FIMER

PowerBOX

PowerBOX-1PH-3PH

Product Manual

⚠ **ATTENTION - IMPORTANT SAFETY INSTRUCTIONS**

This manual contains important safety instructions that must be followed during the installation and maintenance of the equipment.

⚠ **ATTENTION - SAVE THESE INSTRUCTIONS**

Keep this document in a safe place near the electrical switchboard (PowerBOX) for easy access during installation, operation and maintenance.

The installer must read this document in its entirety and scrupulously follow the instructions given in it before installing this equipment, since MA Solar Italy cannot be held responsible for damage caused to people and/or things, or the equipment, if the conditions described below are not observed.

The purpose of this document is to support the qualified technician, who has received training and/or has demonstrated skills and knowledge on the structure and operation of the unit, to install, operate and maintain the inverter and the components of the electrical system connected to it. This manual covers the **PowerBOX** only, and NO other equipment (photovoltaic modules, external disconnects, etc) to which it is connected. Warranty requirements are included in the Terms and Conditions of sale included with the inverter order.

NOTE - Any changes made to the product or to the installation conditions that hasn't been approved by MA Solar Italy will void the warranty.

NOTE - All pictures and illustrations shown in this user manual are indicatives and must be intended as support for installation instruction only. Actual products may vary due to product enhancement. Specifications subject to change without notice. The latest version of this document is available on the MA Solar Italy website.

The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All persons responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. Any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks. This document has been carefully checked by MA Solar Italy, but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall MA Solar Italy be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

Table of Content

1 Safety and accident prevention

1.1 Safety information and instructions

This chapter contains the safety instructions which you must obey when you install and operate the PowerBOX electrical switchboard. Obey these safety instructions to prevent injury or death, or damage to the equipment.

NOTE - The instructions provided in the manual do not replace the safety devices and technical data for installation and operation labels on the product, and they do not replace the safety regulations in force in the country of installation.

READ THE MANUAL - The operators must read and comply with the technical information and instruction provided in the manual and in any additional attached documentation.

NOTE - MA Solar Italy accepts no liability for failure to comply with the instructions for a correct installation and cannot be held responsible for any other upstream or downstream equipment.

READ THE MANUAL - Specific safety information is provided during installation, commissioning and maintenance operation instructions. Always follow the reading order of instruction exactly as described in this manual.

1.2 Symbols and signs

In the manual and/or in some cases on the equipment, the danger or hazard zones/components are indicated with signs, labels, symbols or icons.

	Note - General information about product
	ATTENTION- Important safety information. Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	WARNING - Indicates a potentially hazardous situation, in particular a high voltage, which, if not avoided, could result in death or serious injury. The inverter has high voltages and high energy levels.
	HOT SURFACES - Indicates a potentially hazardous situation related to hot surface, which, if not avoided, could result in serious injury. Some surfaces in the inverter will become hot during operation and must not be touched until the parts have cooled down.
	Risk of injury due to the weight of the equipment. Take care during lifting and transport.
	Indicates that the area must not be accessed or that the operation described must not be carried out.
	Keep out of the reach of children.
	Indicates that it is mandatory to carry out the described operations using the clothing and/or personal protective equipment provided by the employer.
	Indicates the connection point for protective earth.
	Rated temperature range.
	Risk of electric shock. The discharge time (quantified in the figure by the number XX) of the stored energy after de-energizing of the Inverter from both DC side and AC side.
	Direct Current (DC)
	Alternate Current (AC)
	Without isolation transformer
	Positive pole of the input voltage (DC)
	Negative pole of the input voltage (DC)
	Protection rating of equipment
	Indicates the centre of gravity of the equipment.
	Indicates the requirement to wear PPE
	Observe the documentation
	The product complies with the requirements of the applicable Australian standards

2 Introduction and general information

2.1 Warranty and supply conditions

The warranty conditions (available on the official MA Solar Italy website) are valid if the Customer adheres to all indications content in this manual; any condition deviating from those described herein must be expressly agreed in the purchase order.

NOTE – MA Solar Italy declares that the equipment complies with the provisions of law currently in force in the country of installation and has issued the corresponding declaration of conformity

2.1.1 Not included in the supply conditions

MA Solar Italy will NOT be held liable for defects or malfunctions arising from:

- improper use of the equipment,
- deterioration resulting from transportation or environmental conditions,
- performing maintenance incorrectly or not at all,
- tampering or unsafe repairs,
- use or installation by unqualified persons.

MA Solar Italy is not responsible for disposal of the equipment, or part of it, which does not take place based on the regulations and laws in force in the country of installation.

ATTENTION - MA Solar Italy accepts no liability for failure to comply with the instructions for a correct installation and will not be held responsible for systems upstream or downstream of the equipment it has supplied.

FORBIDDEN - It is absolutely forbidden to modify the equipment. Any modification, manipulation, or alteration not expressly agreed with the manufacturer, concerning either hardware or software, shall result in the immediate cancellation of the warranty.

NOTE - The customer is fully responsible for any changes made to the system.

2.2 Scope and target audience

2.2.1 Purpose and document structure

This operating and maintenance manual is a useful guide that will enable you to work safely and carry out the operations necessary for keeping the equipment in good working order.

ATTENTION - If the equipment is used in a manner not specified in this manual, the protections and the certifications provided by the equipment may be impaired with the consequent loss of warranty.

NOTE - The language in which the document was originally written is ENGLISH; therefore, in the event of inconsistencies or doubts please ask the manufacturer for the original document.

2.2.2 List of appendix documents

In addition to this product manual, you can consult (and download) the product documentation by visiting www.fimer.com.

NOTE - Some components' information given in this manual is taken from the original supplier documents. Please refer to the supplier websites for the complete and updated documentation.

NOTE - In certain cases, there may be a need to separately document software functionality or attach supplementary documentation to this manual which is intended for more qualified professionals.

2.2.3 Operator and maintenance personnel skills/prerequisites

⚠ **ATTENTION** - Personnel in charge of using and maintaining the equipment must be skilled in the tasks described and must reliably demonstrate their capacity to correctly interpret what is described in the manual.

⚠ **ATTENTION** - For safety reasons, the installation must be performed by qualified installers and/or licensed electricians, with experience in photovoltaic systems. Installation must be in accordance with the existing regulations in the country of installation and any other local electrical codes. The local electrical utility (or authority having jurisdiction) must approve the installation of the equipment before it is connected to the electrical grid.

⚠ **ATTENTION** - The customer has the civil liability for the qualification and mental or physical state of the personnel who interact with the equipment. They must always use the personal protective equipment (PPE) required by the laws of the country of destination and whatever is provided by their employer.

FORBIDDEN – PowerBOX operation and maintenance performed by personnel that are NOT qualified, is intoxicated, or on narcotics, is strictly forbidden.

2.3 Application area, general conditions

MA Solar Italy shall not be liable for any damages whatsoever that may result from incorrect or careless operations.

FORBIDDEN - Please, do not use this equipment for any application not mentioned in the field of use.

2.3.1 Intended or allowed use

This equipment is an electrical switchboard designed for:

transforming a continuous electrical current (DC) supplied by a photovoltaic generator (PV) in an alternating electrical current (AC) suitable for feeding power into the public distribution grid.

2.3.2 Limits in field of use

- This equipment can be used only with **PowerUNO** and **PowerTRIO** inverters.
- This equipment can be only connected to the electricity grid in countries for which it has been certified/approved.
- This equipment may only be used in compliance with all its technical characteristics.

