

TURBO ENERGY
SOLAR INNOVATION

Instruction
manual

SunBox 



SunBox Model H

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Editor: **Turbo Energy S.L.**

Important note: The satisfaction of the end user will depend heavily on having made an adequate estimate of the demand, power, and energy, present and future, to which the equipment will be subjected. Improper calculation may not provide adequate and sufficient service.

Safety recommendations:

Please read the following information carefully before installing and implementing the product. The installation and commissioning of the system must comply with the Electrotechnical Low Voltage Regulation (REBT), and its complementary technical instructions, specifically, the ITC_BT 03, 04, 05 and 40, and the rest of the current regulations, either locally or regionally. Non-compliant use, use of the product in applications and/or configurations not in accordance with this manual, and/or modifications during assembly will result in warranty cancellation and all liability will be disclaimed.

Solar energy systems must be grounded (lightning protection).

Electrical connections must be made exclusively by a specialist technician.

This manual is intended to be a document that facilitates the correct installation of the SunBox equipment. However, once installed it is important to pay attention to the monitoring of maintenance instructions in order to maintain over time the functional and aesthetic characteristics inherent in the installation.

The correct use and the compliance with the maintenance requirements to be performed will depend heavily on the inevitable rate of aging of the installation. Similarly, the manufacturer will only assume responsibility if the equipment has defects of origin and will reline it if equipment contained in this manual is not maintained, or does not use manufacturer-approved spare parts.

Please read this manual carefully before starting the installation.

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1. Scope

This manual refers to the installation, operation and maintenance of hybrid photovoltaic solar equipment SunBox.

Proper installation, as well as proper maintenance, are essential to ensure optimal performance and make the most of system capabilities.

This manual is complementary and is presented indivisibly with the following additional documents:

- Hybrid Inverter Series Model 5000/48 Manual
- Battery Manual (Lithium Series 5.1kWh)
- Data sheets for:
 - Hybrid Inverter Series Model 5000/48
 - Batteries (Lithium Series 5.1kWh)

2. Description and operation

Description:

The SunBox consists of a mounted and wired cabinet prepared to include up to 2 Turbo Energy Lithium Batteries (Lithium Series 5.1kWh) and a Turbo Energy Hybrid Inverter Series HIS5000/48.

The system includes several protections for both DC and AC:

Continuous current (DC)

- Four 16A fuses
- Overvoltage protections.

AC (Output Protections)

- A magnetothermal switch
- A differential switch

The machine has fast MC4 links that facilitate the connection of each string.

In terms of support and handling, the system includes four wheels, two of them with brakes.

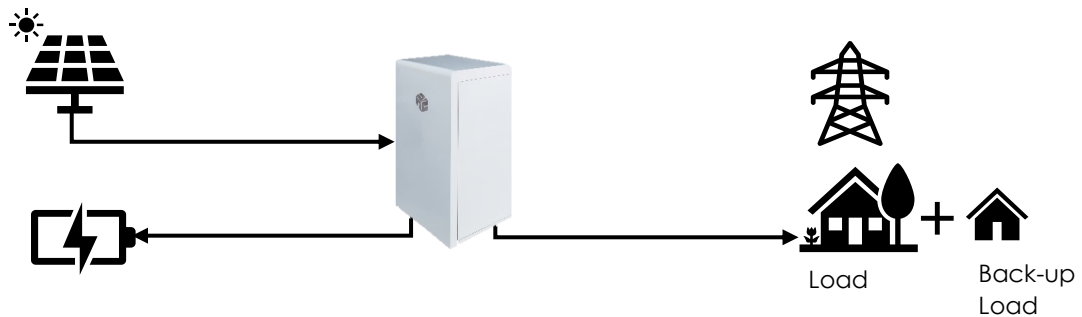
Operation mode:

The SunBox is a grid-connected system that works synchronously in parallel with a photovoltaic installation. It has two operating modes:

