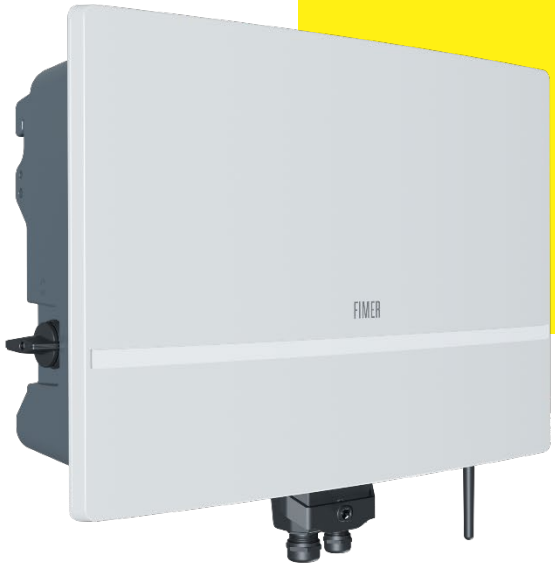
FIMER




# Solar Inverter

# PowerTRIO

## FIM-HY-4.0/5.0/6.0/7.5/8.0/8.5/10.0-SE-A-3PH

# Product Manual

Rev. A – 20/05/2025

⚠ **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 inverter 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. This manual covers the inverter 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 product 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 https://www.fimer.com.

The products are designed to be connected and communicate information and data via a network interface. It is the user's sole responsibility to provide and continuously ensure a secure connection between the product and the user's network or any other network (as the case may be). The user shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. MA Solar Italy and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information. 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. In particular, 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.

EN

# Summary

# 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 inverter and perform maintenance operations on the inverter. 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 |

# 1.3 Installation and maintenance safety

## 1.3.1 General safety information

⚠ **WARNING** - Do not do work on the photovoltaic generator, on the inverter, on its input or output cables, when the inverter is connected to an electrical power system, or to the photovoltaic generator. Before perform any maintenance operation on the inverter, follow this step:
- Prepare the work: Carry out an on-site Risk Assessment or Job Hazard Analysis (Check for proper tools and PPE for the job; Engage the person responsible for electrical equipment or system to review single-line, schematics, switching plans; Define the appropriate work methods and initiate the permit to work process).
- Clearly identify the work location and equipment's.
- Disconnect all sources and secure against reconnection by means of the "Lockout/Tagout" procedure to ensure that any conductor cannot accidentally become live.
- Verify the absence of operating voltage (This must be carried out by means of a proper test instrument).
- Complete the permit to work and "Walk the Permit".

⚠ **WARNING** - Refer to "**Inverter total de-energization and Isolation**" paragraph on this manual to know all detailed necessary steps to safely operate on the inverter.

⚠ **WARNING** - The inverter front cover can be removed from authorized service personnel only qualified by MA Solar Italy (the users are not authorized to remove inverter front cover).

**FORBIDDEN** - Do not proceed with installation if the integrity of the equipment is compromised. Do not use the equipment if you find any operating anomalies.

**FORBIDDEN** - Avoid temporary repairs. All repairs should be carried out using only genuine spare parts, which must be installed in accordance with their intended use.

**FORBIDDEN** - The labels affixed on the equipment must strictly NOT be removed, damaged, defaced, hidden, etc. The technical data provided in this manual does not in any case replace that shown on the labels affixed on the equipment.

## 1.3.2 Environmental conditions and risks

⚠ **ATTENTION** - This device can be installed outdoors, but only in environmental conditions that do not prevent its regular operation. These conditions are listed in the technical data and in the installation chapter.

⚠ **ATTENTION** - Do not remove the connection boxes (AC and signals) of the inverter when it is raining, or when sand or dust can blow into the unit. Infiltration of water or sand into the inverter can cause damage of the unit. It is of paramount importance to evaluate the weather conditions in the risk assessment prior any intervention on the equipment. Any intervention on the inverter can be carried out only in case of dry environment. Don't proceed in case of rain (even light) or high humidity.

⚠ **ATTENTION** - This device is not designed to operate in environments that are particularly inflammable or explosive.

⚠ **ATTENTION** - In the event of fire, use CO2 extinguishers and auto-extraction systems to extinguish the fire in closed environments.

⚠ **ATTENTION** - The installer or maintenance technician must always pay attention to the work environment, ensuring that it is well-lit and there are enough escape routes.

## 1.3.3 Electrical and thermal safety

⚠ **WARNING** - Obey these instructions to prevent injury or death or damage to the equipment. If you are not a qualified electrician, do not perform any electrical installation or maintenance work.

⚠ **WARNING** - Obey all installation safety standards. This requires, among other things, the use of personal protection equipment (PPE) such as arc-proof clothing, arc-proof masks, protective footwear, insulating and protective gloves, eye protection and hearing protection. High power inverter installations have high fault currents.

⚠ **WARNING** - Before you operate on the inverter, isolate the AC line cables from the electrical power system with the AC disconnect switch of the power system transformer (downstream of inverter). Also, isolate the inverter from the photovoltaic generator with the DC disconnect switch of the generator or by other means (upstream of inverter). The internal AC disconnect switch (if present) do not isolate the AC output cables and terminals of the inverter from the electrical power system. The internal DC disconnect switches (if present) do not completely isolate the DC input cables or terminals from the DC voltage supplied by the photovoltaic generator. Refer to "**Inverter total de-energization and Isolation**" paragraph on this manual for further details.

⚠ **WARNING** - Do not work on the communication and control signal cables when power is applied to the inverter or to the external control circuits.

⚠ **WARNING** - Do not perform insulation or voltage withstand tests on the inverter with exception for those indicated in this document.

⚠ **WARNING** - MA Solar Italy inverters must be earthed via the connection points marked with the protective earth symbol ⏚ and using a cable with an appropriate conductor cross-section for the maximum ground fault current that the generating system might experience.

⚠ **HOT SURFACE** - When the device has just been switched off, it may have hot parts as a result of overheating of the heated internal components (e.g.: transformers, accumulators, coils, etc.). Please pay attention to this.

## 1.4 Residual risks

⚠ **ATTENTION** - Despite the warnings and safety systems, there are still some residual risks that cannot be eliminated.

These risks are listed in the following table with some suggestions to prevent them:

| Risk analysis and description | Suggested remedy |
|---|---|
| Noise pollution due to installation in unsuitable environments or where individuals routinely work and/or animals' dwell most of the time. | Reassess the environment or the place of installation. |
| Adverse external weather conditions, water seepage, low temperatures, high humidity, etc. | Maintain ambient conditions suitable for the system. |
| Overheating of components (transformers, accumulators, coils, etc.) that could cause burns. Restricted cooling openings or cooling systems of the equipment. | Use suitable PPE. Wait for the parts to cool down before opening the inverter. Do not restrict cooling openings or cooling systems of the equipment (e.g. heatsinks). |
| Inadequate cleaning that could compromises cooling and does not allow the reading of safety labels. | Clean the equipment, labels and work environment. |
| Stored energy in components that could generate hazardous discharges. | Ensure that the components have discharged their energy before working on them. |
| Inadequate training of staff. | Ask for supplementary courses. |
| Installation of the equipment and/or mounting of the equipment components temporarily incomplete. | Prevent unauthorized access to the installation area. Use enough employees and PPE. |
| Accidental disconnections of the quick-fit connectors, with the equipment in operation, may generate electrical arcs. | Be careful about properly routing the DC inverter cables. |
| Mismatched brand of quick-fit connectors (if present) that may void the warranty and could cause potential damage. | Use the same brand for the counterparts of the quick-fit connectors installed on the inverter. |

# 2 Introduction and general information

## 2.1 Warranty and supply conditions

The warranty conditions (available on the official MA Solar Italy website) are considered 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 specific 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 https://www.fimer.com/.

**NOTE** - Some component's 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 for the described tasks 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 equipment installation before it is connected to the electrical grid.

⚠ **ATTENTION** - 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 provided by their employer.

**FORBIDDEN** - Inverter operation and maintenance performed by personnel that is 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 inverter 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 photovoltaic modules which have ground isolated input poles.
- Only a photovoltaic generator can be connected to the photovoltaic input of the inverter.
- Only MA Solar Italy batteries (PowerX) can be connected to the battery input of the inverter.
- This equipment can be only connected to the electricity grid in countries for which it has been certified/approved.
- The inverter cannot be connected to the DC side in parallel to other inverters.
- 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 the equipment in environments subject to specific flammability risks or in adverse or non-permitted 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 fail 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 inverter.

**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 Characteristics

## 3.1 General conditions

A description of the equipment characteristics is provided to identify its main components and specify the technical terminology used in the manual.

This chapter contains information about the models, details of the equipment, characteristics and technical data, overall dimensions and equipment identification.

⚠ **ATTENTION** - The customer/Installer takes full responsibility if, when reading this manual, the chronological order of its presentation provided is not observed. All information is provided considering occasional inclusion of information in previous chapters.

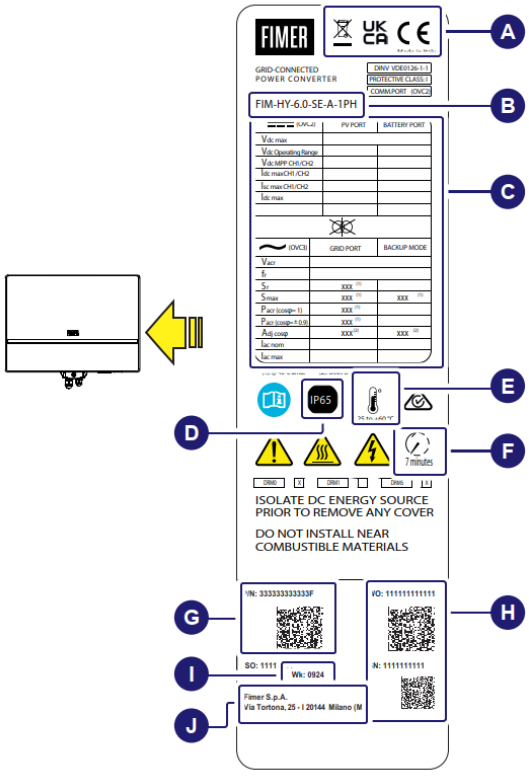
## 3.2 Identification of equipment and manufacturer

**FORBIDDEN** - The labels affixed to the equipment must NOT be removed, damaged, stained, hidden, etc., for any reason whatsoever. Do NOT hide the labels by foreign objects and parts (rags, boxes, equipment, etc.); they must be regularly cleaned and always kept in sight.

**NOTE** - The "Technical data" provided in this manual does not substitute the data supplied on the labels affixed to the equipment.

**NOTE** - The labels shown below have to be intended as example only.

### 3.2.1 Regulatory and identification Label

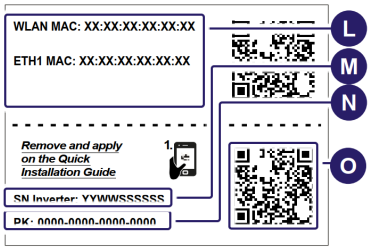



| | |
|---|---|
| **A** | Certification marks |
| **B** | Inverter model |
| **C** | Main technical data |
| **D** | Degrees of protection provided by enclosures (IP Code) |
| **E** | Operating temperature range |
| **F** | Discharge time |
| **G** | Inverter Part Number |
| **H** | YY = Year of manufacture<br>WW = Week of manufacture<br>SSSSSS = Progressive number<br>- Inverter access point SSID: Fimer-YYWWSSSSSS<br>- “Host Name”: http://Fimer-YYWWSSSSSS.local<br>- It is required to register the inverter in Aurora Vision. |
| **I** | Production date: WWYY where: WW (week) YY (year) |
| **J** | Manufacturer |

### 3.2.2 Communication Identification label

The “communication identification label” is divided in two separate parts by a dashed line; take the bottom part and apply it on the plant documentation.