2.3.3 Improper or prohibited use

FORBIDDEN - It is forbidden to install equipment in environments subject to conditions of flammability or in adverse or disallowed environmental conditions, (temperature and humidity).

FORBIDDEN - It is forbidden to use the equipment with safety devices which are faulty or disabled.

FORBIDDEN - It is forbidden to use the equipment or parts of the equipment by linking it to other machines or equipment, unless expressly provided for.

FORBIDDEN - It is forbidden to modify operating parameters that are not accessible to the operator and/or parts of the equipment to vary its performance or change its isolation.

FORBIDDEN - It is forbidden to clean with corrosive products that could corrode parts of the equipment or generate electrostatic charges.

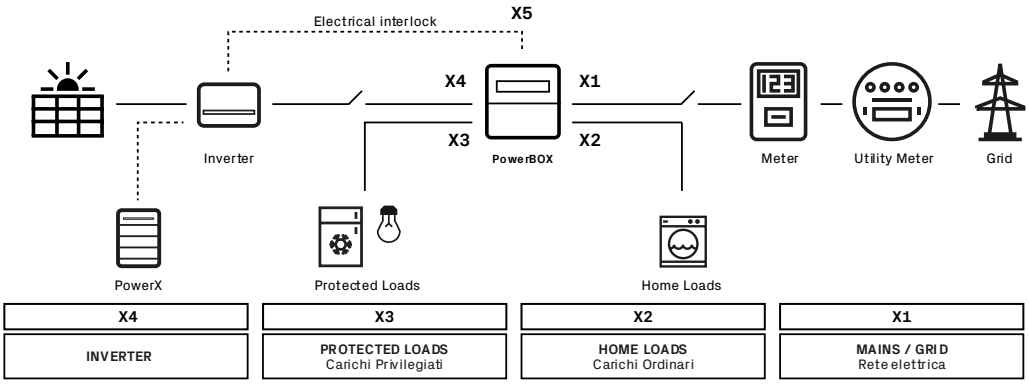
FORBIDDEN - It is forbidden to use or install the appliance or parts of it without having read and understood the contents of the user and maintenance manual. The equipment MUST NOT be used by inexperienced staff, or even experienced staff if carrying out operations on the equipment that fails to comply with the indications in this manual and enclosed documentation.

FORBIDDEN - It is forbidden to place any heavy object, sit or stand up on the PowerBOX electrical switchboard.

FORBIDDEN - It is forbidden to heat or dry rags and clothing on the parts in temperature. In addition to being hazardous, doing so would compromise component ventilation and cooling.

3 Product description

3.1 PowerBOX description



PowerBOX is a switchboard that enables backup functionality in on-grid installations of the inverter. Its role is to monitor the upstream mains voltage and ensure disconnection from the grid during islanded power supply to the protected loads. Typically, the backup switching time is under 0.5 seconds, although external factors or local regulations may prevent the system from entering backup mode. Users should consider the following guidelines:

- Avoid connecting critical loads that require a stable power supply to operate reliably.
- Do not connect loads with a total capacity exceeding the maximum backup limit.
- Battery current may be limited by factors related to the battery's condition, such as temperature and weather, among others.

3.2 Description of the overall energy storage system and backup functionality

PowerUNO and PowerTRIO are hybrid inverters designed by MA Solar Italy to optimise self-consumption in residential environments. The residential energy storage system includes:

- **PowerUNO/PowerTRIO hybrid inverters**. They transform a direct current (DC) from a photovoltaic generator (PV) into an alternating current (AC) which can be fed into the public distribution grid. In addition, the inverter receives data from the energy meter and performs smart management of energy storage in the PowerX battery unit to maximise self-consumption for domestic utilities. The configuration and monitoring of the system are made possible by the embedded Wi-Fi/Ethernet logger which enables to send the system data to a Wi-Fi/Ethernet router which, in turn, sends the data to the Aurora Vision cloud. These data can be consulted online, through the Energy Viewer app for smartphones/tablets or via the inverter internal web server.
- **PowerUNO and PowerTRIO grid and backup capabilities**: PowerUNO and PowerTRIO are capable of operating while connected to the electrical grid and of powering critical loads in islanded mode in case of blackouts and grid outages or off-grid installation via the AC GRID connector. In on-grid installations, a switching and isolation panel (PowerBOX) is required to enable backup mode.
- **PowerX battery unit**. This unit stores unused energy from the PV generator, making it available when energy demand exceeds generation or during nighttime hours.
- **Meter**. It measures the energy at the grid connection point and communicates with PowerUNO or PowerTRIO to manage the system. Based on domestic consumption and the batteries charge level, it is possible that the maximum limit on active power fed into the grid (set by the operator) may be exceeded; in this case the system can automatically limit the feeding of active power into the grid (export-limitation and/or zero injection).

⚠ **ATTENTION –** The product is not suitable for supplying power to life-sustaining medical devices since power outages may result in danger to life.

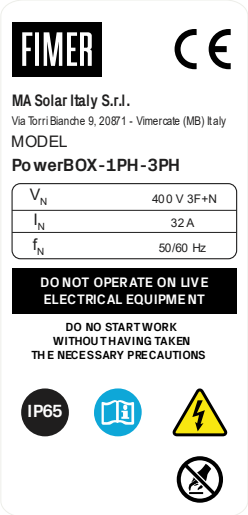
⚠ **ATTENTION –** To power the loads in backup mode, it is essential to have energy at the input of the inverter provided either by the photovoltaic modules or by the PowerX BESS. If there is no available power from batteries or PV modules in backup mode, the backup power supply will be automatically terminated.

4 Characteristics

4.1 General conditions

4.2 Identification of equipment and manufacturer

4.2.1 Regulatory and identification label



A	Certification marks
B	PowerBOX model
C	Main technical data
D	Keep out of the reach of children.
E	Environmental protection rating
F	Indicates the connection point for protective earth.
G	Degrees of protection provided by enclosures (IP Code)
H	Serial Number
I	Production Date
J	Manufacturer

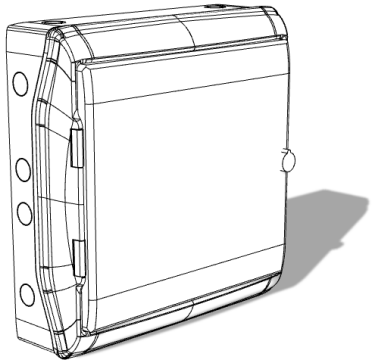
4.3 Models

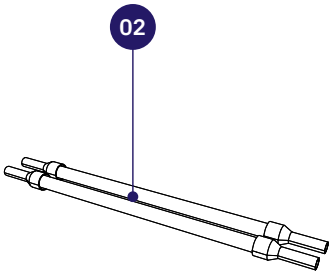
This document involves the following product models:

PowerBOX Model	Description
PowerBOX-1PH-3PH 3R559900000F	PowerBOX for three-phase and single-phase systems; IP65 backup panel, rated current 32A, rated voltage 400VAC (3-phase with neutral), maximum exchanged power 22.17kW (bidirectional), maximum three-phase inverter power 10kW, maximum single-phase inverter power 6kW.