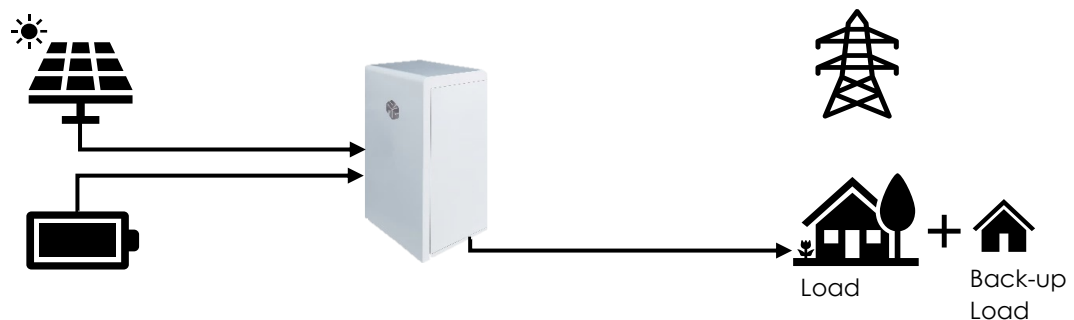
1. Self-consumption mode

Depending on the energy coming from the photovoltaic panels, there are two different situations:

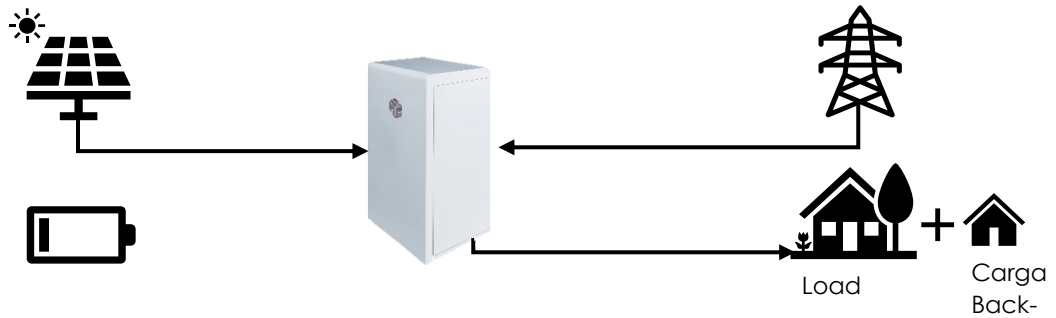
1. When the demand for electricity consumption is lower than the energy produced by photovoltaic panels, the Inverter transforms the DC into AC to meet the demand for electricity, while charging the batteries with excess power. In this way energy is accumulated for later use at times when energy production is not sufficient.



2. When the demand for electricity consumption exceeds the energy produced by photovoltaic panels, the Inverter transforms the DC into AC and takes the missing power from the batteries or the grid, depending on whether the batteries are charged or not, to meet the demand for electricity.
 - i. When the batteries are sufficiently charged, the inverter transforms the energy stored in DC to AC to 220V to supply the load. When the batteries are left with the minimum charge level that allows them to ensure a proper operation, they are automatically disconnected to protect the system.



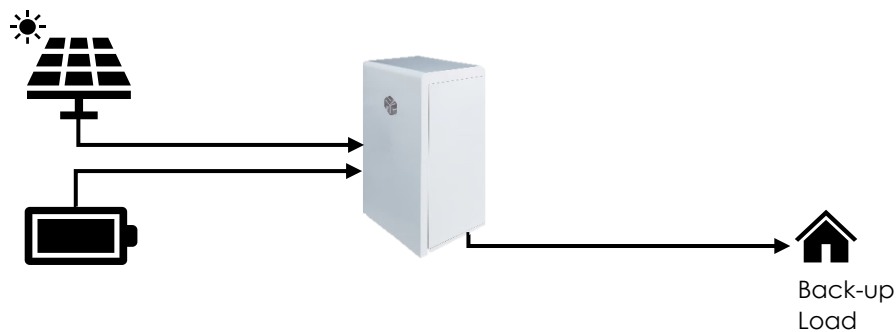
- ii. When the batteries do not have enough charge level to ensure proper operation, the inverter takes the missing power to meet the demand from the grid. In this way the system works in parallel with the network and with photovoltaic panels.



In the end, the Inverter performs the energy balancing functions and ensures the operation of the system.

2. Back-Up mode

It is a mode that ensures that, when the grid fails, the critical loads connected continue to operate thanks to the power provided by the generation and/or batteries.



3. Specifications

Batteries

- Manufacturer: Turbo Energy SL
- Model: Lithium Series 5.1kWh
- Attached data sheet and instruction manual.

Inverter/Charger

- Manufacturer: Turbo Energy SL
- Model: HIS5000/48
- Attached data sheet and instruction manual.