**NOTE** - It’s recommended to create a plant map and apply the “communication identification label” on it.




| | |
|---|---|
| **L** | **WLAN (Wi-Fi) MAC address**, and<br>**ETH1 (Ethernet) MAC address** |
| **M** | **Inverter Serial Number** (YYWWSSSSSS):<br>YY = Manufacturing Year<br>WW = Manufacturing week<br>SSSSSS = Progressive number |
| **N** | **Product Key**:<br>To be used as Wi-Fi access point password, or to be used to access to the Web UI as username and password in case of lost credentials, and to commission the inverter using the Web UI. |
| **O** | **QR Code**:<br>To be used to commission inverter using Fimer internal WEB UI. |

## 3.3 Models and range of equipment

**NOTE** - The choice of the inverter model must be made by a qualified technician who knows about the installation conditions, the devices that will be installed in addition to the inverter and possible integration with an existing system.

| Inverter model | |
|---|---|
| **FIM-HY-4.0-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 4 kW |
| **FIM-HY-5.0-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 5 kW |
| **FIM-HY-6.0-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 6 kW |
| **FIM-HY-7.5-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 7.5 kW |
| **FIM-HY-8.0-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 8.0 kW |
| **FIM-HY-8.5-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 8.5 kW |
| **FIM-HY-10.0-SE-A-3PH** | PowerTRIO - Hybrid string inverter - 3 phase - 10.0 kW |

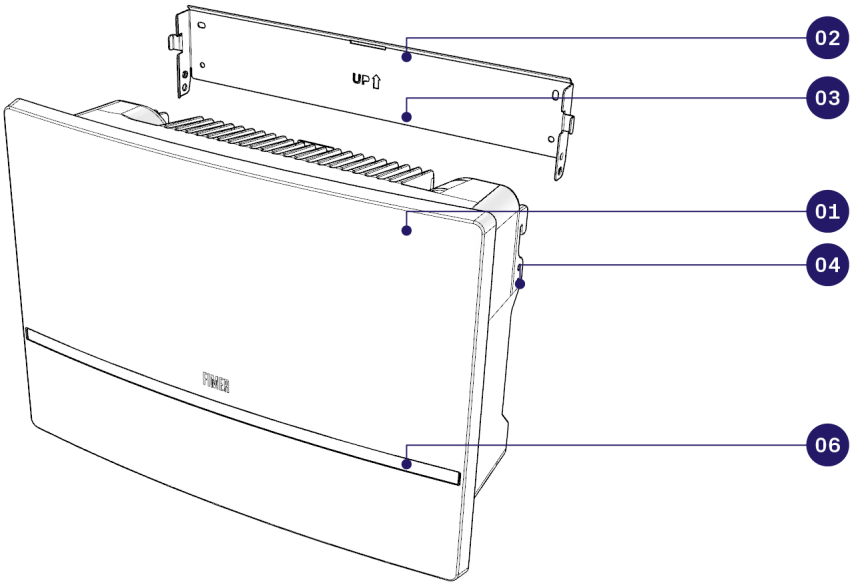
**Main features:**

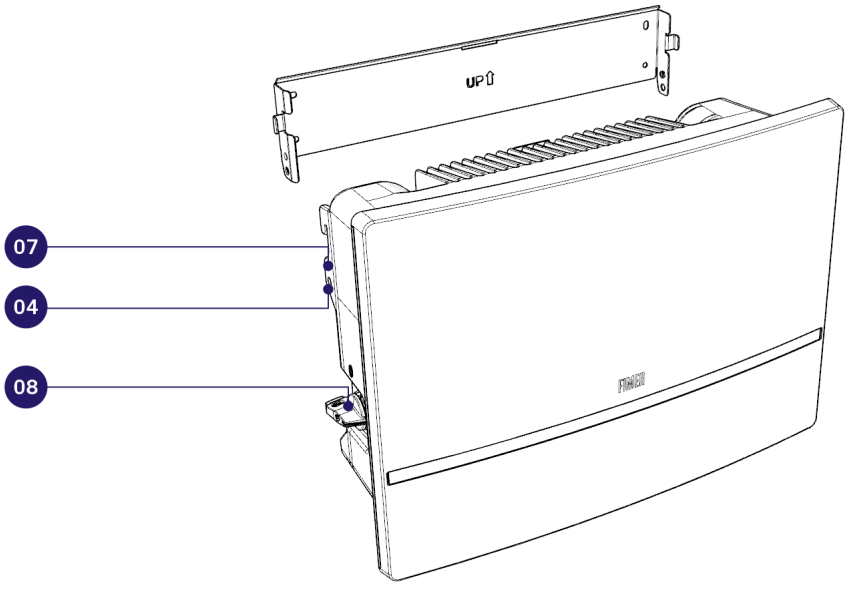
- Battery ready inverter, DC or AC coupled
- Full power 100% unbalanced backup
- Embedded Wi-Fi, ethernet and USB
- Plug & play connections
- Integrated spirit level on the wall bracket
- Patented AFCI

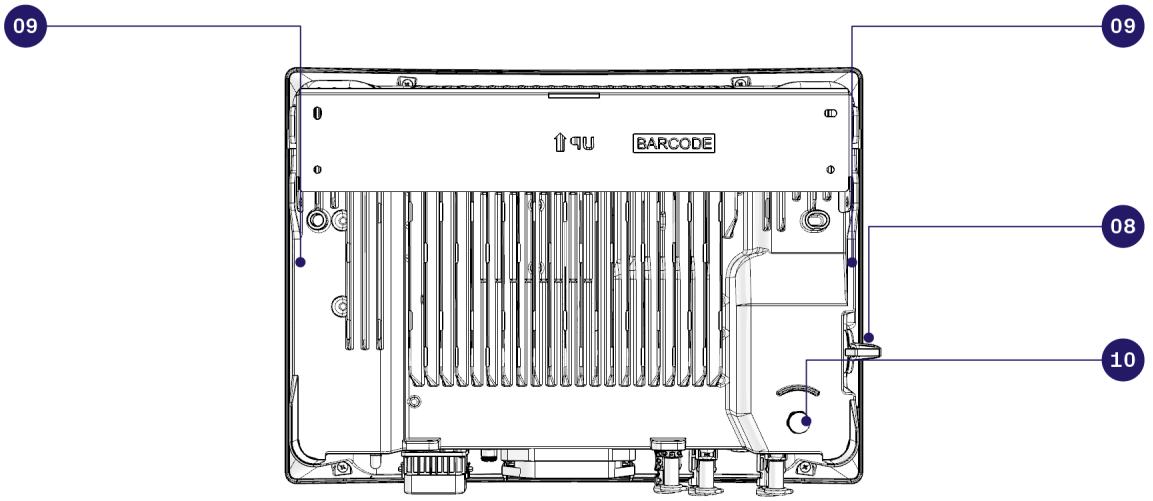
## 3.4 Component reference numbers

| | |
|---|---|
| **01** | Inverter |
| **02** | Spirit level |
| **03** | Mounting bracket |
| **04** | Side bracket screws (M5) |
| **05** | Protective earth (PE) external connection point |
| **06** | LED strip |
| **07** | Padlock hole |
| **08** | DC disconnect switch |
| **09** | Handles |
| **10** | Anti-condensation valve |
| **11** | Quick fit input connectors MPPT 1 |
| **12** | Quick fit input connectors MPPT 2 |
| **13** | Quick fit battery power connectors |
| **14** | Ethernet port |
| **15** | USB port |
| **16** | Smart plug port |
| **17** | Coin cell |
| **18** | Wi-Fi/AFCI button |
| **19** | BMS connector |
| **20** | Wi-Fi antenna connector |
| **21/22** | AC OUTPUT (Grid and Backup) |
| **23** | Battery MC4-Evo stor connectors (supplied with optional PowerX wiring kit) |
| **24** | Hypercap (supplied) |
| **25** | Connectivity cable gland M25 |
| **26** | Connectivity cable gland M20 |
| **27** | Smart plug connector, Hypercap T. Block (supplied) |
| **28** | BMS cable (supplied with optional PowerX wiring kit) |
| **29** | AC Grid & backup quick fit connector (supplied) |
| **30** | Wi-Fi antenna (supplied) |

### 3.4.1 Inverter external view

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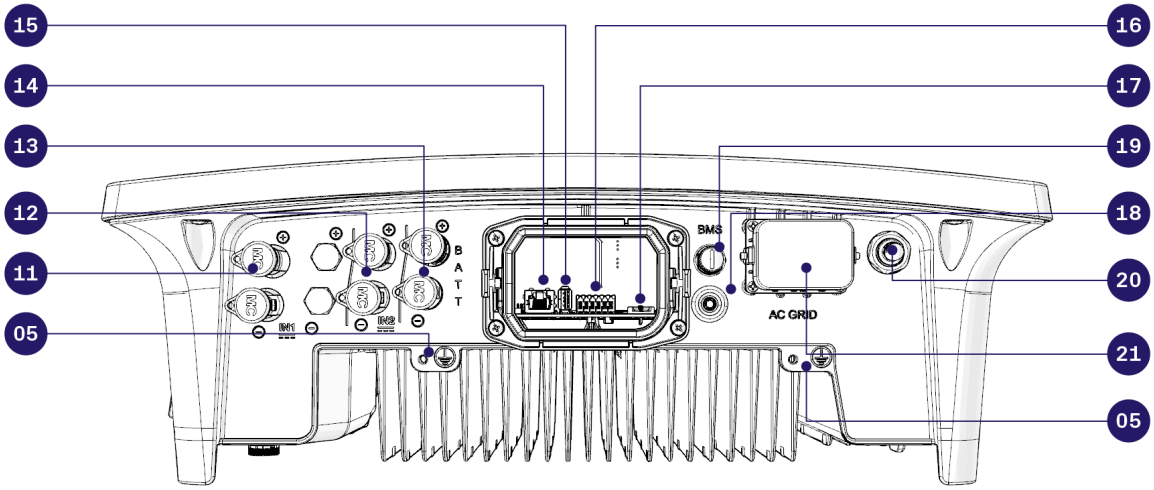
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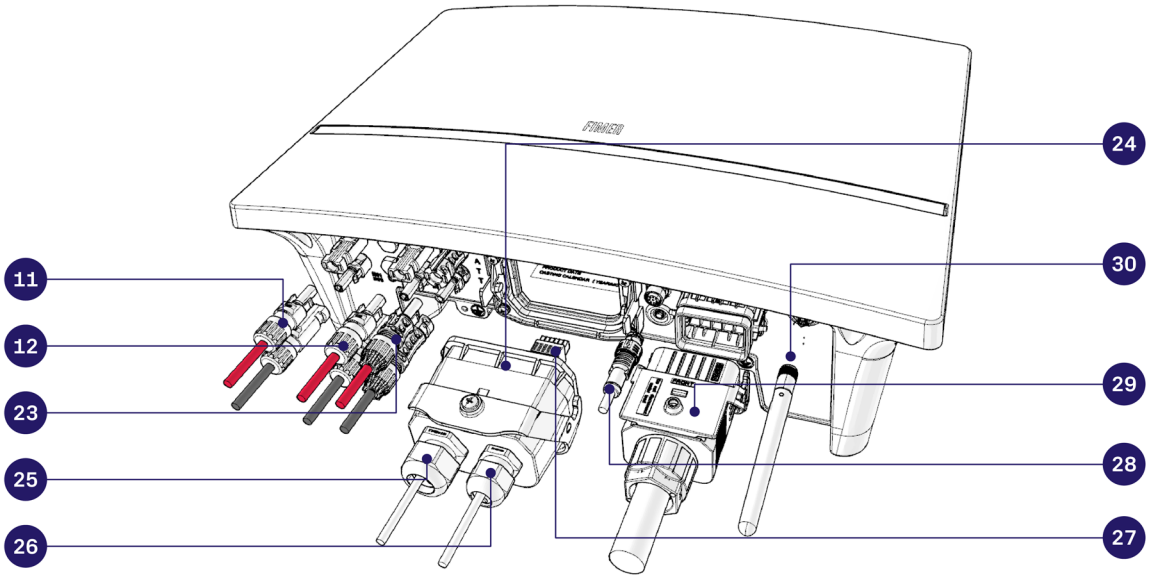
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# 3.5 Technical data