4.4 Package content

	DESCRIPTION	QUANTITY
01	PowerBOX	1
02	Jumper AWG10	2
03	Cable gland M32	4
04	Cable gland M16	1
05	Wall mounting sealing plugs	4





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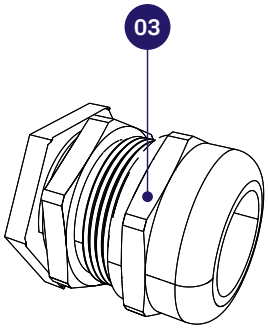

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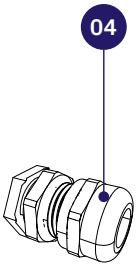

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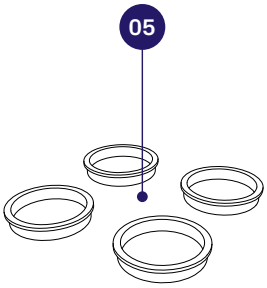


x 4

4.5 Technical data

4.5.1 Technical data table

TECHNICAL DATA	
Electrical	
Nominal Voltage (V_n)	400 V / 230 V
Nominal Current (I_n)	up to 32 A (*)
Nominal Frequency (f_n)	50 / 60 Hz

(*) See paragraphs "**Installation**" for details.

Environmental	
Ambient temperature range	-25 … +60 °C
Relative humidity	4 … 100%

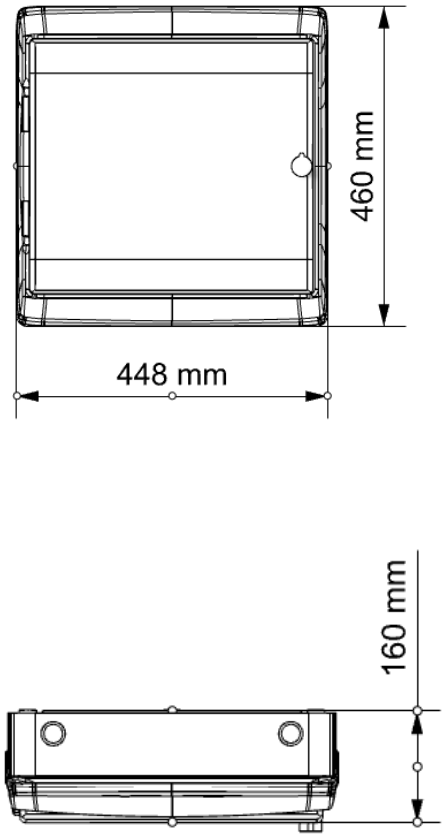
Physical	
Environmental protection rating	IP65
Dimensions (W x H x D)	430 x 415 x 155 mm
Weight	3 kg

4.5.2 Connectors cross section range

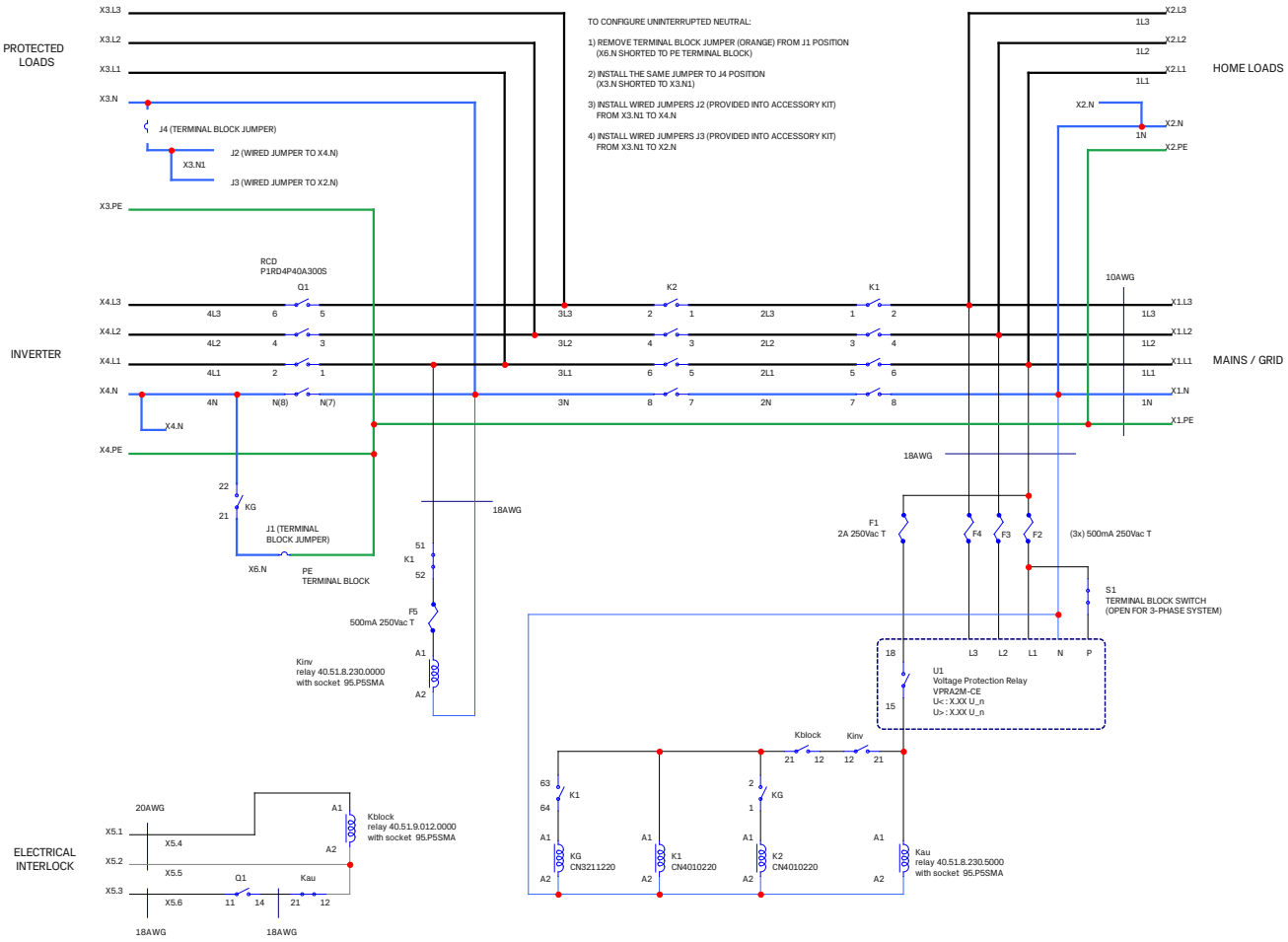
TERMINAL BLOCKS		
X1	Mains power-supply (utility)	up to 10 mm^2
X2	Normal loads (non-backed-up loads)	up to 10 mm^2
X3	Protected loads (backed-up-loads)	up to 10 mm^2
X4	Inverter	up to 10 mm^2
X5	Inverter electrical interlock	up to 1.0 mm^2

NOTE - The cross-section of the power cables must be determined by the designer or installer, based on the specific requirements of the installation (operational current, voltage drop, short-circuit protection, installation conditions, regulatory standards and safety codes).

4.5.3 Overall dimensions of the PowerBOX



4.6 Topographic diagram of the PowerBOX



⚠ **ATTENTION** - In single-phase installations, terminals L1 and N must be used. Voltage monitoring is carried out on the L1-N phase voltage.

⚠ **ATTENTION** - if the PowerBOX is used in a three-phase configuration, **it is necessary to remove jumper S1**.

4.6.1 On-line mode

In on-line (grid-connected) mode, there is electrical continuity between terminals X1/X2/X3/X4 of the PowerBOX, as contactors K1 and K2 (DDI) are closed. In this mode, all loads can be powered either by the grid or the inverter. The inverter can also exchange energy with the grid.

4.6.2 Backup mode

In backup mode, contactors K1 and K2 isolate the network formed by terminals X3/X4 (islanded network) from the utility grid, connected to terminal blocks X1/X2. In this mode, the inverter can supply protected loads with backup power. During islanded operation, the contactor KG connects the neutral line to the protective ground (PE).