SUNBOX - Model H	
Photovoltaic panels data	
Max. photovoltaic field power	6500 W _p
Max voltage. DC voltage	550 Voc
MPPT working range	100-500Vmp
Starting voltage	150V
Independent MPPT	2
Maximum current per MPPT	11A
Category DC surges	II
AC output	
Nominal AC power	5000W
Rated output voltage	230V
Rated output frequency	50/60Hz
Max current. Output to mains	22.8A
Back-Up output	
Nominal Back-Up power	5000W
Rated output voltage	230V
Rated output frequency	50/60Hz
Rated output Back-Up current	21,7A
AC to Back-Up Switching	Automatic
Batteries data	
Energy	5,1kWh / 10,2kWh
Available energy	4,60kWh / 9,20kWh
DoD	90%
Cycles at 90% DoD	>6000
Manufacturer Cells	CATL
Cells	Metal Can
Type of technology	LiFePO ₄
Nominal battery voltage	51,2V
Max current. Loading / Unloading	50A
Communication with BMS	CAN

DC side protections (by MPPT)	
CAT II surges	Integrated
2 x Fuse holder and fuse 15A/1000Vdc	Integrated
AC side protections	
Differential and Magnetothermic AC	Integrated
Differential and Magnetothermic Back-Up	Integrated
General Data	
Communication with the Portal	Wi-Fi
Communication with EzMeter	RS485
User Interface	APP
Weight (Kg)	85Kg
Dimensions (width*height*depth)	600*1250*600mm
IP rating	IP20
Certificates and Regulations	
Network connection regulations	RD1699
Safety regulations	IEC/EN62109-1 & -2 IEC 62040-1
EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4, EN61000-4-16, EN61000-4-18, EN61000-4-29

4. Installation and assembly

4.1. Recommendations for setting up strings

Voc < 41V

Panel 1660x1004mm

MPPT 1	MPPT 2
Mínimo 6 paneles	Mínimo 6 paneles
Máximo 12 paneles	Máximo 12 paneles

Voc < 50,9V

Panel 2024x1004mm

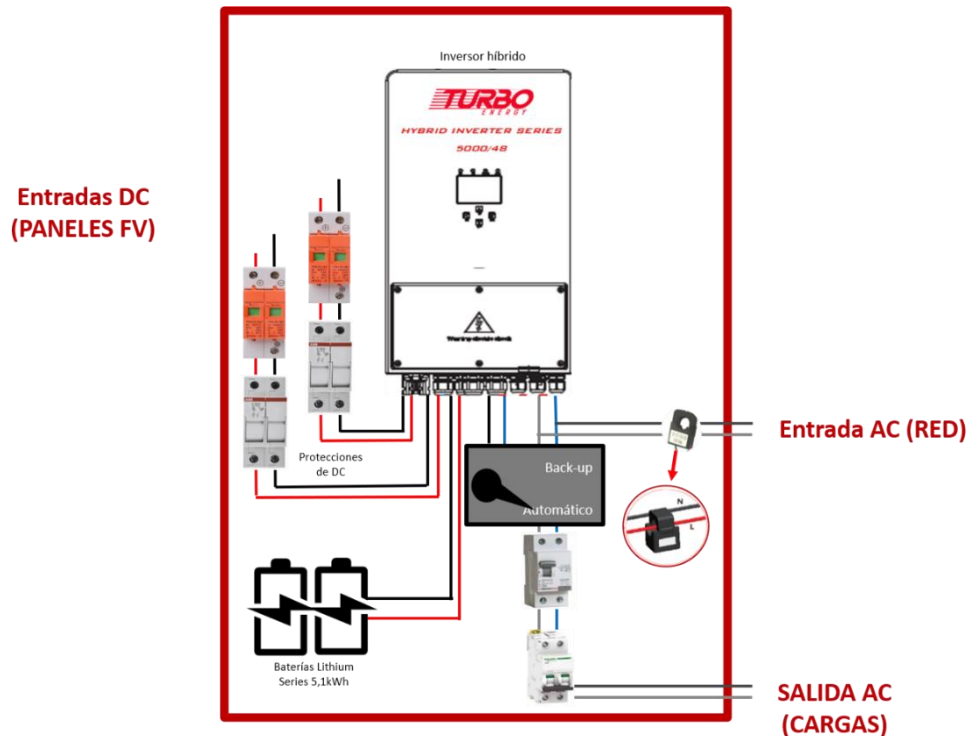
MPPT 1	MPPT 2
Mínimo 5 paneles	Mínimo 5 paneles
Máximo 10 paneles	Máximo 10 paneles

4.2. Preliminary recommendations for installation

The installation of the Model H should be carried out in a place protected from inclement weather, and it is especially relevant that its location is kept dry and avoid potentially flooded areas. The operating temperature range should be considered, which must not exceed 50°C or be less than 0°C. Take appropriate measures to ensure the operating temperature range.