## 3.5.1 Technical data table

| Technical data and types | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inverter** | **FIM-HY-4.0 SE-A-3PH** | **FIM-HY-5.0 SE-A-3PH** | **FIM-HY-6.0 SE-A-3PH** | **FIM-HY-7.5 SE-A-3PH** | **FIM-HY-8.0 SE-A-3PH** | **FIM-HY-8.5 SE-A-3PH** | **FIM-HY-10.0 SE-A-3PH** |
| **Input side** | | | | | | | |
| Absolute maximum DC voltage ($Vmax, abs$) | 1000 V | | | | | | |
| Start-up DC voltage ($V_{start}$) | 200 V adj. 150 ... 500 V | 200 V adj. 170 ... 500 V | 200 V adj. 200 ... 500 V | 215 V adj. 215 ... 500 V | 215 V adj. 215 ... 500 V | 215 V adj. 215 ... 500 V | 215 V adj. 215 ... 500 V |
| Operating DC voltage range ($V_{dcmin}$ ... $V_{dcmax}$) | 0.7 × $V_{start}$...975V (min 110 V) | 0.7 x $V_{start}$...975V (min 130 V) | 0.7 × $V_{start}$...975V (min 145 V) | 0.7 × $V_{start}$...975V (min 155 V) | 0.7 × $V_{start}$...975V (min 155 V) | 0.7 × $V_{start}$...975V (min 155 V) | 0.7 × $V_{start}$...975V (min 155 V) |
| Rated DC voltage ($V_{dcr}$) | 625 V | | | | | | |
| Rated DC power ($P_{dcr}$) | 4128 W | 5176 W | 6205 W | 7732 W | 8247 W | 8763 W | 10256 W |
| Suggested maximum DC power [1] | 6000 W | 7500 W | 9000 W | 11250 W | 12000 W | 12750 W | 12750 W |
| DC/AC ratio | Up to 150%, according to location | | | | | | |
| Number of independent MPPT | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Maximum DC power for each MPPT [2] ($P_{MPPTmax}$) | 5625 W Linear derating 800≤$V_{MPPT}$≤950V | 3882 W Linear derating 800≤$V_{MPPT}$≤950V | 4654 W Linear derating 800≤$V_{MPPT}$≤950V | 5799 W Linear derating 850≤$V_{MPPT}$≤975V | 6186 W Linear derating 850≤$V_{MPPT}$≤975V | 6572 W Linear derating 850≤$V_{MPPT}$≤975V | 6572 W Linear derating 850≤$V_{MPPT}$≤975V |
| DC voltage range of MPPT ($V_{MPPT\ min}$ ... $V_{MPPT\ max}$) at $P_{acr}$ | 265V...800V | 170V...800V | 200V...800V | 250V...850V | 265V...850V | 285V...850V | 330V...850V |
| Maximum DC current ($I_{dc\ max}$) for each MPPT ($I_{MPPT\ max}$) | 16 A (MPPT1) | 32A / 16 A – 16 A (MPPT1 – MPPT2) | 32A / 16 A – 16 A (MPPT1 – MPPT2) | 32A / 16 A – 16 A (MPPT1 – MPPT2) | 32A / 16 A – 16 A (MPPT1 – MPPT2) | 32A / 16 A – 16 A (MPPT1 – MPPT2) | 32A / 16 A – 16 A (MPPT1 – MPPT2) |
| Maximum short circuit current per MPPT | 20 A | | | | | | |
| Number of DC inputs pairs for each | 1 (MPPT1) | 1 – 1 (MPPT1 – MPPT2) | 1 – 1 (MPPT1 – MPPT2) | 1 – 1 (MPPT1 – MPPT2) | 1 – 1 (MPPT1 – MPPT2) | 1 – 1 (MPPT1 – MPPT2) | 1 – 1 (MPPT1 – MPPT2) |
| DC connection type | Quick fit PV connector [3] | | | | | | |
| **Input protection** | | | | | | | |
| Reverse polarity protection | Yes, from limited current source | | | | | | |
| Over voltage protection for each MPPT – varistor | Yes | | | | | | |
| Photovoltaic array isolation control | According to local standard | | | | | | |
| DC switch rating for each MPPT | 25 A / 700 V - 12 A / 1000 V | | | | | | |
| **Battery input/output** | | | | | | | |
| Operating DC voltage range ($Udmin$ ... $UdM$) | 600 V ... 980 V | 600 V ... 980 V | 600 V ... 980 V | 600 V ... 980 V | 600 V ... 980 V | 600 V ... 980 V | 600 V ... 980 V |
| Nominal operating DC voltage range ($UdNmin$ ... $UdNM$) | 620 V | | | | | | |
| Nominal operating DC voltage ($UN$) | 605 V ... 635 V | | | | | | |
| Withstand voltage ($UM$) | 980 V | | | | | | |
| PowerX max. units | 2 | | | | | | |
| Max operating current [4] | 17 A | | | | | | |
| Maximum charge power from DC side [5] | 5625 W | 7764 W | 9308 W | 10256 W | 10256 W | 10256 W | 10256 W |
| Maximum discharge power | 4000 W | 5000 W | 6000 W | 7500 W | 8000 W | 8500 W | 10000 W |

| Technical data and types | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inverter** | **FIM-HY-4.0 SE-A-3PH** | **FIM-HY-5.0 SE-A-3PH** | **FIM-HY-6.0 SE-A-3PH** | **FIM-HY-7.5 SE-A-3PH** | **FIM-HY-8.0 SE-A-3PH** | **FIM-HY-8.5 SE-A-3PH** | **FIM-HY-10.0 SE-A-3PH** |
| **AC Output** | | | | | | | |
| AC Grid connection type | Three-phase | | | | | | |
| Rated AC power ($Pacr$ @cosϕ=1) | 4000 W | 5000 W | 6000 W | 7500 W | 8000 W | 8500 W | 10000 W |
| Maximum AC output power ($Pacmax$ @cosϕ=1) | 4000 W | 5000 W | 6000 W | 7500 W | 8000 W | 8500 W | 10000 W |
| Maximum apparent power (Smax) | 4000 VA | 5000 VA | 6000 VA | 7500 VA | 8000 VA | 8500 VA | 10000 VA |
| Rated AC grid voltage ($Vac,r$) | 380 V / 400 V | | | | | | |
| AC voltage range [6] | 320 V ... 480 V | | | | | | |
| Rated Output Current at Vac 400 V ($Iac,r$) | 5.8 A | 7.2 A | 8.7 A | 10.9 A | 11.6 A | 12.3 A | 14.5 A |
| Maximum AC current ($Iac\ max$) | 6.1 A | 7.6 A | 9.1 A | 11.4 A | 12.2 A | 12.9 A | 15.2 A |
| Contributory fault current | 6.1 A | 7.6 A | 9.1 A | 11.4 A | 12.2 A | 12.9 A | 15.2 A |
| Rated frequency ($fr$) | 50 Hz / 60 Hz | | | | | | |
| Frequency range [7] ($fmin...fmax$) | 45 ... 55 Hz / 55 ... 65 Hz | | | | | | |
| Nominal power factor and adj. range | > 0.995, adj. ± 0.8 - 1 (over/under exited) | | | | | | |
| Total current harmonic distortion | < 3% of $I_{ac,max}$ | | | | | | |
| AC connection type | Female panel connector | | | | | | |
| AC Output short time withstand current | 460 A, 10 ms ($I_{cw}$) – 1083 A ($I_{pk}$) | | | | | | |
| **Grid connected output protection** | | | | | | | |
| Anti-islanding protection | According to local standard | | | | | | |
| Maximum external AC overcurrent protection | 10 A | 10 A | 10.0 A | 16.0 A | 16.0 A | 16.0 A | 20.0 A |
| Output overvoltage protection - varistor | 4 (L1-PE, L2-PE, L3-PE, N-PE), TYPE II protection class [8] | | | | | | |
| Efficiency | | | | | | | |
| Maximum efficiency | 97.7 % | 97.9 % | 97.9 % | 97.9 % | 97.9 % | 97.9 % | 98.3 % |
| Euro efficiency | 95.9 % | 96.8 % | 97.0 % | 97.3 % | 97.3 % | 97.4 % | 97.9 % |
| MPPT efficiency | 99.9 % | | | | | | |
| **Backup mode [9]** | | | | | | | |
| Voltage waveform | S (sine) | | | | | | |
| Dynamic output performance | 1 (linear load), 2 (non-linear load) | | | | | | |
| Maximum apparent 3-phase power ($Smax$) | 4000 VA | 5000 VA | 6000 VA | 7500 VA | 8000 VA | 8500 VA | 10000 VA |
| Maximum apparent 1-phase power ($Smax$) | 1333 VA | 1667 VA | 2000 VA | 2500 VA | 2667 VA | 2833 VA | 3333 VA |
| Rated AC grid Voltage ($Vacr$) | 380 V / 400 V | | | | | | |
| AC Voltage range | 320 V ... 480 V | | | | | | |
| Maximum AC current ($Iac\ max$) | 6.1 A | 7.6 A | 9.1 A | 11.4 A | 12.2 A | 12.9 A | 15.2 A |
| Rated output frequency ($fr$) | 50 Hz / 60 Hz | | | | | | |
| Frequency range ($fmin...fmax$) | 45 ... 55 Hz / 55 ... 65 Hz | | | | | | |
| Maximum neutral point compensation current ($I_{NP}max$) | 2.5 A rms | | | | | | |

| Technical data and types | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inverter** | **FIM-HY-4.0 SE-A-3PH** | **FIM-HY-5.0 SE-A-3PH** | **FIM-HY-6.0 SE-A-3PH** | **FIM-HY-7.5 SE-A-3PH** | **FIM-HY-8.0 SE-A-3PH** | **FIM-HY-8.5 SE-A-3PH** | **FIM-HY-10.0 SE-A-3PH** |
| **Embedded communication** | | | | | | | |
| Embedded physical interface | Wi-Fi [10], Ethernet, RS-485 | | | | | | |
| Embedded communication protocols | Modbus TCP(SunSpec) | | | | | | |
| Datalogger data retention | 30 days | | | | | | |
| Remote monitoring | Energy Viewer (mobile APP), Energy Viewer Web, Plant Portfolio Manager | | | | | | |
| Local monitoring | Energy Viewer (mobile APP) / Internal web server (WEB UI) | | | | | | |
| Commissioning (Energy policy included) | Internal web server (WEB UI) | | | | | | |
| **Environmental** | | | | | | | |
| Ambient temperature range | -25...+60°C with derating above 50°C | -25...+60°C with derating above 50°C | -25...+60°C with derating above 45°C | -25...+60°C with derating above 45°C | -25...+60°C with derating above 45°C | -25...+60°C with derating above 45°C | -25...+60°C with derating above 40°C |
| Wet locations | Yes | | | | | | |
| Relative humidity | 4 ... 100 % condensing | | | | | | |
| Classification of the degree of environmental pollution by external environment | PD3 | | | | | | |
| Acoustic noise emission level (at rated DC voltage $V_{dcr}$) | < 40 dBA @ 1 m | | | | | | |
| Acoustic noise emission level (worst case) | < 50 dBA @ 1 m | | | | | | |
| Maximum operating altitude | 3000 m (9842 ft) with derating above 2000 m (6561 ft) | | | | | | |
| Ambient storage/transport temperature | -40 °C ... +85 °C | | | | | | |
| Humidity storage/transport | 4 % ÷ 100 % | | | | | | |
| Environmental classification | 4K6 (IEC 62477-1:2022) / 4K26 (IEC 60721-3-4:2019) | | | | | | |
| Humidity skin condition | Dry | | | | | | |
| Vibrations | 4M1 | | | | | | |
| Chemically active substances | 4C2 | | | | | | |
| Mechanically active substances | 4S2 | | | | | | |
| **Physical** | | | | | | | |
| Environmental protection rating | IP65 | | | | | | |
| Cooling | Natural | | | | | | |
| Dimension (H x W x D) | 373 mm x 518 mm x 183 mm (see paragraph 3.5.5 for further details) | | | | | | |
| Weight | 18 kg | | | | | | |
| Mounting system | Wall mounting bracket | | | | | | |
| **Safety** | | | | | | | |
| Isolation level | Transformer less | | | | | | |
| Overvoltage category according IEC 62109-1 | OVC III (AC Port), OVC II (PV port and Battery port) | | | | | | |
| Marking | CE, RCM | | | | | | |
| Safety and EMC standards | IEC/EN 62109-1, IEC/EN 62109-2, IEC 62477-1, EN 61000-6-2, EN 61000-6-3, EN 61000-3-2, EN 61000-3-3, EN 61000-3-11, EN61000-3-12 | | | | | | |
| Grid standards (check your sales channel for availability) [11] | CEI 0-16, CEI 0-21, DIN V VDE V 0126-1-1, VDE-AR-N 4105, G83/2, G59/3, G98-1, G99-1, RD 413, ITC-BT-40, AS/NZS 4777.2, C10/11, IEC 61727, IEC 62116 | | | | | | |
| **Other features** | | | | | | | |
| Load manager | Yes, with integrated relay | | | | | | |
| AC backup, off grid | Yes | | | | | | |
| Battery charge from AC | Yes, it can be enabled | | | | | | |
| AC-coupled mode | Yes, settable during commissioning | | | | | | |

1) Value subject to derating; refer to the product documentation for further details.
2) Extra power available in conjunction with Battery ESS

3) Refer to the document “String inverter – Product Manual appendix” available at www.fimer.com/solarinverters to know the brand and the model of the quick fit connector
4) The maximum operating current applies to both the charging and discharging cases
5) Also limited by the capability of the installed Battery ESS
6) The AC voltage range may vary depending on specific country grid standards
7) The Frequency range may vary depending on specific country grid standards
8) As per test defined in EN/IEC 61643-11
9) PowerBOX required
10) As per IEEE 802.11 b/g/n standard
11) Further grid standards will be added, please refer to Fimer Solar page for further details

**Remarks:**

- **Designed and manufactured in Italy**
- **Features not specifically listed in the present data sheet are not included in the product**