5 Installation

5.1 Installation safety instruction

⚠ **WARNING** -The installation must be carried out with the equipment disconnected from any voltage sources.

⚠ **WARNING** - The internal residual current device Q1 (RCD) also functions to shut down the inverter. It must be switched off before opening the PowerBOX or before carrying out any work on the privileged loads circuit.

⚠ **ATTENTION** - This device is intended to be installed in a suitable plant for its use and its purpose. All the installation instructions described in this chapter must be followed considering the plant structure where the device is intended to be installed. Its performance therefore depends on the correctness of the installation.

⚠ **ATTENTION** - It is mandatory to adhere to the indications provided in this manual, the diagrams and the enclosed documentation, paying attention to follow the installation sequence exactly as described in this manual.

⚠ **ATTENTION** - Staff authorised to carry out the installation must be specialised and experienced in this job. They must also have received suitable training on equipment of this type. The installation must be performed by qualified installers and/or licensed electricians in accordance with the existing regulations in the country of installation.

⚠ **ATTENTION** - The local electrical utility (or authority having jurisdiction) must approve the equipment installation before it is connected to the electrical grid.

5.2 Installation site and position

5.2.1 General recommendation on installation position

⚠ **ATTENTION** - Please refer to the warranty terms and conditions to evaluate any possible warranty exclusions due to improper installation.

- Refer to "**Technical data**Error! No bookmark name given." paragraph to check the required environmental conditions (protection rating, temperature, humidity, altitude, etc.).
- The installation location shall be easily accessible.
- Installation of the unit in a location exposed to direct sunlight **is not acceptable**. Add an awning in case of direct sunlight installation.
- Final installation of the device must not compromise access to any disconnection devices that may be located externally.
- Do not install in small, closed rooms where air cannot circulate freely.
- Always ensure that the flow of air around the switchboard is not blocked to prevent overheating.
- Do not install in locations where flammable substances or gases may be present (minimum distance 3 m).
- Do not install the inverter outdoors in salt areas because it will be corroded there and may cause fire. A salt area refers to the region within 500 meters from the coast or prone to sea breeze.
- Install on a wall or strong structure suitable to bear the weight.
- Do not install the unit at a place within children's reach.

5.2.2 Installation of cable glands

The installation kit includes five cable glands: four of size M32 **(03)** and one of size M16 **(04)**. The cable glands must be installed by the installer, using the dedicated knockouts on the enclosure. The positioning should be selected to best suit the system layout, based on the direction of entry of the electrical cables.

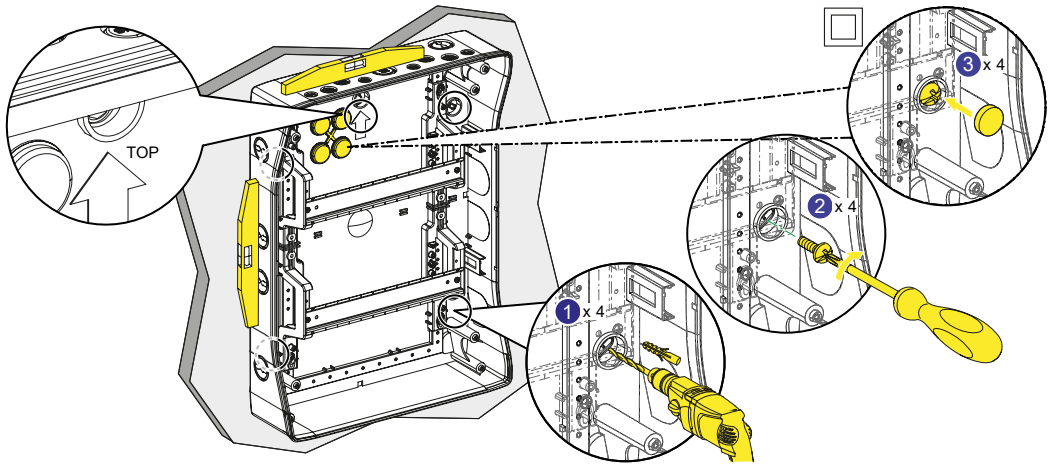
The cable glands are assigned as follows:

- Mains/Grid – M32
- Home Loads – M32 (to be installed only if non-priority loads need to be powered)
- Protected Loads – M32
- Inverter – M32
- Electrical Interlock – M16

5.2.3 Tilting admittance

The PowerBOX **(01)** must be installed in vertical position with a maximum inclination of 5°.

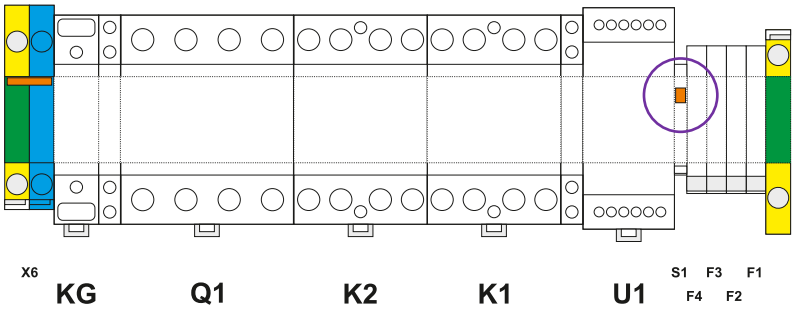
5.2.4 Wall mounting the PowerBOX



1. **Drill the mounting holes**: using a drill, create holes at the four designated reference points located on the back of the box.
2. **Secure the enclosure**: insert wall plugs into the drilled holes, then fix the enclosure firmly in place using the appropriate screws.
3. **Ensure IP protection**: to maintain the specified IP protection rating, install the dedicated sealing plugs provided with the installation kit **(05)**.

5.3 Connection between PowerBOX and PowerUNO/PowerTRIO

⚠ **ATTENTION -** if the PowerBOX is used in a three-phase configuration, **it is necessary to remove jumper S1**.



5.3.1 Symbol Legend

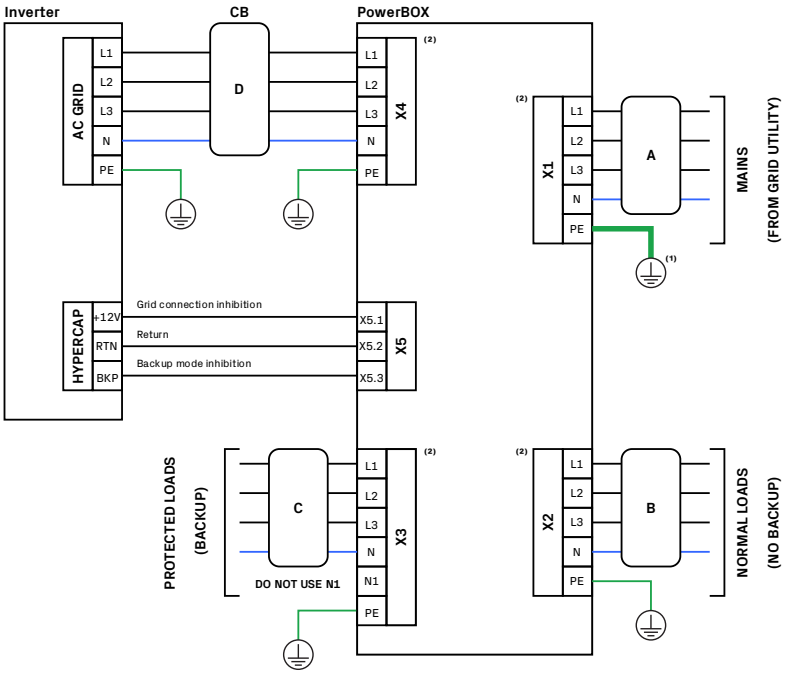
The table below defines the characteristics of the devices identified by the letters A, B, C, and D in the diagrams.