Recommendations for system connection:

Below is a simplified scheme of the interior of the SunBox Model H:



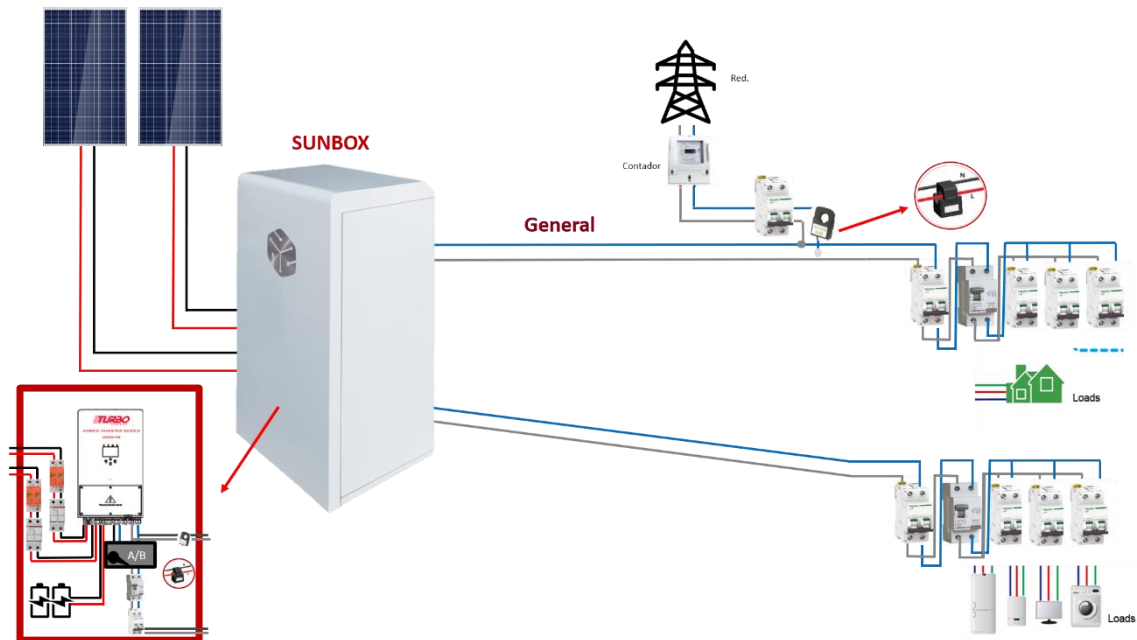
The equipment is prepared so that the installer simply has to connect the input of panels, network, back up, Ez-meter and batteries, if applicable, to the place

indicated below. All protections specified in the schematic are included and pre-assembled, thus facilitating the function of the installer.