### 3.5.2 Tightening torques

| Component | Torque |
|---|---|
| AC Grid & backup quick fit connector **(29)** - cable gland | 6.5 Nm |
| Connectivity cable gland **(25)** - M25 cable gland | 7.5 Nm |
| Connectivity cable gland **(26)** - M20 cable gland | 7 Nm |
| Hypercap **(26)** locking screw | 0.55 Nm |
| AC Grid & backup quick fit connector **(29)** locking screw | 0.55 Nm |
| Side bracket screws **(04)** - M5 screws | 3.5 Nm |
| Protective earth (PE) external connection point **(05)** - M5 screw | 3.5 Nm |
| MC4 connectors counterpart; Staubli; | 3.4 ... 3.5 Nm |

### 3.5.3 Cable gland clamping range

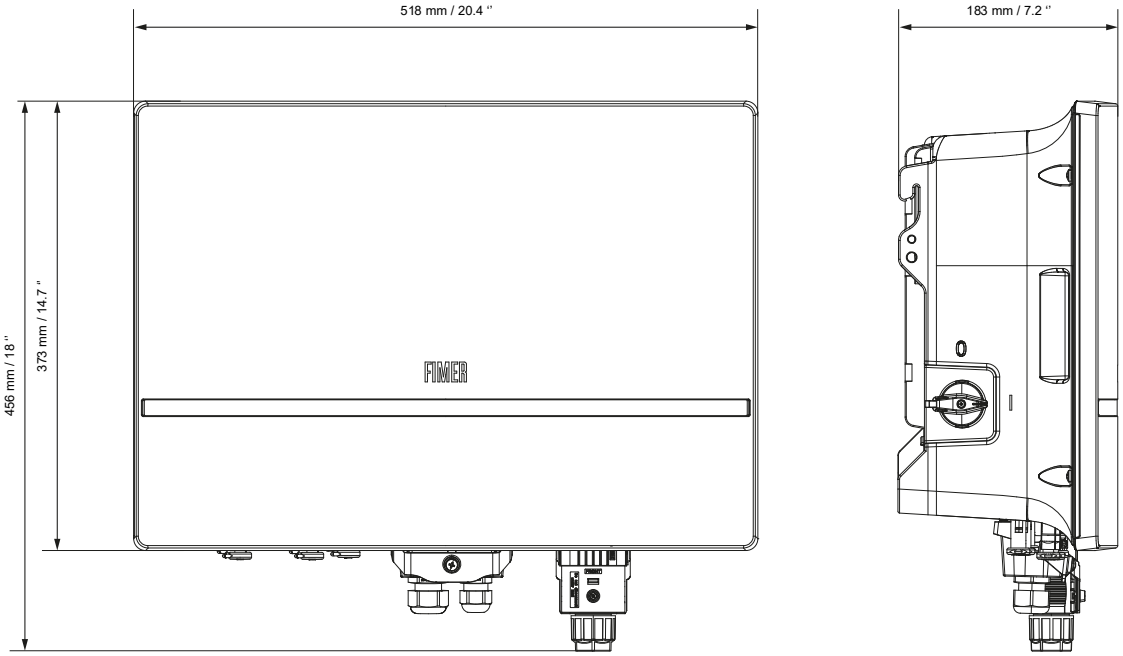
| Component | mm |
|---|---|
| AC Grid & backup quick fit connector **(29)** - cable gland | 10...21 mm |
| Connectivity cable gland **(26)** - M20 cable gland | 5...10 mm |
| Connectivity cable gland **(26)** - M20 cable gland when equipped with three-holes gasket | each hole: 3 ... 5 mm |
| Connectivity cable gland **(25)** - M25 cable gland | 10 ...17 mm |
| Connectivity cable gland **(25)** - M25 cable when gland equipped with two-holes gasket | each hole: 4 ... 6 mm |
| MC4 connectors counterpart; Male | 5 ... 6 mm |
| MC4 connectors counterpart; Female | 5 ... 6 mm |

### 3.5.4 Connectors cross section range

| Component | $mm^2$ |
|---|---|
| AC Grid & backup quick fit connector **(29)** | 4 ... 6 $mm^2$ |
| Smart plug connector **(27)** (without plastic collar ferrule) | 0.25 ...1.5 $mm^2$ |
| MC4 connectors Counterpart; Male | 4 ... 6 $mm^2$ |
| MC4 connectors counterpart; Female | 4 ... 6 $mm^2$ |

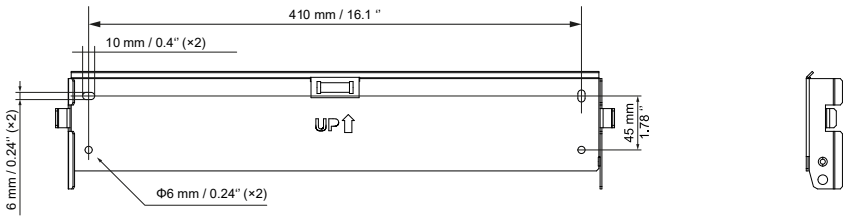
## 3.5.5 Overall dimensions of the inverter

The overall dimensions, including the mounting bracket **(05)**, are expressed in millimetres / inches.




## 3.5.6 Overall dimensions of the mounting bracket

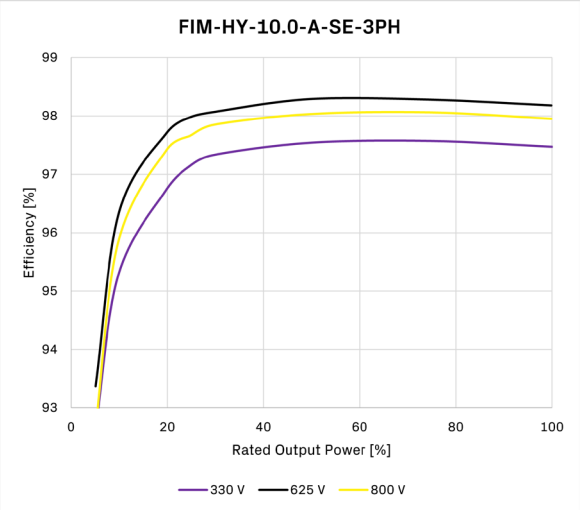
The dimensions of the wall mounting bracket **(05)** are expressed in millimetres and inches

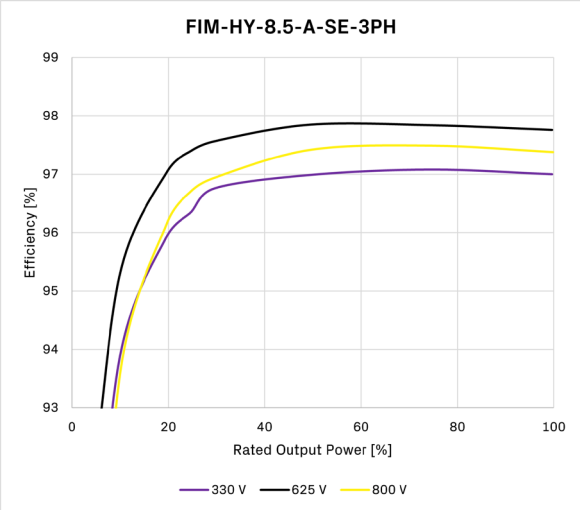


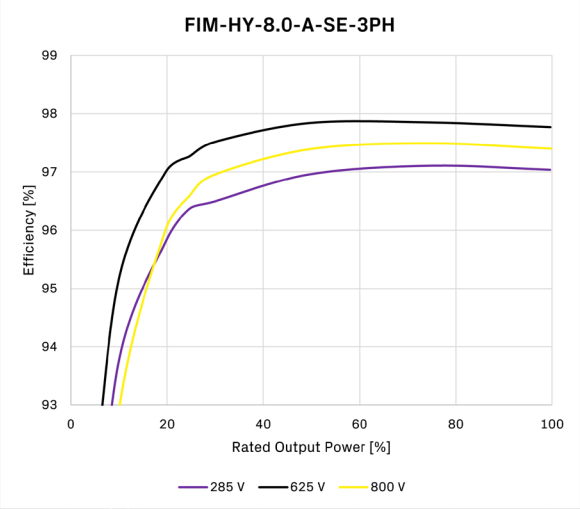
## 3.6 Efficiency curves

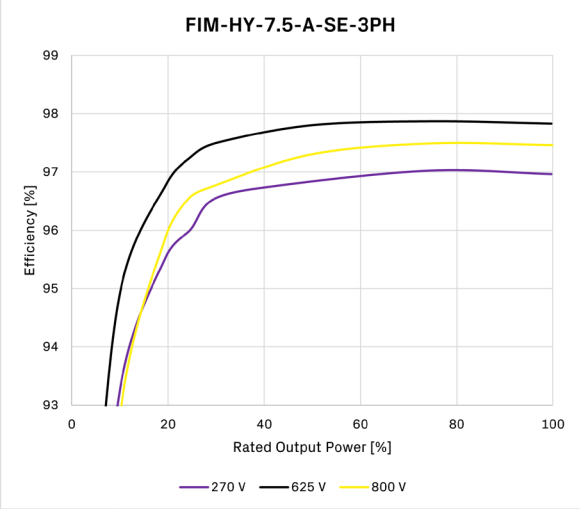
Graphs of the efficiency curves of all inverter models described in this manual are shown below.

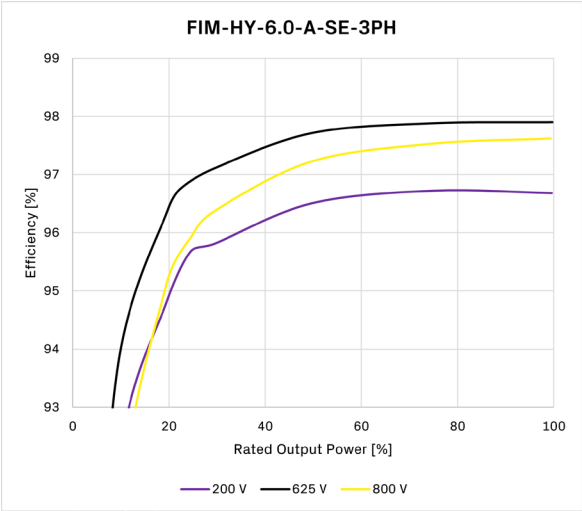
**NOTE** - The efficiency curves are linked to technical parameters that are continually being developed and improved and should therefore be considered approximate.

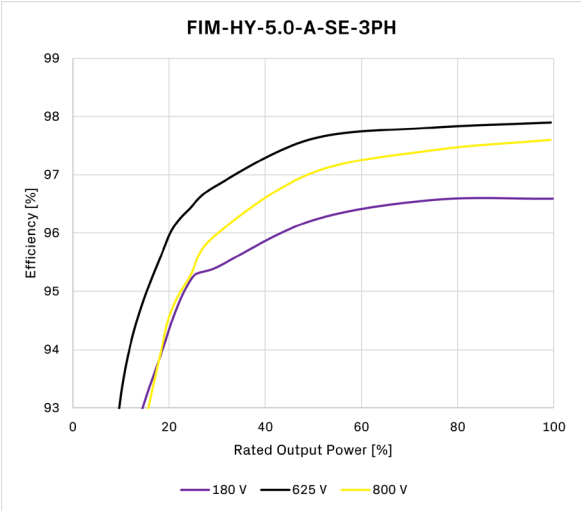


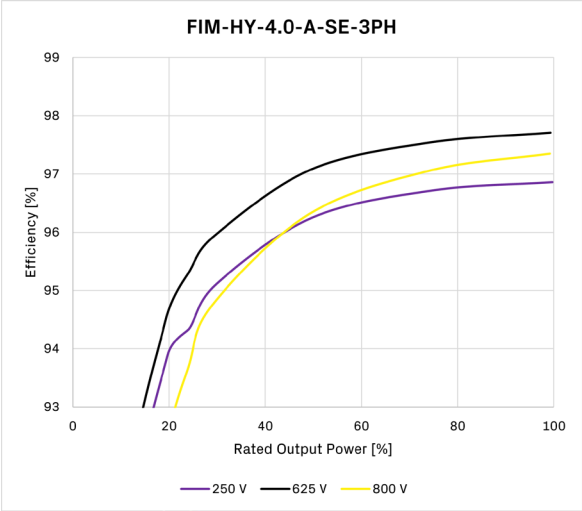




FIM-HY-6.0-A-SE-3PH
Efficiency [%]
99
98
97
96
95
94
93
0
20
40
60
80
100
Rated Output Power [%]
200 V
625 V
800 V


FIM-HY-5.0-A-SE-3PH
Efficiency [%]
99
98
97
96
95
94
93
0
20
40
60
80
100
Rated Output Power [%]
180 V
625 V
800 V


FIM-HY-4.0-A-SE-3PH
Efficiency [%]
99
98
97
96
95
94
93
0
20
40
60
80
100
Rated Output Power [%]
250 V
625 V
800 V

## 3.7 Power derating

To allow inverter operation in safe thermal and electrical conditions, the unit automatically reduces the value of the power fed into the grid.