Symbol	
A	Automatic circuit breaker with thermal-magnetic characteristics, rated for a maximum of C32A.
B	Install a residual current device with sensitivity max 30 mA
C	Install a residual current device with sensitivity max 30 mA
D	Automatic circuit breaker with thermal-magnetic characteristics (see 5.3.9)

⚠ **WARNING -** To mitigate the risk of electrical shock, all wiring operations must be performed with the entire system de-energised, ensuring that the disconnect switch DC side and on the grid side of the inverter are open and the Lockout/Tagout (LOTO) procedure is applied. Additionally, take care to avoid mistakenly swapping the phases with the neutral!

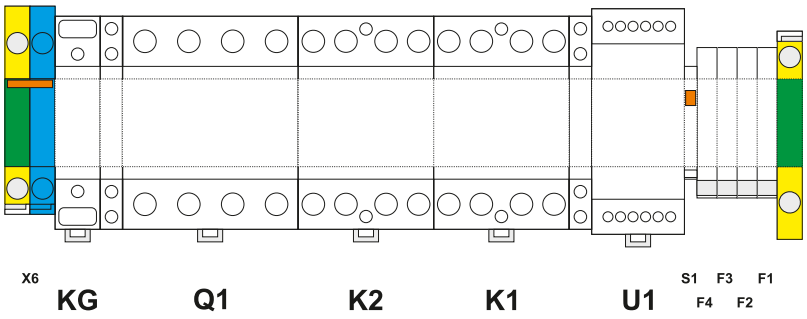
⚠ **ATTENTION -** The installation must be performed by qualified installers and/or licensed electricians in accordance with the existing regulations in the country of installation and in accordance with all safety rules for performing electrical works. The customer has civil liability for the qualification and mental or physical state of the personnel who interact with the equipment. They must always use the personal protective equipment (PPE) required by the laws of the country of destination and whatever is provided by their employer.

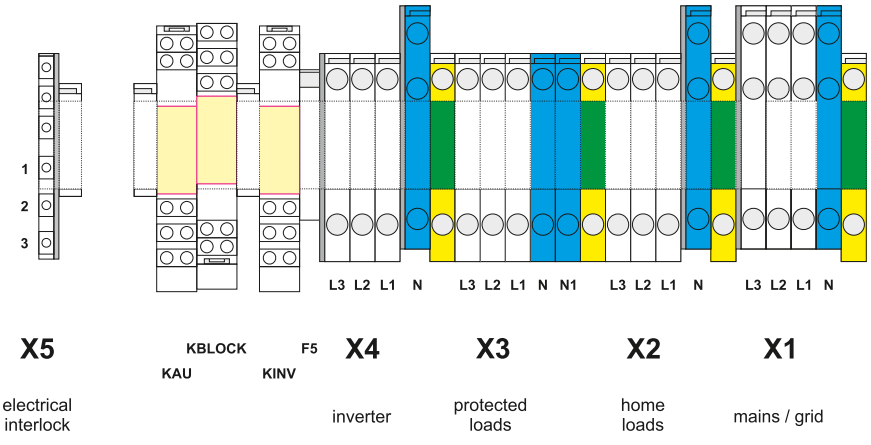
5.3.2 Installation with interruption of the neutral conductor



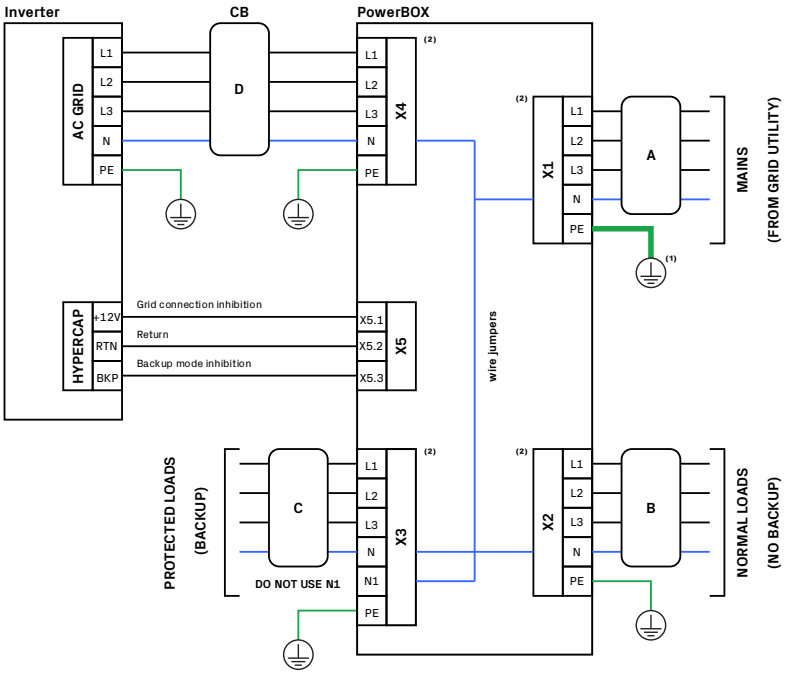
(1) **The PE cable must be connected correctly, securely, and reliably**

(2) **For single-phase installations, use only L1 and N.**



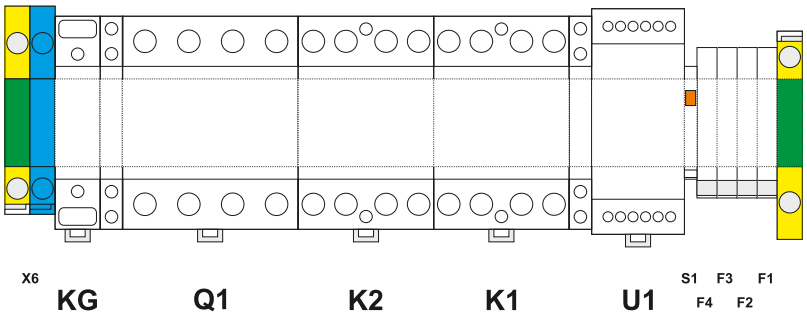


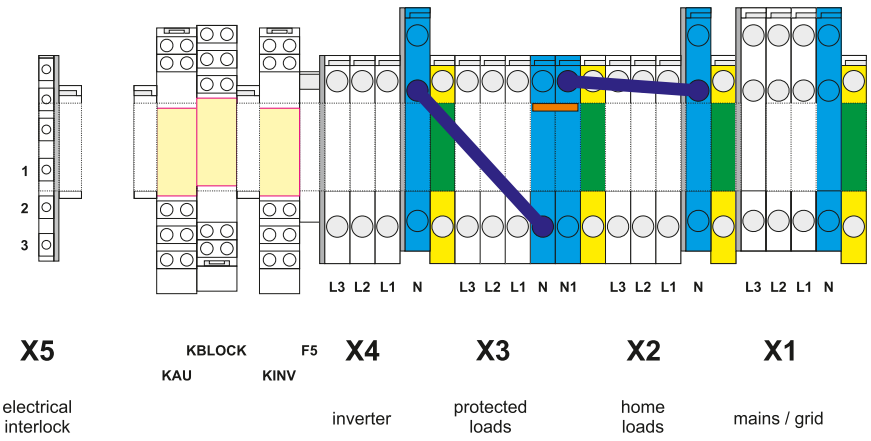
5.3.3 Installation without interruption of the neutral conductor (AU/AS/NZ)



(1) The PE cable must be connected correctly, securely, and reliably

(2) For single-phase installations, use only L1 and N.





