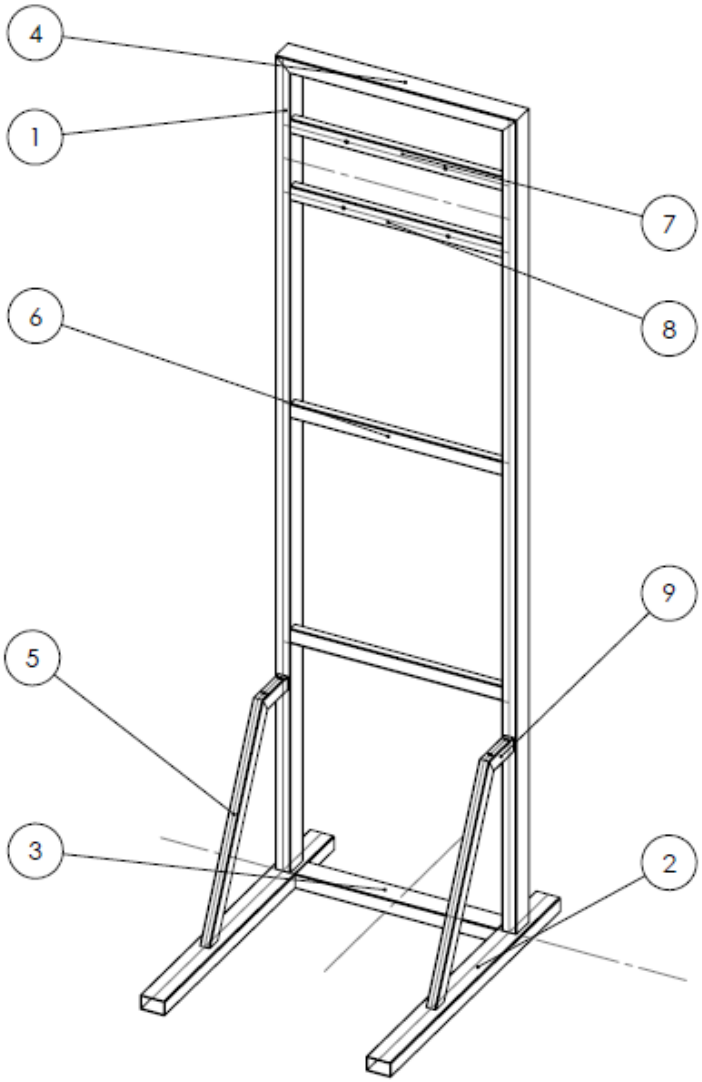


Figure - Frame of the mounting rack

Position	Quantity	Name	Length, mm	Total length, mm
1	2	Rectangular tube 50,00 x 30,00 x 2,00	1700	5596
2	2	Rectangular tube 50,00 x 30,00 x 2,00	650	
3	1	Rectangular tube 50,00 x 30,00 x 2,00	408	
4	1	Rectangular tube 50,00 x 30,00 x 2,00	488	
5	2	Rectangular tube 30,00 x 20,00 x 2,00	458,39	2818,78
6	2	Rectangular tube 30,00 x 20,00 x 2,00	428	
7	1	Rectangular tube 30,00 x 20,00 x 2,00	428	
8	1	Rectangular tube 30,00 x 20,00 x 2,00	428	
9	2	Rectangular tube 30,00 x 20,00 x 2,00	95	