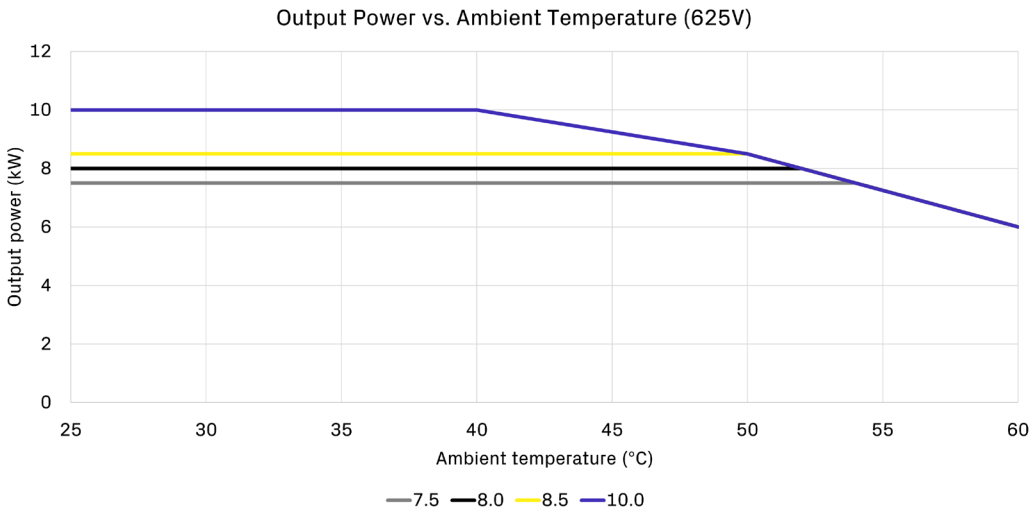
Power derating may occur due to:

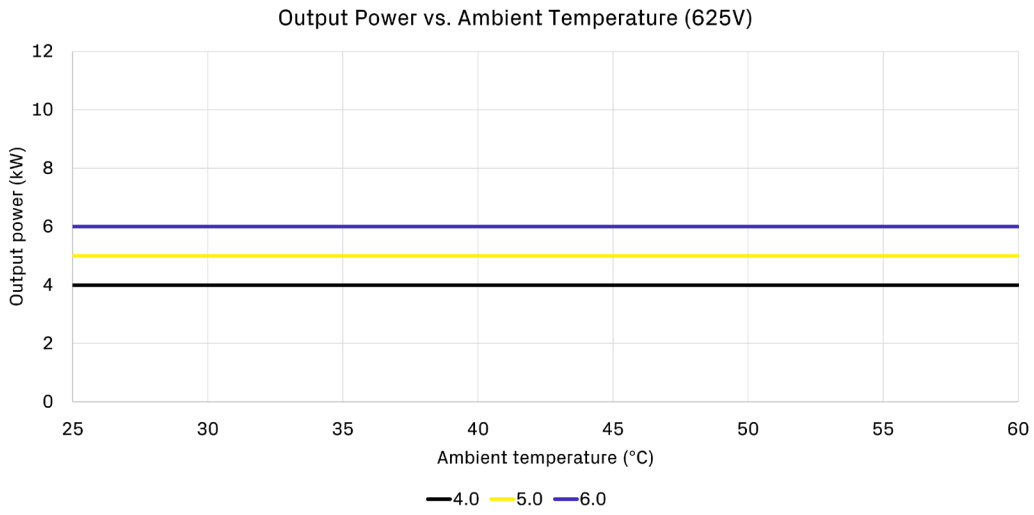
- Adverse environmental conditions (thermal derating)
- Input voltage values too low / too high.
- Percentage of output power (value set by the user)
- Grid voltage over frequency (mode set by user)
- Grid overvoltage U>10min Der. (enabling carried out by user)
- Anti-islanding
- Grid under voltage
- High input current values.

### 3.7.1 Power derating due to environmental conditions

The power reduction value and the inverter temperature at which it occurs depend on the ambient temperature and on many operating parameters. Example: input voltage, grid voltage and power available from the photovoltaic field.

The curves below show the de-rating of output power as a function of ambient temperature at rated DC voltage (input voltage 625 V ... 630 V, output voltage 230 V / 50 Hz.



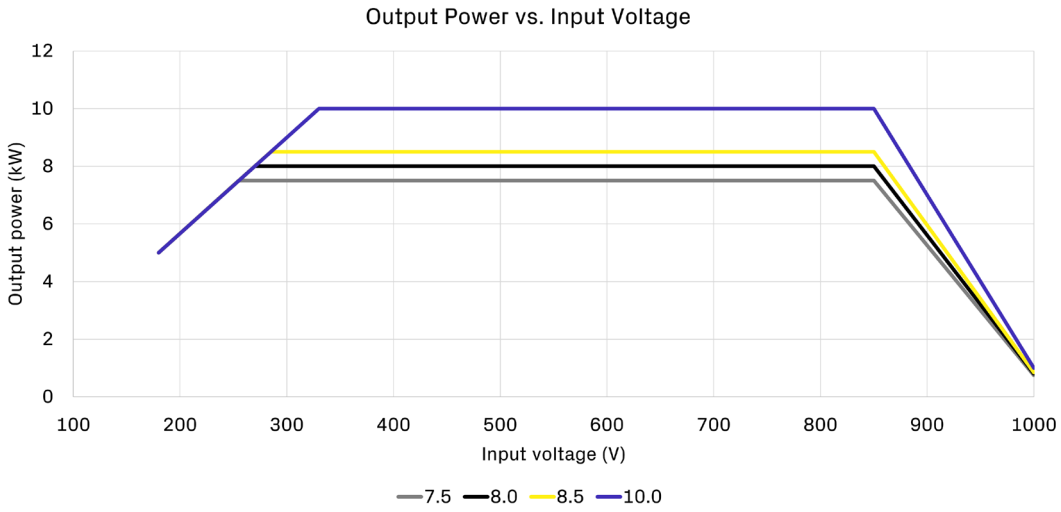



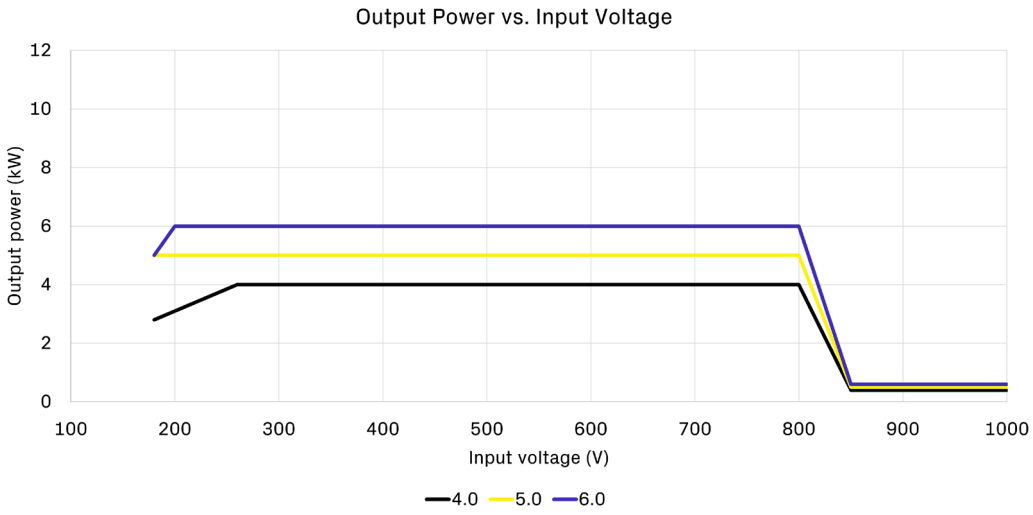

The inverter can therefore reduce the output AC power during certain periods of the day according to the value of these parameters.

### 3.7.2 Power derating due to the input voltage

The power reduction occurred for too high or too low DC input voltage values is adjusted automatically.

**NOTE** - Power reduction behaviour is guaranteed only in case of balanced input channels.



### 3.7.3 Power derating due to altitude

⚠ **WARNING** - On account of the rarefaction of the air (at high altitudes), particular conditions may occur that should be considered when choosing the place of installation:
- Less efficient cooling and therefore a greater likelihood of the device going into derating because of high internal temperature.
- Reduction in the dielectric resistance of the air which, in the presence of high operating voltages (DC input), can create electric arcs (electrical discharges) that may damage the equipment.

⚠ **WARNING** - As the altitude increases, the failure rate of some electronic components increases exponentially because of cosmic radiation.

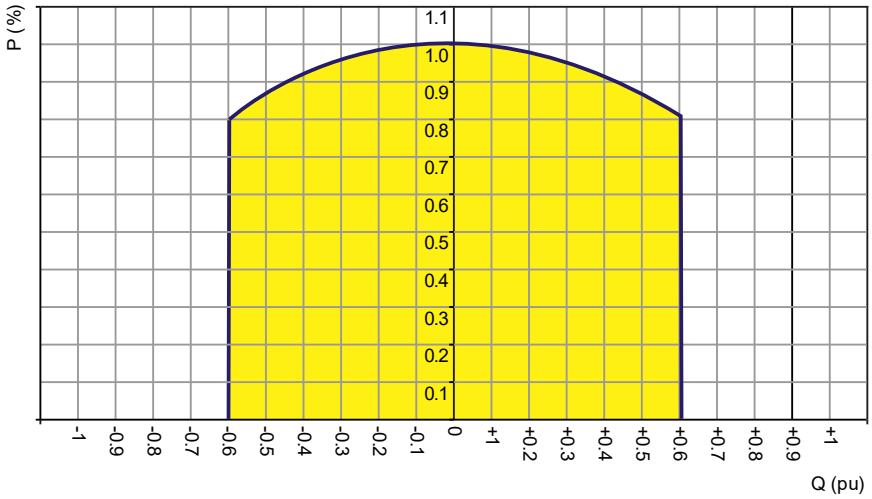
⚠ **ATTENTION** - All installations at altitudes of over 2000m (6562 ft) must be assessed case by case considering the aforesaid criticalities.

### 3.7.4 P-Q Capability

⚠ **ATTENTION** - P-Q capability may be reduced to match the specific grid code requirements applicable in your country.

The following represents the maximum P-Q capability of the unit under the specified operating conditions.

| | FIM-HY-4.0 SE-A-3PH | FIM-HY-5.0 SE-A-3PH | FIM-HY-6.0 SE-A-3PH | FIM-HY-7.5 SE-A-3PH | FIM-HY-8.0 SE-A-3PH | FIM-HY-8.5 SE-A-3PH | FIM-HY-10.0 SE-A-3PH |
|---|---|---|---|---|---|---|---|
| Ambient temperature | 50°C | 45°C | 45°C | 45°C | 45°C | 45°C | 40°C |
| Rated output voltage ($U_n$) | 380 V /400 V AC | | | | | | |
| Nominal Active Power ($P_n$) | 4000 W | 5000 W | 6000 W | 7500 W | 8000 W | 8500 W | 10000 W |
| Nominal Apparent Power ($S_n$) | 4000 VA | 5000 VA | 6000 VA | 7500 VA | 8000 VA | 8500 VA | 10000 VA |
| Nominal Reactive Power ($Q\_n$) | 2400 VAr | 3000 VAr | 3600 VAr | 4500 VAr | 4800 VAr | 5100 VAr | 6000 VAr |
| $\cos(\phi)$ @ $S_n$ | -0.8 ... 1 ... +0.8 | | | | | | |
| Capability with grid voltage | 1.0 × Un | | | | | | |



## 3.8 Characteristics of a photovoltaic generator

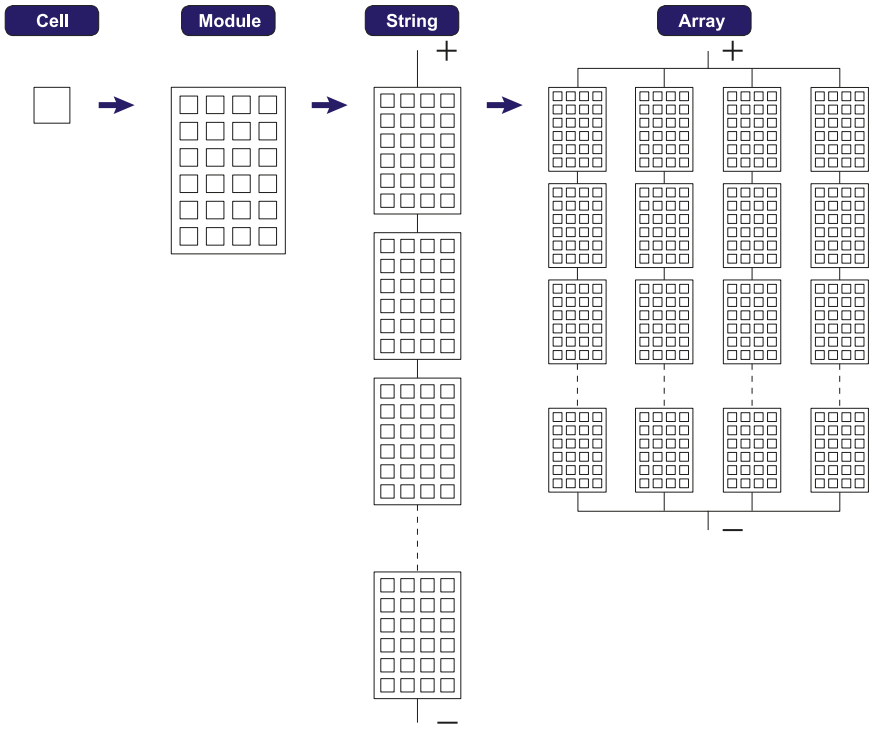
A PV generator consists of an assembly of photovoltaic modules that transform solar radiation into DC electrical energy and can be made up of:

- Strings: number (n) of PV modules connected in series
- Array: group of (m) strings connected in parallel.