To configure the system with a pass-through neutral, it is necessary to reposition one of the jumpers and to use the two wire jumpers provided in the accessory kit and:

- Remove terminal block jumper (orange) from J1 position (X6.N shorted to X6.N1)
- Install the same jumper to J4 position (X3.N shorted to X3.N1)
- Install the wired jumper J2 (provided into accessory kit) from X3.N1 to X4.N
- Install the wired jumper J3 (provided into accessory kit) from X3.N1 to X2.N

5.3.4 Characteristics and sizing of the PE cable

⚠ Ensure that the PE cable is securely connected. Otherwise, electric shocks may occur.

⚠ Do not connect the neutral wire to the enclosure as a PE cable. Otherwise, electric shocks may occur.

5.3.5 Characteristics and sizing of the inverter line cable

The same prescriptions as those in PowerUNO and PowerTRIO product Manuals (paragraph 5.4) apply.

PowerUNO

Inverter model	External circuit breaker CB	Line conductor maximum length (m)	
	terminals X4 to inverter AC GRID port	4 mm²	6 mm²
FIM-HY-2.0-SE-A-1PH	2W (L1+N) 230 V min. 16 A magnetic curve B/C	31	47
FIM-HY-3.0-SE-A-1PH	2W (L1+N) 230 V min. 16 A magnetic curve B/C	21	31
FIM-HY-3.3-SE-A-1PH	2W (L1+N) 230 V min. 20 A magnetic curve B/C	19	29
FIM-HY-3.6-SE-A-1PH	2W (L1+N) 230 V min. 20 A magnetic curve B/C	17	26
FIM-HY-4.0-SE-A-1PH	2W (L1+N) 230 V min. 25 A magnetic curve B/C	16	24
FIM-HY-4.6-SE-A-1PH	2W (L1+N) 230 V min. 25 A magnetic curve B/C	14	21
FIM-HY-5.0-SE-A-1PH	2W (L1+N) 230 V min. 25 A magnetic curve B/C	13	19
FIM-HY-6.0-SE-A-1PH	2W (L1+N) 230 V min. 32 A magnetic curve B/C	10	16

PowerTRIO

Inverter model	External circuit breaker CB	Line conductor maximum length (m)	
	terminals X4 to inverter AC GRID port	4 mm²	6 mm²
FIM-HY-4.0-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 10 A magnetic curve B/C	63	94
FIM-HY-5.0-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 10 A magnetic curve B/C	50	76
FIM-HY-6.0-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 10 A magnetic curve B/C	42	63
FIM-HY-7.5-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 16 A magnetic curve B/C	34	50
FIM-HY-8.0-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 16 A magnetic curve B/C	31	47
FIM-HY-8.5-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 16 A magnetic curve B/C	30	44
FIM-HY-10.0-SE-A-3PH	4W (L1, L2, L3, N) 400 V min. 20 A magnetic curve B/C	25	38

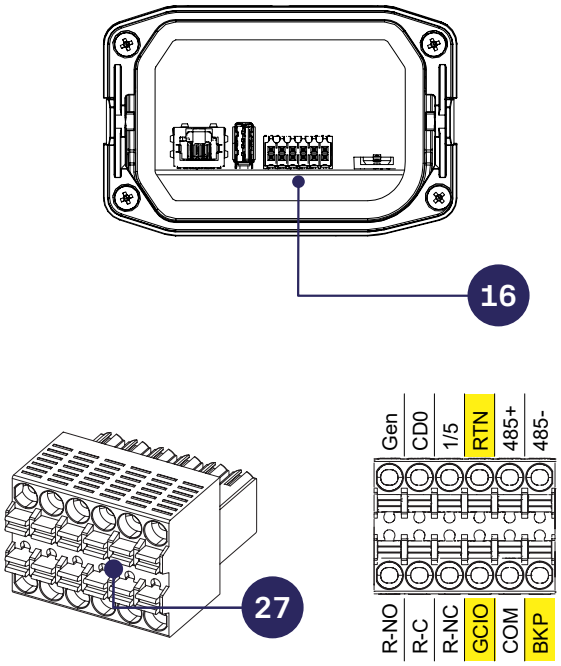
The values are calculated in nominal power conditions, considering:

- loss of power along the line no greater than 1%
- use of copper cable, with HEPR rubber isolation and positioned in open air.

5.3.6 Connection between X4 and PowerUNO/PowerTRIO AC cable connection (AC GRID)

The same prescriptions as those in PowerUNO and PowerTRIO Product Manuals apply (fimer.com).

5.3.7 Connection between X5 and PowerUNO Terminal Signals



The terminals block (27) provides 3 terminal necessary to configure an electrical interlock with an external panel that performs the separation from the electrical grid function:

PowerUNO Terminal	Description	PowerBOX Terminal
BKP	Backup mode inhibition	X5.3
+12V (GCIO)	Grid connection inhibition	X5.1
RTN	Common return path	X5.2

5.3.7.1 BKP: backup mode inhibition

The BKP signal is pulled up by the internal logic of the inverter and it is an input for the digital logic. When the signal is connected to RTN (LOW), the backup is enabled. When the signal is floating (HIGH) the backup is inhibited.

5.3.7.2 +12V: grid connection inhibition

The +12V signal is an output for the digital logic of the inverter and must be used to operate the interlocking devices of an external panel of the plant. **This output is rated 12 V dc - 500 mA maximum**. During the backup operational mode, the signal is ON. When the inverter ends the backup mode and it is ready for the grid connected operations, the signal is OFF.

5.3.8 Main protection circuit breaker (A)

To protect the PowerBOX power lines and its devices, the line connected to terminals X1 must be equipped with a circuit breaker:

Mains protection circuit breaker (A)		
Type	Automatic circuit breaker with thermal-magnetic protection	
Installation	Single-phase	Three-phase
Voltage/ current rating	230 Vac max. 32 A	400 Vac max. 32 A
Magnetic protection characteristic	Magnetic curve B/C	Magnetic curve B/C
Number of poles	2W (L + N)	4W (3 phases with neutral wire)

5.3.9 Inverter protection breaker (D)

To protect the AC grid connection line of the inverter, an overcurrent protection device with the following features must be installed (these are the characteristics of a load protection switch referred to a single inverter installation):

Inverter protection c. breaker (D = CB)				
Type	Automatic circuit breaker with thermal-magnetic protection			
Voltage/ current rating (*)	FIM-HY-2.0-SE-A 1PH	230Vac min. 16A	FIM-HY-4.0-SE-A 3PH	400Vac min. 10A
	FIM-HY-3.0-SE-A 1PH	230Vac min. 16A	FIM-HY-5.0-SE-A 3PH	400Vac min. 10A
	FIM-HY-3.3-SE-A 1PH	230Vac min. 20A	FIM-HY-6.0-SE-A 3PH	400Vac min. 10A
	FIM-HY-3.6-SE-A 1PH	230Vac min. 20A	FIM-HY-7.5-SE-A 3PH	400Vac min. 16A
	FIM-HY-4.0-SE-A 1PH	230Vac min. 25A	FIM-HY-8.0-SE-A 3PH	400Vac min. 16A
	FIM-HY-4.6-SE-A 1PH	230Vac min. 25A	FIM-HY-8.5-SE-A 3PH	400Vac min. 16A
	FIM-HY-5.0-SE-A 1PH	230Vac min. 25A	FIM-HY-10.-SE-A 3PH	400Vac min. 20A
	FIM-HY-6.0-SE-A 1PH	230Vac min. 32A		
Magnetic protection characteristic	Magnetic curve B/C			
Number of poles	2W (L + N)		4W (3 phases with neutral wire)	