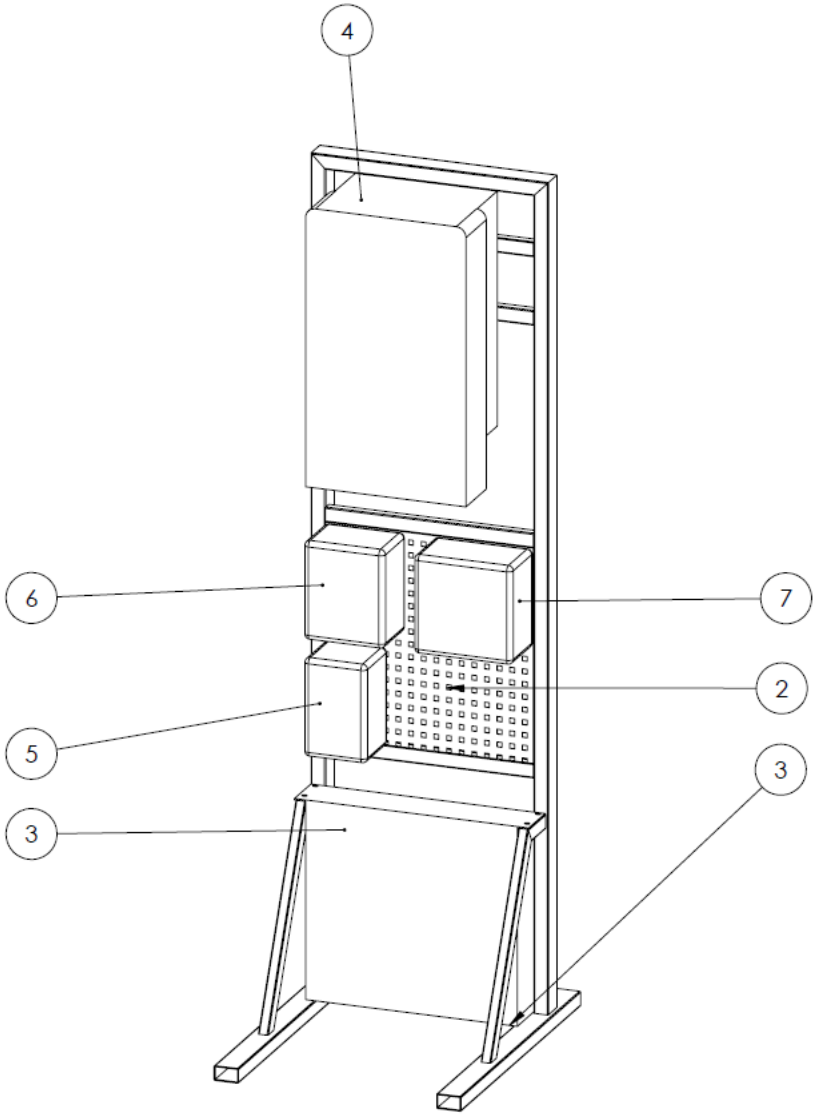
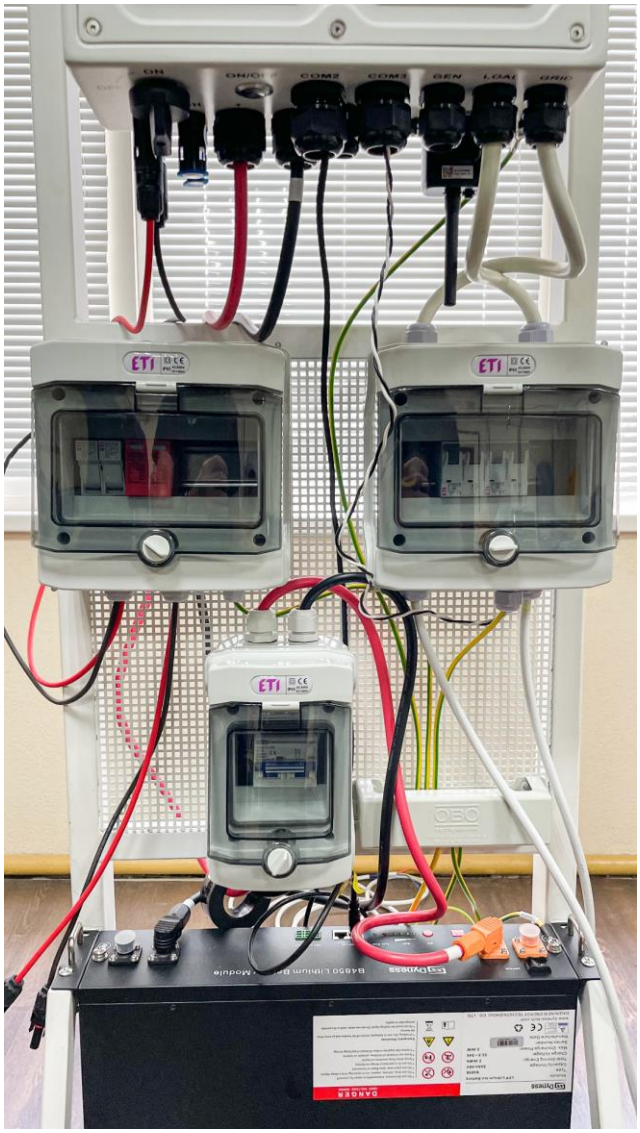
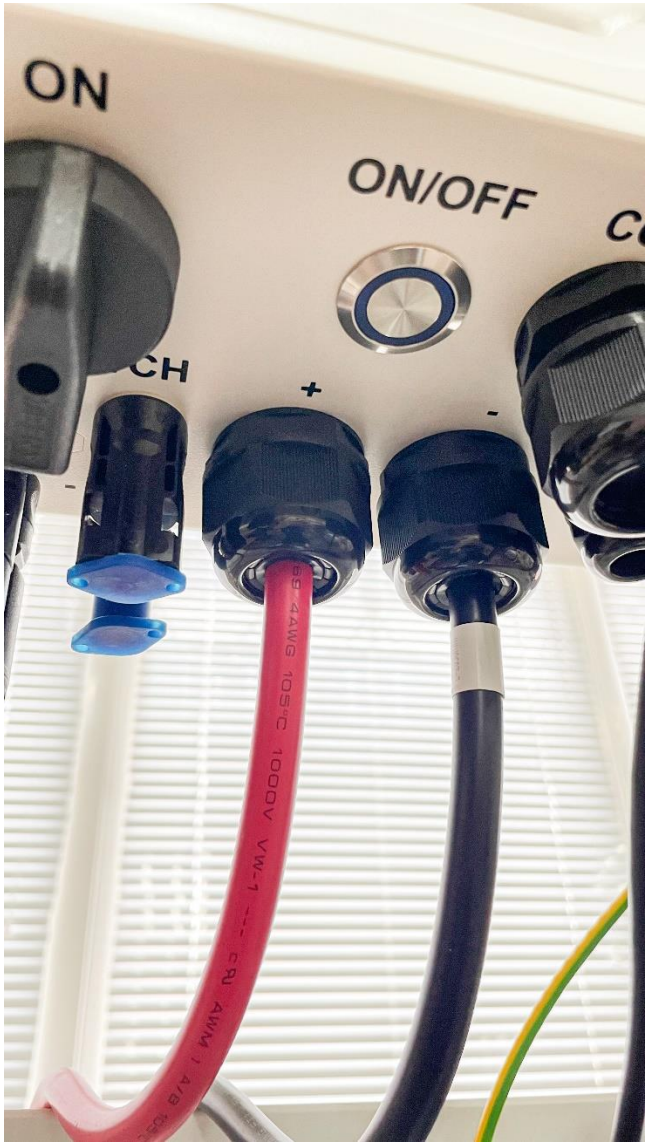