The string technology was developed to significantly reduce the installation costs of a photovoltaic system that are mainly associated to wiring on the DC side of the inverter and subsequent distribution on the AC side.

- A photovoltaic panel consists of many photovoltaic cells mounted on the same support.
- A string consists of a certain number of panels connected in series.
- An array consists of two or more strings connected in parallel.
- Large photovoltaic systems can include multiple arrays connected to one or more inverters.

**NOTE** - The greater the number of panels in each string, the lower the cost and the less complex the wiring connections of the system.




**ATTENTION** - The current of each array must fall within the rating value limits of the inverter (see "Technical data").

**ATTENTION** - The inverters referred to in this document are **transformer-less**. This type requires the use of insulated photovoltaic panels (**IEC 61730 Class A** rating) and the need to keep the photovoltaic generator floating with respect to ground: no terminal of the generator must be connected to ground.

## 3.9 Description of the energy storage system

**PowerTRIO** is a hybrid inverter designed to optimise self-consumption in residential environments. The residential energy storage system is composed by:

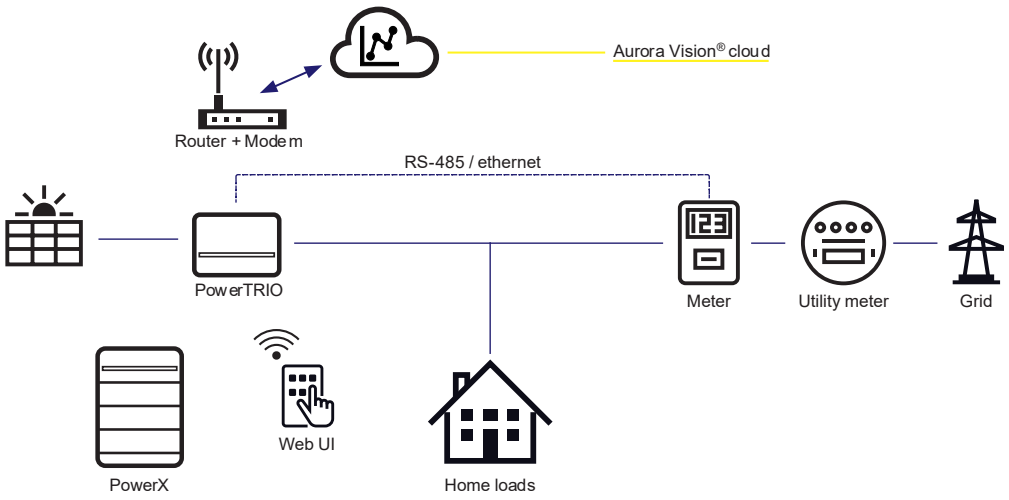
- **PowerTRIO** hybrid inverter. It transforms a direct current (DC) from a photovoltaic generator (PV) into an alternating current (AC) which can be fed into the public distribution grid. In addition, the inverter receives data from the Fimer energy meter and performs smart management of energy storage 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 or through the Energy Viewer app for smartphones/tablets.
- **PowerX** battery unit. It temporarily stores the unused energy from the photovoltaic generator. The energy stored will subsequently be used whenever the demand for energy is greater than that produced by the generator or during nighttime.
- **Meter**. It measures the energy at the grid connection point and communicates with 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 (zero injection).

Energy storage system operating diagram

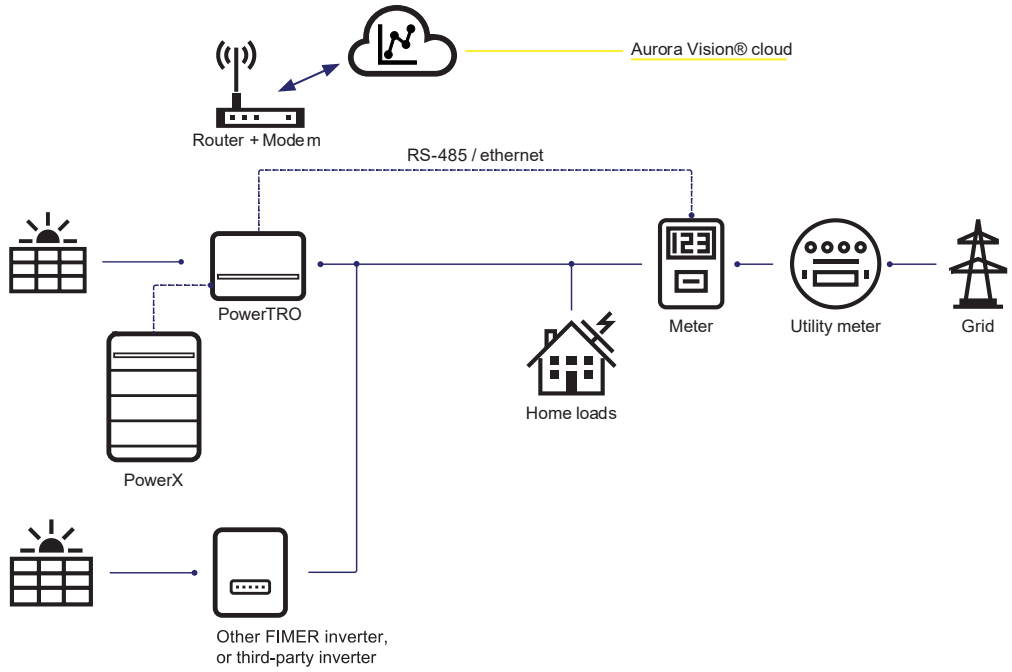
### 3.9.1 Energy storage system operating diagram

**Single inverter installation**

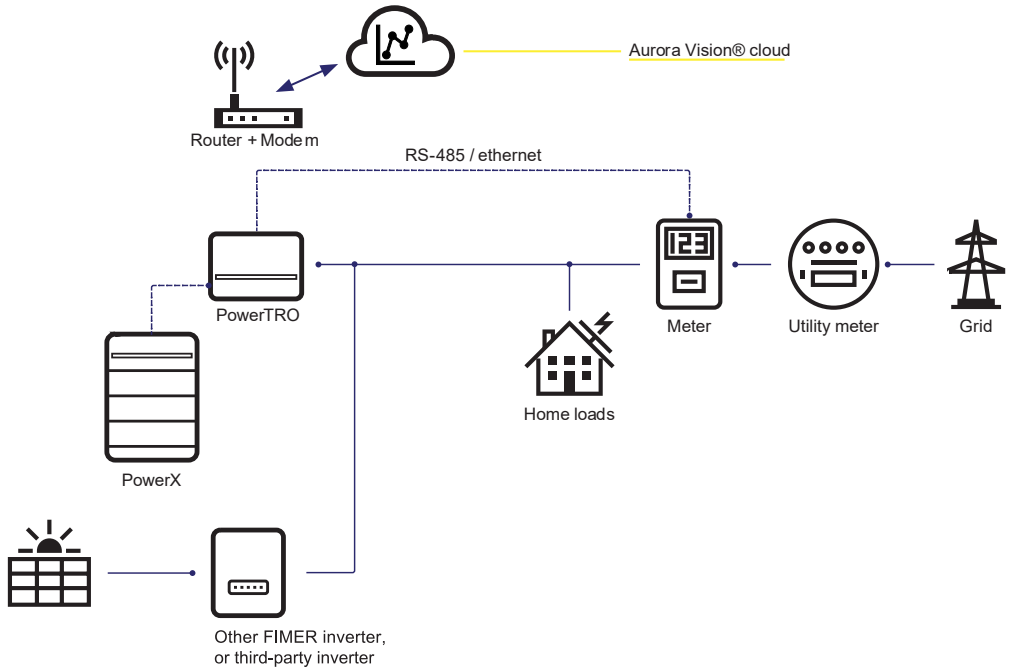


EN

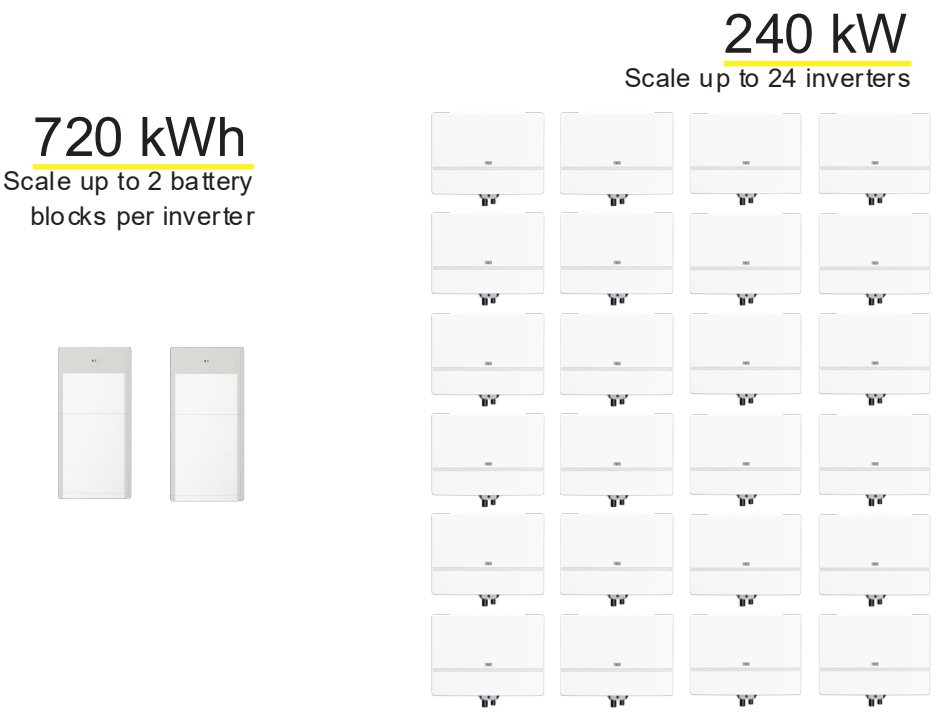
**Multi-inverter installation**




**AC coupled installation**



### 3.9.2 Energy storage system modularity




### 3.9.3 Notes on the system sizing

Decisions on how to structure a photovoltaic system depend on a series of factors and considerations, such as type of panels, space availability, future location of the system, energy production goals over the long term, etc.

**NOTE** - For proper sizing of the PV system, it is recommended to use calculation software configured according to the technical parameters specified in the product documentation.

## 3.10 Functionality and components description

### 3.10.1 Highlights

| | | | |
|---|---|---|---|
| One size for all<br>from 4 kW to 8.5 kW | x2 faster<br>switching frequency | -20 dB (A)<br>noise reduction | |
| +40%<br>time saving<br>for commissioning |  | 24 / 7<br>real time monitoring | |
| | | Battery<br>ready | 100%<br>recyclable |
| No tools<br>for commissioning | 100%<br>unbalanced load backup | Patented<br>ARC fault detection | Blockchain<br>ready |
| +55%<br>CPU performance | Connected<br>SG ready & EV charger | Built-in<br>ethernet and Wi-Fi | Setup<br>anytime |

### 3.10.2 Improved commissioning and maintenance

**Fimer Web User Interface (integrated)**

Easy commissioning with the integrated Web User Interface

**Remote firmware update function**

The firmware of the inverter can be updated both locally (via the internal Web User Interface) and remotely (Via Aurora Vision cloud products).