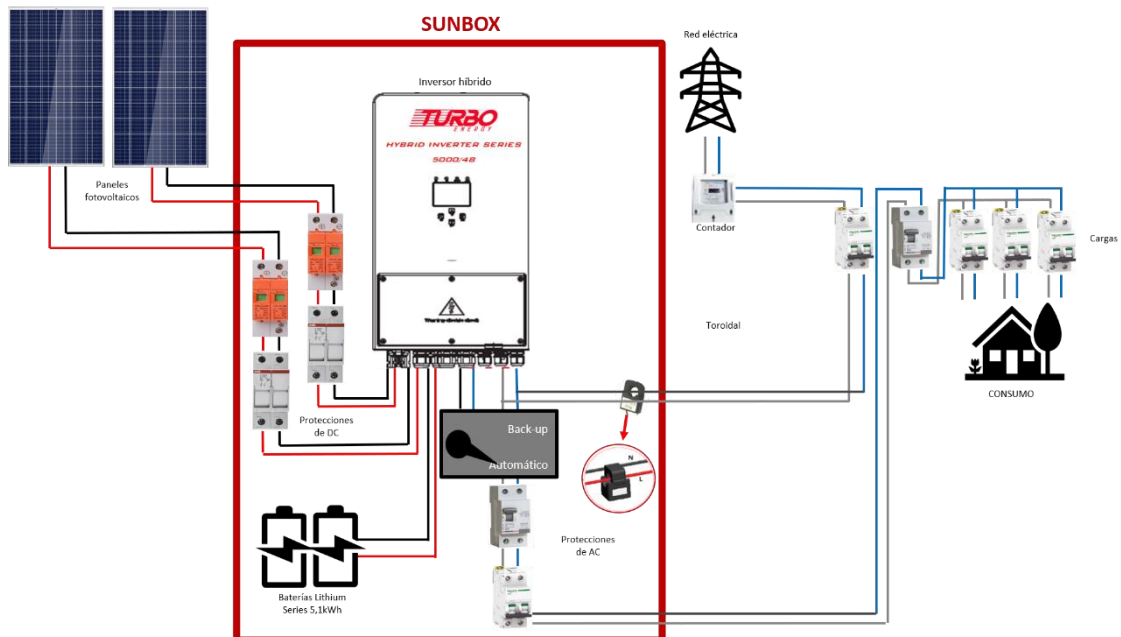
- Photovoltaic panels must be connected in series to the input specified below. Internally connects to the overvoltage protection and its corresponding fuses.
- The inverter's network output is protected with its differential and automatic switches. It must be connected after the magnetothermal of the general housing frame and to the specified internal terminals of the SunBox by a 6 mm² hose.
- The Back-up* output must be connected to the critical load circuit (e.g. the kitchen circuit) and isolated from the rest of the magnetothermals in the general box of the house, and to the SunBox internal terminals specified by a 6 mm² hose.
- In case batteries need to be installed, the SunBox model H comes ready to store up to 2 Turbo Energy Lithium Series 5.1kWh batteries. Its installation is explained below.

*The Network and Back-up outputs in normal network operation will be the same as they are internally connected, however, in case of network failure, if the system stays running in isolation, the inverter opens the contact that joins the network and back-up and leaves the back-up output running in isolation. This is because the inverter cannot operate in island mode, therefore the automatic must be separated from the frame so that it can operate in isolation. The operation in isolation will depend on whether the corresponding batteries have been installed and will operate by solar energy and batteries only for the duration of renewable energy. It should be noted that the power will be limited to 2.3 kW, therefore it is not possible to include loads that require a lot of power.

The overall connection of the SunBox will remain as shown in the following scheme:

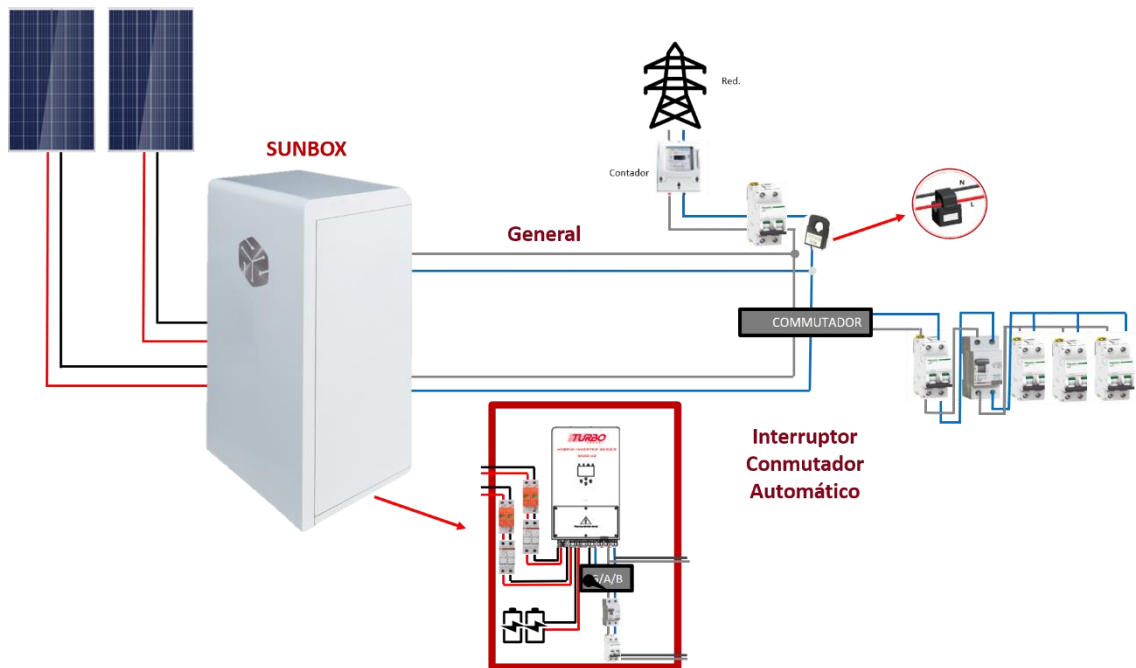


In this case, you must separate the general loads (top of the image) and the back-up loads (bottom). Therefore, for easier connection and to avoid handling of the connections of the installation loads, the following configuration is proposed:

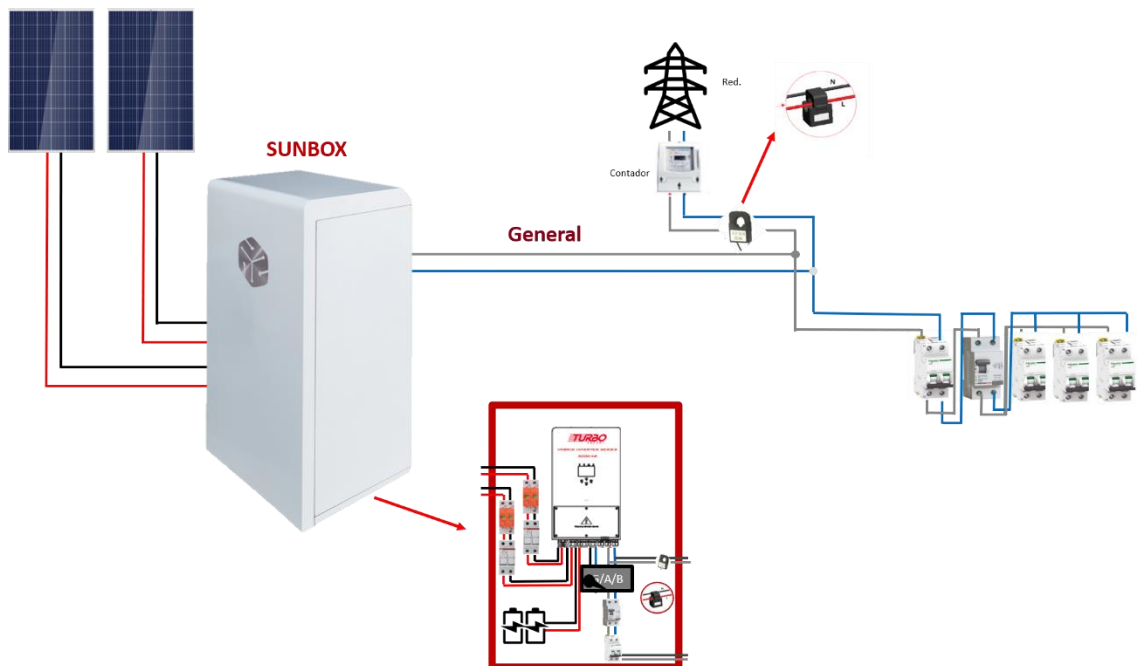


In this way, all the power of the network passes through the equipment and it distributes the power.

If you want to independent the network system and prevent possible equipment failures from causing momentary power outages, it is proposed to place an automatic switch that allows network power without going through the SunBox.



The SunBox Model H is not prepared to withstand excessively high currents, so for high-power installations, the following connection is recommended:



4.3. DC wiring

The series of photovoltaic panels shall be carried out as indicated in section 4.1.

The cabinet already has the right protections installed for continuous sockets.

To access the connections, open the back door of the Model H cabinet. It is very important to note that each positive must be connected to its negative in the cabinet, for this it is recommended to mark the cables or make connections one at a time until the installation is complete.



4.4. AC wiring

To connect Grid, Back-up and Ez meter open the back door of the Model H cabinet and connect to the pointed and identified terminals with colors, phase gray, neutral blue, yellow and earth green.



4.5. Grounding

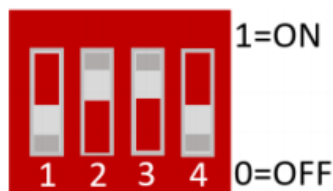
Connect ground wire to the ground plate on the grid side, preventing electric shock if the original protective conductor fails. Using the auxiliary connecting elements we must connect the grounding, both to the rack and to the structure of photovoltaic modules. In the panel and accessory box, 20+5 m (every 3 panels) of grounding cable is supplied. The 5m are for the connection between

the two structures and the 20m for the connection of the structures with the cabinet passing through the grounding, so that all the grounding points are connected to each other. Make sure that the grounding of all cabinet structures are connected to each other via the ground wire.