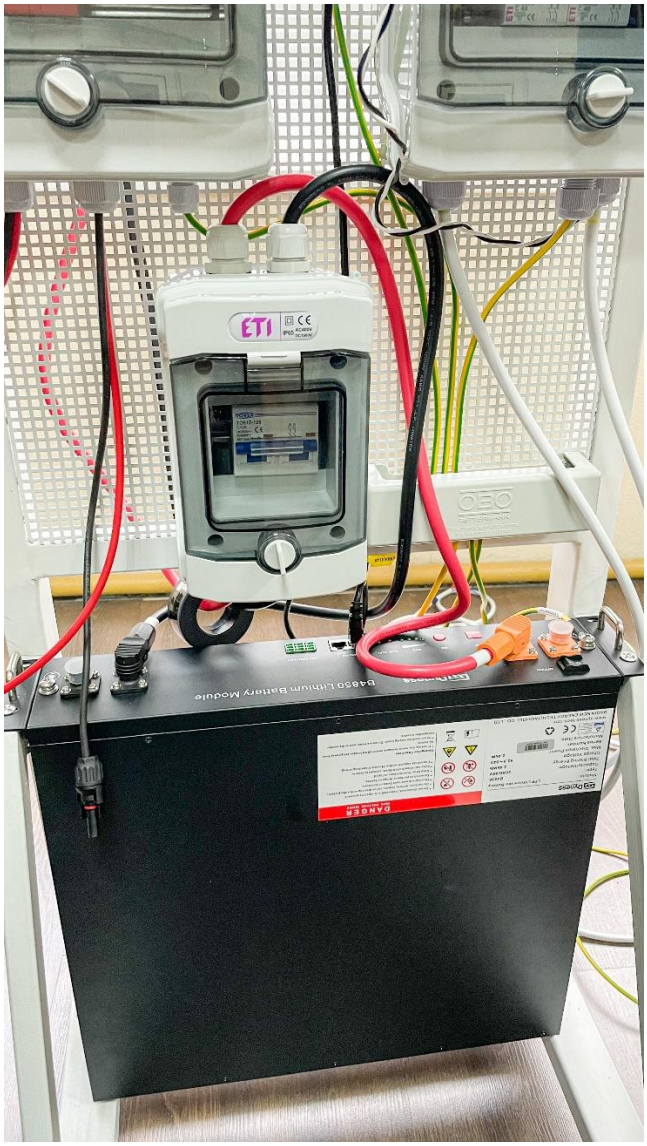
Figure - Schematic representation of mounting the main elements of the system on the mounting stand