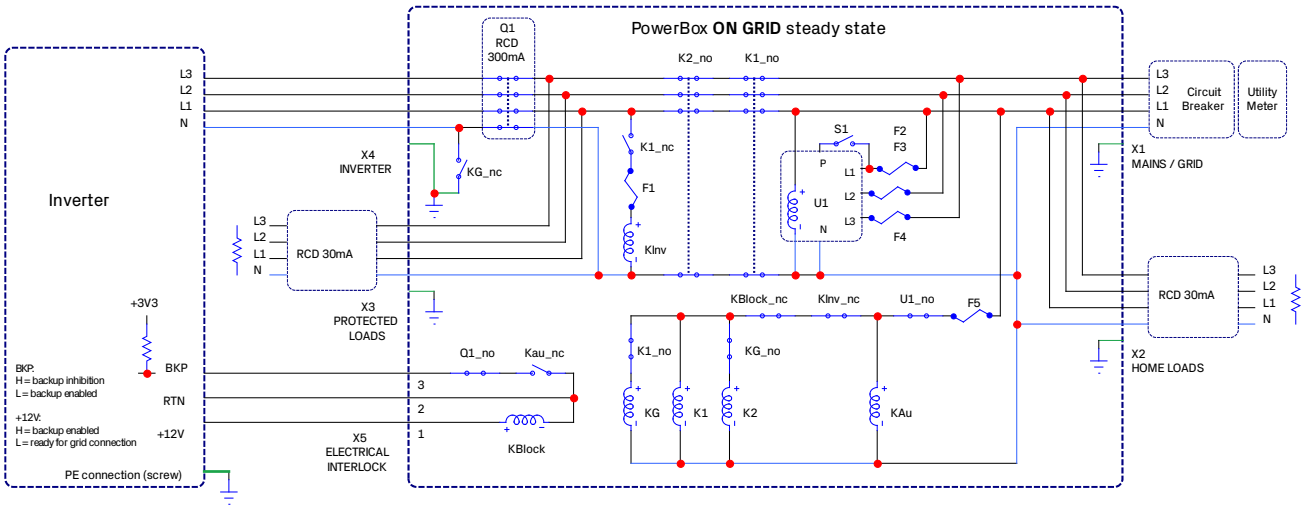
(*): consider thermal and other derating when selecting the current rating of the protection equipment for your application.

5.3.10 Differential protection downstream of the inverter

Inside the PowerBOX, a residual current circuit breaker (RCCB) is installed to protect the inverter line, with the following specifications:

Residual current protection device requirements	**Description**
Type	A
Sensibility	300 mA

5.3.11 On-grid mode (steady-state)



During normal operation (on-grid), there is no isolation between the electrical grid (mains) and the inverter. Provided the requirements of the standard are met:

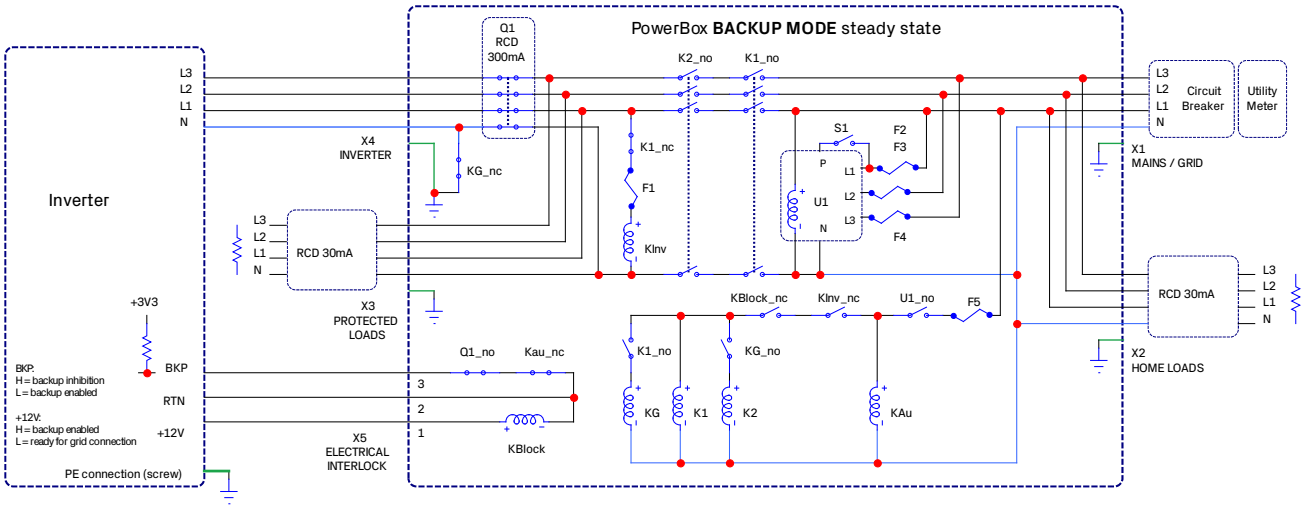
- The inverter is connected in on-grid mode and injects the available power.
- The inverter does not prevent the closing of PowerBOX contactors $K1$ and $K2$ (via the K_{BLOCK} relay).
- PowerBOX contactors $K1$ and $K2$ are closed.
- PowerBOX does not send a backup command to the inverter.
- PowerBOX keeps the ground and the neutral of the backup network separated (contactor KG).

5.3.12 Transition from on-grid to backup mode

When the grid supply moves outside the selected standard limits:

- The inverter disconnects.
- The PowerBOX opens contactors $K1$ and $K2$.
- The PowerBOX issues a backup command to the inverter.
- The inverter secures PowerBOX contactors $K1$ and $K2$ via the K_{BLOCK} relay.
- The PowerBOX grounds the neutral of the backup network through contactor KG.
- The inverter activates backup mode.

5.3.13 Backup mode (steady state)



During backup mode operation:

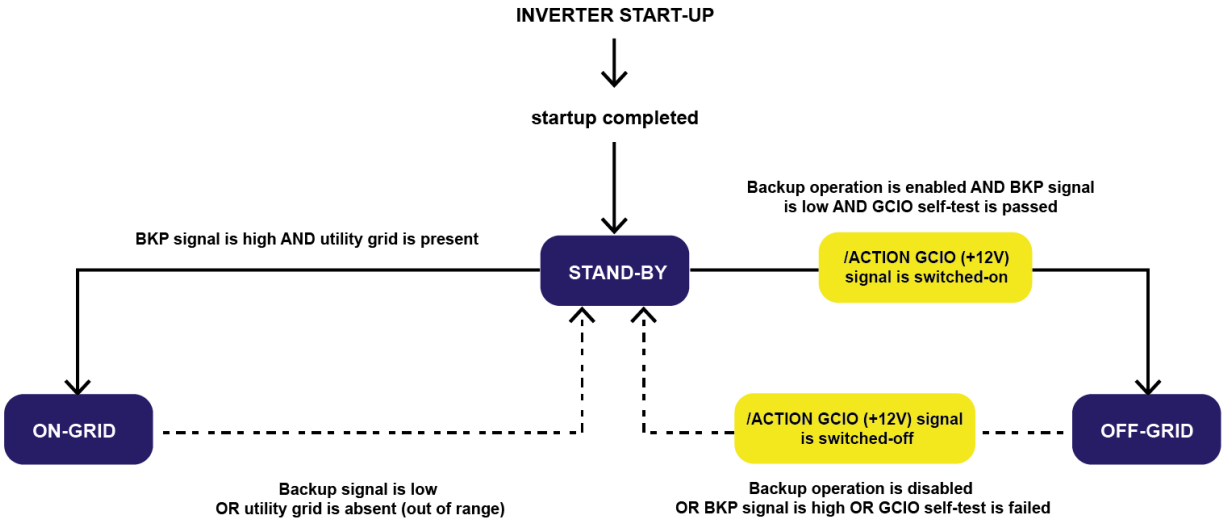
- The inverter supplies the protected loads in stand-alone mode.
- Contactors $K1$ and $K2$ are held open by the inverter via the K_{BLOCK} relay.
- The neutral is grounded through contactor KG, ensuring the proper functionality of the 300mA RCD (integrated in the PowerBOX) and the external RCD (downstream of X3).
- An additional safety interlock on K1 and K2 is provided by relay K_{INV}, which prevents reclosing if voltage is detected on the backup supply.