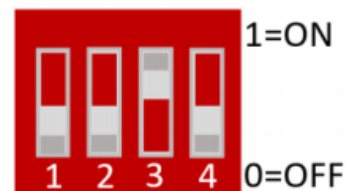
4.5. Recommendations for batteries installation

1. Make sure the inverter is turned off and has no grid connection.
2. Make sure the battery is also turned off.
3. Set up battery switches as follows:

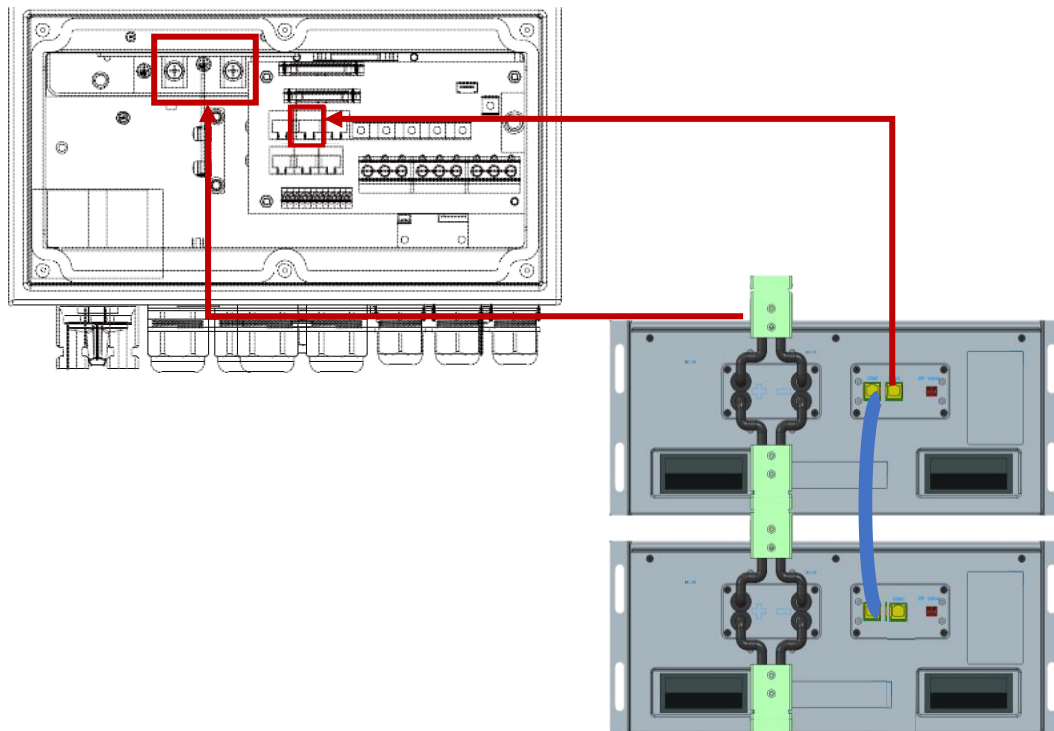
Master battery:



Rest of batteries:



4. Place the battery in the capsule structure with the corresponding screws.
5. If you incorporate a pair of batteries, connect them in parallel and to the inverter. If you only have one battery, connect it directly to the inverter (picture detail).
6. Connect the RJ cable to the CAN port of the master battery. Also connect the Master Battery to the slaves with the corresponding RJ connector (picture detail).



7. Turn on all batteries with the power button (On/Off) for 2-4 seconds.

For more information read the attached Lithium Series 5.1kWh battery manual.

4.5. Commissioning

Once you are finished with all connections, the machine is ready to commission. It will proceed as follows:

1. Reset the DC and AC protections at the back of the cabinet.
2. Start the Batteries. To do this, press the Power button (On/Off) for 2-4 seconds. The BMS will start, and both the LCD screen and the power button will light up.
3. Connect the loads as specified in the previous scheme, and ready for service.

5. Inverter/Charger Configuration

When programming the inverter, you can choose from various configuration options:

1. Selling first: the priority for excess energy is to deliver it to the grid.
2. Zero Export to Load: Output power supplies Back Up load.
3. Zero export to CT: Production feeds at the sum of loads (General and Back up).

You have to select one of these three modes and enable or disable the option to feed power to grid.

In addition, power can be prioritized to charging or battery.