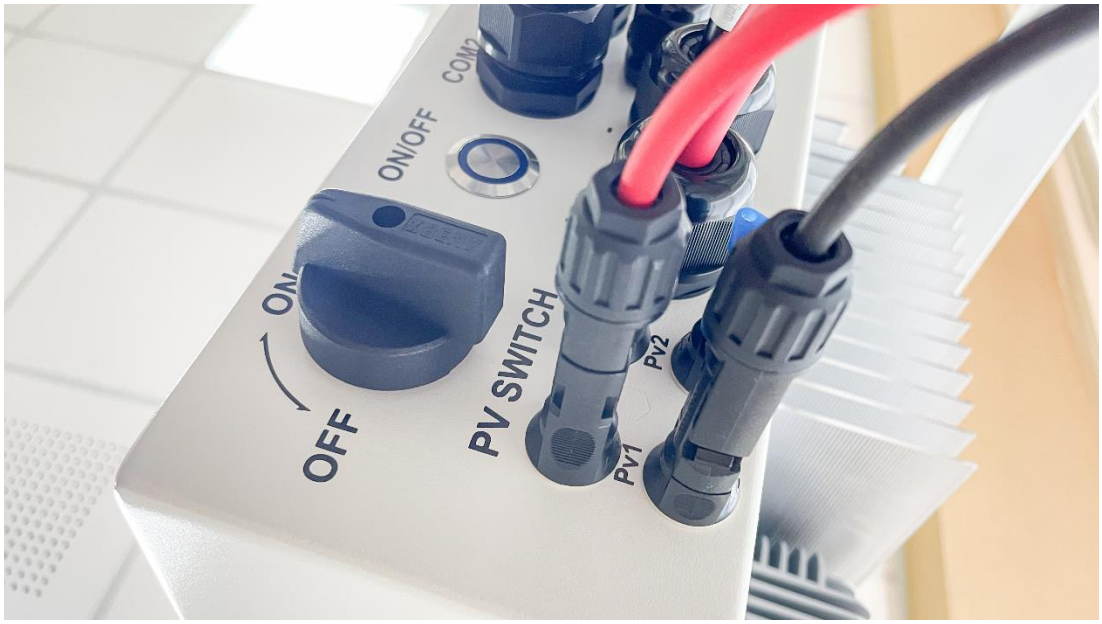
Position	Quantity	Description	Quantity
1	Mounting rack		1
		Rectangular tube 50,00 x 30,00 x 2,00	5596 mm
		Rectangular tube 30,00 x 20,00 x 2,00	2818,78 mm
2	Perforated sheet		1
3	Battery		1
4	Inverter		1
5	Shield	DC panel (battery)	1
6	Shield	DC panel (photovoltaic modules)	1
7	Shield	AC panel (mains + load)	1

Appendix B
Detailed view of the elements of the installed system




ON
ON/OFF
CH
+
-


ETI
OBO
B4850L lithium Battery Module


COM2
ON/OFF
ON
OFF
PV SWITCH
PV2
PV1

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