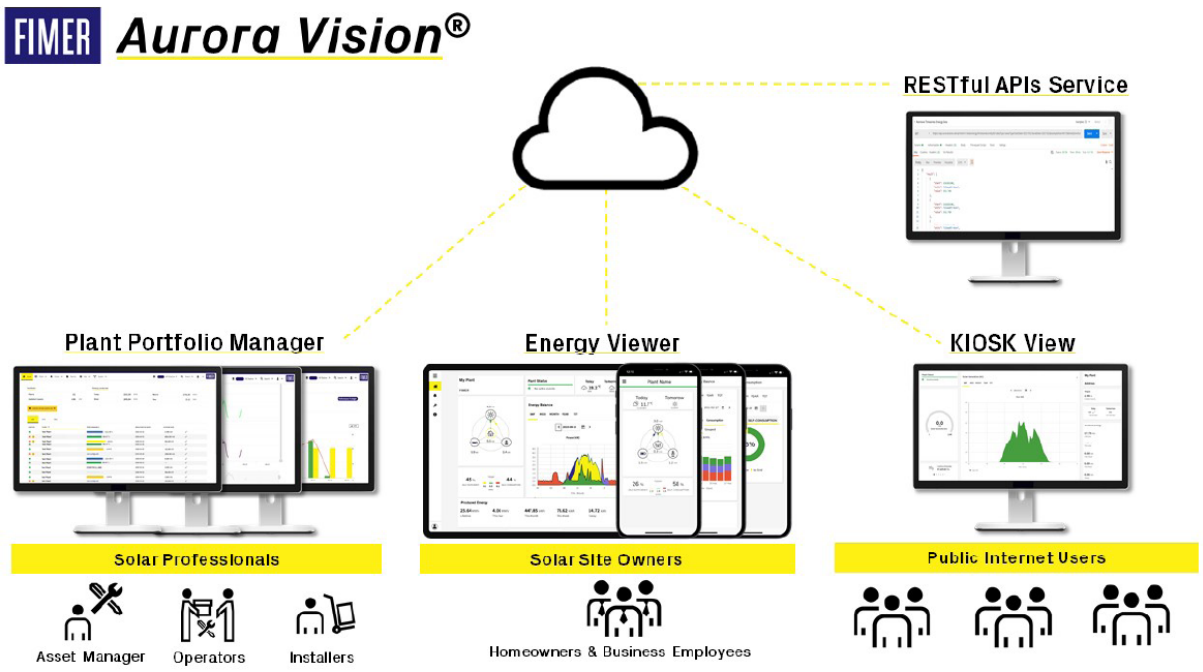
### 3.10.3 Aurora Vision®

Integrated logging capability allows remote monitoring of the plant without the needs of any additional external loggers.

Aurora Vision is a cloud-based platform enabling remote monitoring and asset management of Fimer devices in range of solar power application.

Aurora Vision consists of two different products, designed to meet different market needs, an APIs Service (RESTful architecture) to enabled third party data integration and a KIOSK view to show publicly solar plant benefits and performances:

- **Plant Portfolio Manager**. An advanced professional web-portal that allows stakeholders (such as installers / operators / managers) to monitor and control fleets of photovoltaic systems installed for final customers.
- **Energy Viewer**. A smart and easy-to-use mobile app for monitoring the main power generation and self-performances indicators, for owners of residential and commercial PV plants, to keep energy use and savings in check.
- **APIs Service**. Harness the power of data from Fimer photovoltaic systems to design solutions and provide opportunities.
- **KIOSK View**. A public and customizable web page based on HTML5 (self-updating and embeddable in external frames) to show the benefits and performances of a solar power plant.




**NOTE** - Please contact the MA Solar Italy technical support for getting your own Aurora Vision® account in order to access Plant Portfolio Manager (mainly for plant administrators). Download the Energy Viewer App (App Store or Google Play Store) or visit https://www.auroravision.net/ and click on "Sign-Up" to get your Aurora Vision account and Self-Register your plant (mainly for site owners).

### 3.10.4 AC BACKUP operational mode

The inverter can operate in backup mode. Refer to paragraph 5.7 "AC BACKUP Mode" for details.

### 3.10.5 Remote ON/OFF and DRM0/1/5 functionalities (AS/NZS 4777.2 standard).

This command can be used to remote ON/OFF and DRM0/1/5 functionalities via external commands by means the multi-signal connector **(16)**.

**Remote ON/OFF functionality:**

When the functionality is active the switching on of the inverter, besides being dictated by the presence of normal parameters which allow the inverter to be connected to the grid, also depends on the external control for switching on/off.

**DRM functionalities:**

The AS/NZS 4777.2 standard contains requirements related to grid stability and remote system control by the utility.

- DRM0 (demand response mode 0): operates the disconnection from the grid upon command from the utility.
- DRM1 (demand response mode 1): reduces import from grid to zero upon command from the utility.
- DRM5 (demand response mode 5): reduces export to grid to zero upon command from the utility.

**NOTE** - Only one between remote ON/OFF and DRM0 functionalities can be connected to the multi-signal connector **(16)**. The desired functionality must be enabled via the integrated web user interface.

**NOTE** - Currently, the DRM1 functionality is not implemented at the software level.

### 3.10.6 Load manager relay

The inverter is equipped with a load manager relay, which can be used in different operating configurations.

Load manager is a device able to activate loads based on specific rules. In PV sector these algorithms are used mainly for improving PV self-consumption.

The relays are not power components (**30 V ac / V dc, 1A max**) and must be used, for example, to control a power relay installed outside the inverter.

### 3.10.7 Reactive power production

This inverter can generate reactive power and feed it into the grid via the power factor setting.

Power feeding modes vary by country and local grid regulations.

### 3.10.8 Active power limitation

This inverter can limit the active power fed into the grid to a desired, adjustable value.

### 3.10.9 Data transmission and control

The inverter features embedded multi-communication interfaces (Wi-Fi and Ethernet) and supports the SunSpec-compliant Modbus TCP protocol, enabling easy integration with third-party monitoring and control systems that support the same SunSpec standard.

**NOTE** - The Modbus TCP register map is the same for all communication interfaces (Ethernet and Wi-Fi) of the inverter. Please consult (and download) the product documentation by visiting www.fimer.com

## 3.11 Communication interfaces

The integrated Ethernet and Wi-Fi board enables local or remote connection to the inverter.

The inverter provides the following integrated communication interfaces:

### 3.11.1 Wi-Fi (IEEE 802.11 b/g/n 2.4GHz)

Wi-Fi is recommended for local connection to the inverter's WEB UI using any WLAN standard device (tablet, smartphone) for commissioning and parameter settings.

A second radio channel is also available for connection to a Wi-Fi router.

### 3.11.2 Ethernet

By default, the Ethernet port **(14)** is pre-configured to enable communication.

Once the ethernet port of the inverter is physically connected, no specific settings are required.

After powering on for the first time, the inverter automatically obtains the necessary network parameters if a DHCP server is present.

If there is no DHCP server the inverter configures itself with an IPv4 link-local address, which allows communication with other inverters on the same network. However, it still doesn't allow communication with Aurora Vision services. Configure a static IP address in this case if you want to access AV services.

If an internet connection is available, the inverter will automatically configure itself to transmit telemetry data to Aurora Vision Cloud, without the need for additional devices (logging capabilities are integrated into the inverter by default).

**NOTE** - Aurora Vision® is the Fimer cloud solution allowing customer to remotely monitor and manage its own solar plants. Please refer to www.fimer.com or contact MA Solar Italy technical support for further information on how getting an Aurora Vision account.

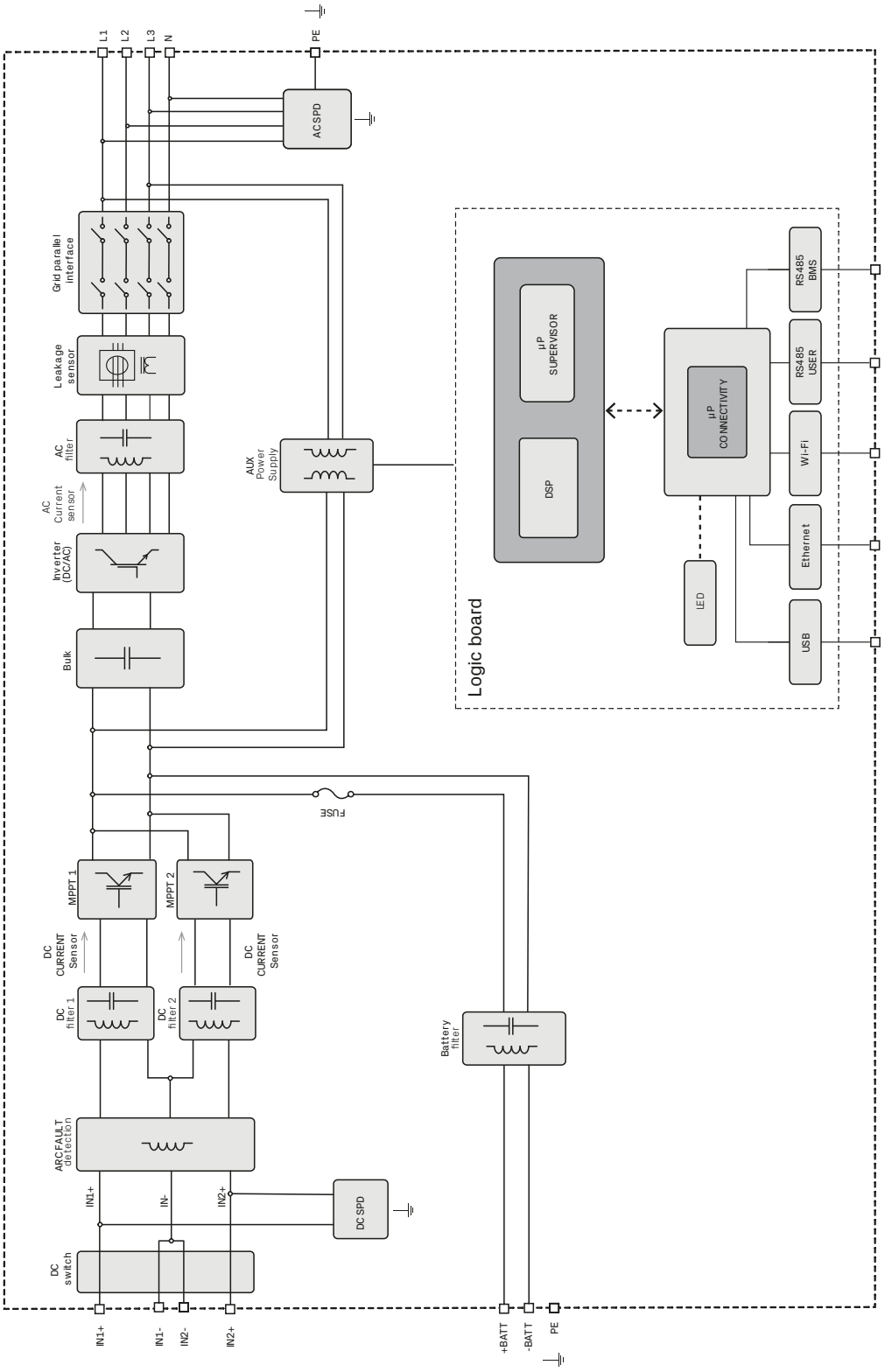
With the inverters connected via Ethernet and an available internet connection, remote firmware upgrades are always possible through Aurora Vision® Cloud.

### 3.11.3 RS-485 communication line

RS-485 communication line for connecting the Fimer meter.

## 3.12 Topographic diagram of the equipment

The diagram summarises the internal structure of the inverter.



## 3.13 Safety devices

### 3.13.1 Anti-Islanding

In the event of a local grid outage by the electricity company, or when the equipment is switched off for maintenance operations, the inverter must be physically disconnected to ensure the protection of the people working on the grid, in accordance with the relevant national laws and regulations. To prevent possible islanding, the inverter is equipped with an automatic safety disconnection system called “Anti-Islanding”.

**NOTE** - The method used to ensure an active anti-islanding protection is active frequency drift in combination with **RoCoF** (Rate of Change of Frequency) techniques.

**NOTE** - Anti-islanding protection mechanisms are different depending on the grid standards, even if they all have the same purpose.

### 3.13.2 Ground fault of the photovoltaic panels

**ATTENTION** - Use this inverter with panels connected in “floating” mode, i.e. with no earth connections on the positive and negative terminals.

An advanced ground fault protection circuit continuously monitors the ground connection and disconnects the inverter when a ground fault indicating the fault condition by means of the red “GFI” LED on the LED strip **(06)**.

### 3.13.3 Arc Fault Detection functionality

The Inverter provides protection from arc faults. The dedicated circuitry detects arcing conditions on DC side and in case of such event allows the disconnection from AC grid.