The recommended working mode is: Zero Export to CT / Solar Sell Enabled / Load First. In this way the energy generated will feed the charge, the excess amount will go to the battery and finally, the excess energy will be fed into the grid.

The Model H inverter also incorporates the possibility to use the Grid Peak Shaving function, which allows to reduce the maximum power consumed of the grid.

For more detailed information refer to the HIS 5000/48 Inverter Manual.

6. Security measures

To ensure proper installation it is recommended:

- i. Use safe mounting tools and install safety devices. Use healthy stairs and check that they are securely fixed (70°) on firm support points.
- ii. Use the appropriate EPIs for mounting: protective goggles, safety shoes, gloves and helmet approved.

7. Maintenance recommendations

To keep the system in good condition, achieve optimal operation and extend its service life, it is recommended to perform the following maintenance tasks:

- i. Reviewing connections, and wiring status, replace damaged cables and re-fix connections if necessary.
- ii. Review and check the status of DC fuses. It is suggested, as a simple method of verification, to sequentially disconnect the DC lines one by one to verify the energy input of each panel group. To do this, it is mandatory to disconnect the DC disconnect prior to each disconnection of continuous lines.
- iii. **Important:** each continuous line has two fuses, one for the positive and one for the negative. If applicable, replace damaged fuses. If once

replaced the line remains current in the presence of solar radiation, and verified that the rest of the lines do have, contact technical service.

8. Troubleshooting

Carefully review the content of:

- Page 10 of the Battery Manual.
- Page 24 of the Hybrid Inverter Manual

TECHNICAL DATA SHEETS APPENDIX

**INVERTER/CHARGER
BATTERIES**

Technical data

Hybrid Inverter Series

3600/48 and 5000/48



HYBRID INVERTER WITH BACK-UP MODE



MAXIMUM CUSTOMER SATISFACTION



intertek
Total Quality. Assured.

Hybrid Inverter Series 3600/48 and 5000/48

Technical Data

Technical Data	HYBRID INVERTER SERIES 3600/48	HYBRID INVERTER SERIES 5000/48
Battery input data		
Battery type	Acid-Lead or Li-Ion	
Battery Voltage range (V)	40V-60V	
I _{max} Charge (A)	90A	120A
I _{max} Discharge (A)	90A	120A
Load curve	3 steps/equalization	
External Temperature Sensor	Optional	
Cycle Life	Self-adapting to BMS	
Input data CC		
P _{max} CC (W)	4680W	6500W
Input range PV (V)	370V (100V-500V)	
MPPT range (V)	125V-425V	
Full charge range (V)	240V-425V	
Startup voltage	150V	
Max input current (A)	11A+11A	
N° MPPTs	2	
Strings per MPPT	1 / 1	
Output data CA		
Nominal Power (W)	3600W	5000W
Max. Power (W)	3960W	5500W
Peak Power (Offgrid)	Twice the Nominal Power, 10S	
Max. Back-Up Power (W)	5000W	
Nominal CA output current (A)	15.7	21.7
Max. CA current (A)	18	25
Peak Current (A)	35A	
Power factor	0.8-1	
Output frequency and voltage	50/60Hz; 220/230/240Vac (single phase)	
Grid type	Single phase	
Harmonic distortion	THD<3% (line loading)<1.5%	
Efficiency		
Max. Efficiency	97.60%	
European Efficiency	96.50%	
MPPT Efficiency	99.90%	

CAUTION: READ THE INSTRUCTION AND INSTALLATION MANUAL BEFORE USING THE PRODUCT.

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Technical data

Battery Lithium Series 48V 5.1 kWh



LONG-LASTING LITHIUM-ION BATTERIES



MAXIMUM CUSTOMER SATISFACTION



PLUG & PLAY



Battery Lithium Series 48V 5.1 kWh

Technical data

Electrical

Nominal Capacity	5.12 kWh
Usable Capacity	4.6 kWh
Depth of Discharge (DoD)	90%
Nominal Voltage	51.2V
Voltage operating range	48 - 57.6V
Cycle Life	>= 6000

Physical

Weight	52 kg
Dimensions	475 x 446 x 200 mm
Protection class	IP20
Battery type	LiFePO ₄

Operation

Maximum charge/discharge current	50A (0.5 C)
Temperature operating range	0°C...50°C
Humidity	15% - 85%
Maximum operating altitude	< 3000 m

BMS

Energy consumption	<2 W running / <100mW at rest
Monitoring parameters	System voltage and current, Cell voltage and temperature
Communication	Compatible CAN and RS-485

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