5.3.14 Transition from backup mode to on-grid

When the grid supply returns within standard limits:

- U1 deactivates the backup request signal.
- The inverter powers down and disconnects from the backup network.
- Relay K_{INV} disengages the safety interlock on $K1$ and $K2$.
- The inverter releases the primary block on the K_{BLOCK} contactors.
- Relay KG disconnects the neutral from ground.
- Contactors $K1$ and $K2$ close.
- All loads are now supplied by the grid.
- The inverter is free to reconnect in accordance with the timing and conditions set by the grid standard.

5.3.15 Flow chart



6 Operation

6.1 Enabling the backup mode

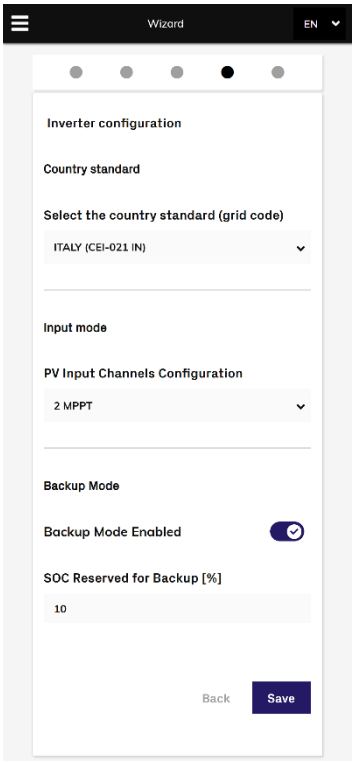
The backup mode must also be enabled at the software level via the internal Web UI.

To access the Web UI, refer to the PowerUNO product manual. There are two ways to enable the backup mode:

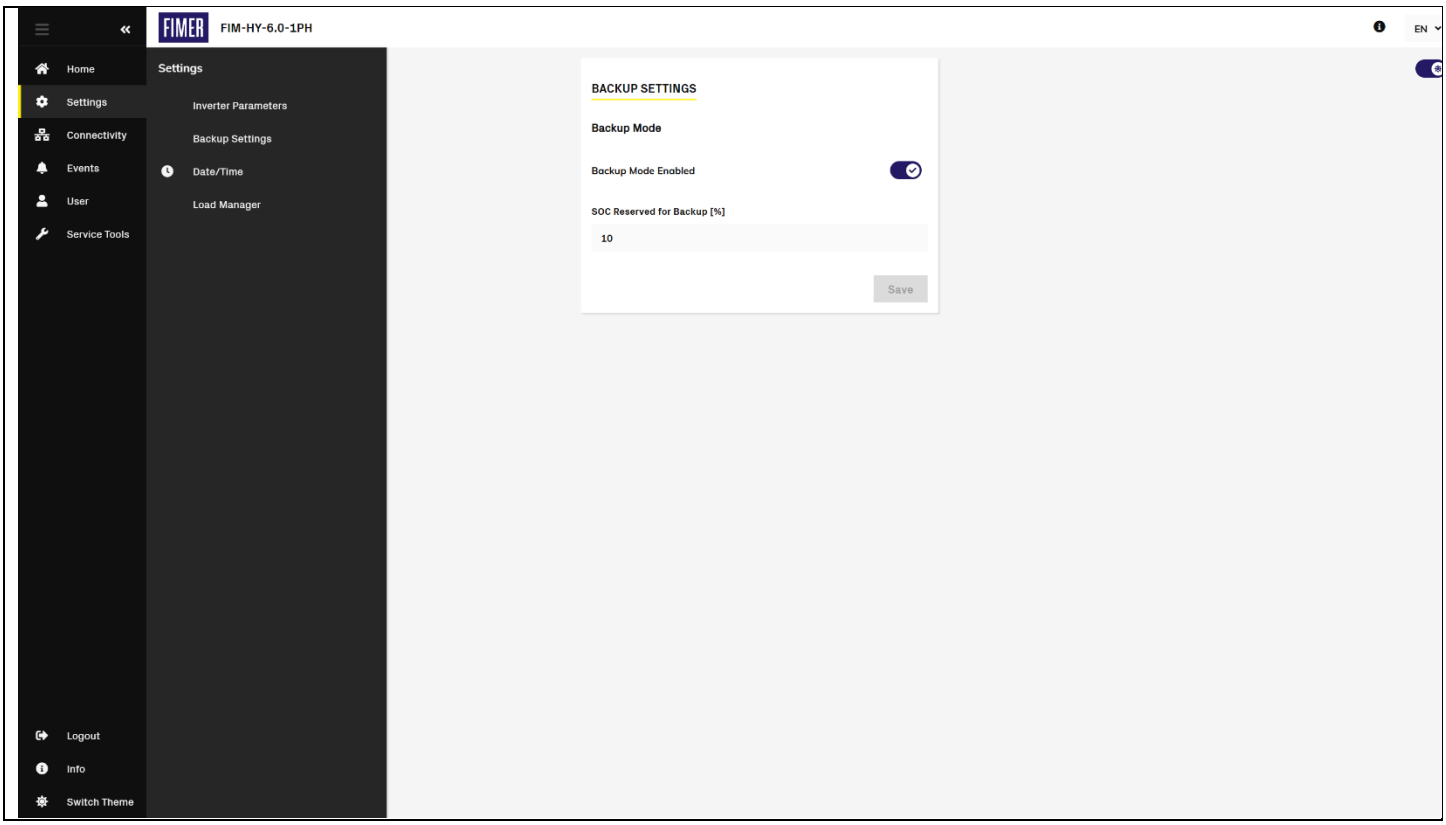
- During the commissioning wizard
- After the commissioning wizard

6.1.1 Enabling the backup mode during the commissioning wizard

Enable the **Backup Mode Enabled** flag. If a PowerX storage system is present, you can reserve a percentage of the battery charge specifically for backup. The minimum configurable value is 10% of the system's capacity.



6.1.2 Enabling the backup mode after the commissioning wizard



Log in to the Web UI using administrator-level (**Admin**) credentials. Go to the **Settings > Backup Settings** menu and enable the **Backup Mode Enabled** flag. If a PowerX storage system is present, you can reserve a percentage of the battery charge specifically for backup. The minimum configurable value is 10% of the system's capacity.

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For more information please contact your local MA Solar Italy representative or visit:

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