### 3.13.4 Overvoltage surge arresters

As an additional protection to prevent damage caused by the discharges from lightning and electrostatic induction phenomena, this inverter is equipped with DC and AC over-voltage surge arresters.

### 3.13.5 Other safeguards

This inverter is equipped with additional protective devices to ensure safe operation in any circumstance. These protections include:

- Constant monitoring of the grid voltage to ensure that voltage and frequency values remain within operating limits.
- Internal temperature control to automatically limit the power (if necessary) to prevent overheating of the unit (derating).

**NOTE** - The numerous control systems determine a redundant structure to ensure absolutely safe operations.

# 4 Lifting and transport

## 4.1 Transport and handling

Transport of the equipment, especially by road, must be carried out with means for protecting the components (in particular, the electronic components) from violent shocks, humidity, vibration, etc.

During handling, do not make any sudden or fast movements that could create dangerous swinging.

## 4.2 Equipment weight

| Device | Weight |
|---|---|
| All PowerTRIO models | 18 kg / 40 lbs |

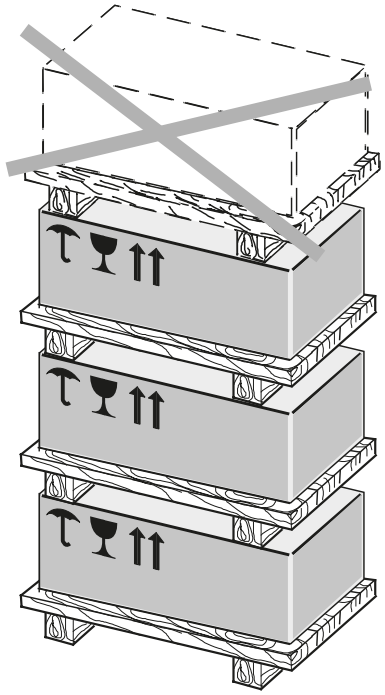
## 4.3 Storage

⚠ **ATTENTION** - DO NOT store the equipment (also valid for spare parts units) in a location exposed to severe weather conditions (e.g. rain, snow or a high level of humidity). Always comply with storage temperature indicated in "Technical data" paragraph in this manual.

If the package is stored correctly, it can withstand a **maximum load of 3 stacked units**.

⚠ **ATTENTION** - DO NOT stack the package with equipment or products other than those indicated.

⚠ **ATTENTION** - Accessory components that come in separate packages can be stacked separately.



### 4.3.1 Unpacking and checking

⚠ **ATTENTION** - Packaging elements (cardboard, cellophane, staples, adhesive tape, straps, etc.) may cause cuts and/or injuries if not handled with care. They should be removed with the proper equipment.

**NOTE** - The components of the packaging must be disposed on in accordance with the regulations in force in the country of installation.

When you open an equipment package, check that the equipment is undamaged and make sure all the components are present.

**NOTE** - If any defects or damage are found, stop unpacking and consult the carrier, and promptly inform Fimer customer support.

## 4.3.2 Lifting

**LIFTING** - Risk of injury due to the heavy weight of the equipment!

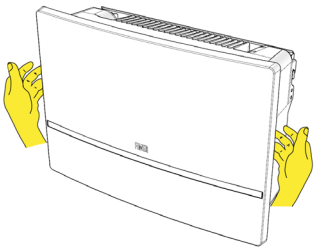
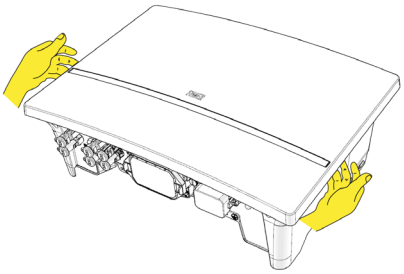
MA Solar Italy usually stores and protects individual components by suitable means to make their transport and subsequent handling easier. Nonetheless, as a rule, it is necessary to turn to the experience of specialised staff to take charge of loading and unloading components.

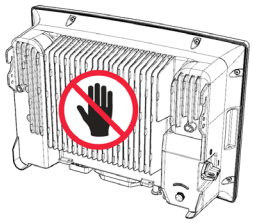
The Inverter must be lifted using the 2 handles (one each side on the diecast) or alternatively using suitable lifting equipment.

⚠ **ATTENTION** - In case of manual lifting the number of required operators necessary to lift the equipment must be in accordance to local regulations relating lifting limits per operator.

⚠ **ATTENTION** - Do not lift several units or parts of the equipment at the same time, unless otherwise indicated.

It is required to use one of the following lifting methods to move the equipment during installation or maintenance phases:

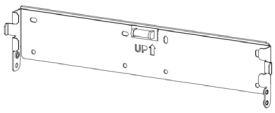
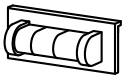
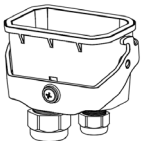
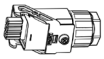
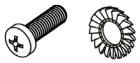
| Vertical lifting | Horizontal lifting |
|---|---|
|  |  |



⚠ **ATTENTION** – DO NOT grab the equipment from the rear flange! Risk of injury due to cutting surfaces and risk of equipment damage. Always use proper lifting equipment!

## 4.4 List of supplied components

The table below shown the available component in the inverter package (common for all models):

| Component | | Quantity |
|---|---|---|
|  | Mounting bracket with integrated spirit level **(03)** | 1 |
|  | Spirit level | 1 |
|  | Hypercap **(24)** | 1 |
|  | Smart plug **(27)** | 1 |
|  | AC OUTPUT connector **(29)** | 1 |
|  | Wi-Fi antenna **(30)** | 1 |
|  | M5 screw + M5 serrated lock washers to clamp the earth cable on the Protective earth (PE) external connection points **(05)** | 1 + 2 |
|  | Side bracket screws **(04)** M5 screws for mechanically securing the inverter to the bracket | 2 |
|  | Quick installation guide | 1 |
|  | RAEE disposal of waste leaflet | 1 |

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# 5 Installation

## 5.1 Installation safety instruction

⚠ **WARNING** - The inverter front cover can be removed from authorized service personnel only (the users are not authorized to remove inverter front cover).

⚠ **WARNING** -When the photovoltaic panels are exposed to sunlight they provide continuous DC voltage to the inverter. Before installation may begin, photovoltaic panels must be shaded or isolated.

⚠ **WARNING** -The installation must be carried out with the equipment disconnected from any voltage sources. Refer to paragraph 8.2 "**Inverter total de-energization and Isolation**" on this manual to know all the necessary step to safely operate on the inverter.

⚠ **ATTENTION** - This device is intended to be installed in a suitable plant for its use and its purpose. All the installation instruction 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

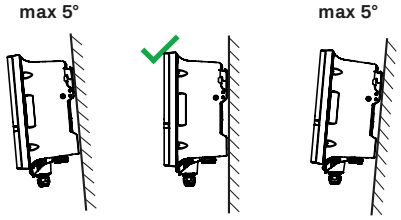
### 5.2.1 General recommendation on installation position

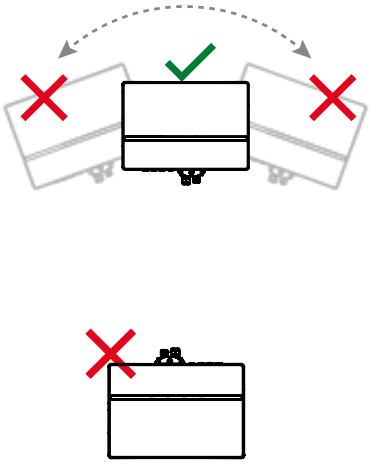
⚠ **ATTENTION** - Please refer to the warranty terms and conditions to evaluate any possible warranty exclusions due to improper installation.

- Refer to "**Technical data**" 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 inverter 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.
- Do not install on wooden walls or other flammable supports.
- Install on a wall or strong structure suitable to bear the weight.
- Do not install the unit at a place within children's reach.
- Do not install in rooms where people live or where the prolonged presence of people or animals is expected, because of the high noise that the inverter produces during operation. The level of the sound emission is heavily influenced by where the appliance is installed (for example: the type of surface around the inverter, the general properties of the room, etc.) and the quality of the electricity supply.
- Do not install the inverter in a place where personnel are easy to encounter its enclosure and heat sinks, because these parts can be hot during operation.
- Installations of the inverter over 2000 meters (6560 ft) must be valued taking in consideration the derating due to altitude.

### 5.2.2 Tilting admittance

The unit must be installed in vertical position with a maximum inclination as indicated in the figures below.





### 5.2.3 Distances

Maintenance operations from MA Solar Italy service could entails removing the front cover. Always observe the required installation safety distances to allow routine check and maintenance operations.

⚠ ATTENTION - Installation position shall not prevent access to the disconnection means.

Provide a sufficient working space in front of the inverter that allows to remove the front cover (MA Solar Italy service only) and to allow wiring connections.

Install at a height which takes into consideration the weight of the unit and in a position which is suitable for servicing, unless suitable means will be provided to carry out these mentioned operations.

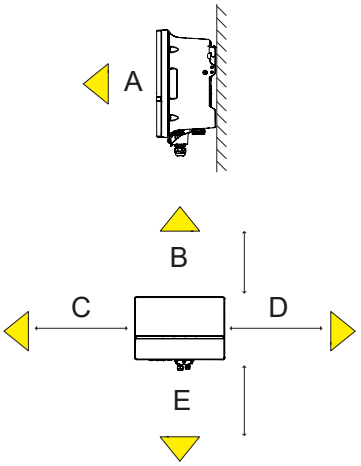
If possible, install it at eye-level so to allow to easily check the LED strip **(06)**.

Do not install any object (e.g. AC or DC cables) that could be damaged by overheating from outgoing hot air flow coming from top side (ΔT= +15 °C compared to ambient temperature). In case of this kind of installation needs, please evaluate the installation of a proper air deflector. Always respect the minimum distances required.

Respect the minimum distances from surrounding objects that could prevent the inverter installation and restrict or block the air flow:

- A = 70 cm (27”)
- B = 30 cm (12”)
- C = 35 cm (14”)
- D = 35 cm (14”)

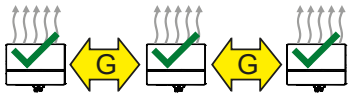
Below are some scenarios that may vary the minimum clearance distances:



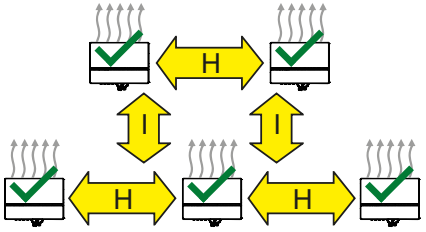

**NOTE** – The minimum required bottom free space (**E**) may depends on cable type (cable dimension, bending radius, etc). This evaluation must be done by the installer during the plant design phase.
**E** = 40 cm (16”)

### 5.2.4 Installation of multiple units

In case of installation of multiple units in the same place, position the inverter side by side paying attention to keep the minimum clearance distance G of 35 cm / 14”.

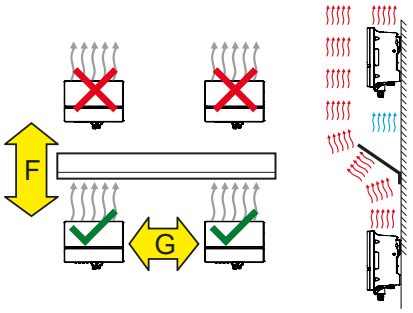



If the space available does not allow this arrangement, position the inverters in a staggered arrangement so that heat dissipation is not affected by other inverters below. Respect the following minimum clearance distances H of 100 cm / 39” and I of 30 cm / 12” (measured from the outer edge of units).




The stacked installation is not recommended because heat dissipation of the inverters positioned at the top is affected by other inverters below. Respect the following minimum clearance distances G of 35 cm / 14” and F of 100 cm / 39”.

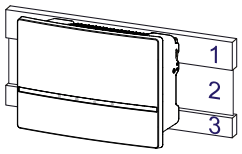
It is recommended to install an air deflector between the inverters as indicated in the picture below:



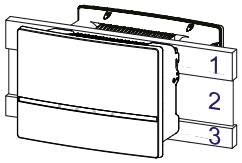

The installation of a single inverter or two inverters positioned back-to-back is also permitted on a structure which must be composed of:

1. a support for the attachment of the brackets
2. a septum between the two inverters
3. a support for the rear lower part of the inverter

Single inverter




Two inverters installed back-to-back




## 5.2.5 Wi-Fi signal environmental checks

The inverter can be commissioned and monitored using the Wi-Fi communication channel. The Wi-Fi board of the inverter uses radio waves to transmit and receive data. It is therefore important to assess this factor to have an optimal installation.

Walls made in reinforced concrete and surfaces covered with metal (doors, shutters, etc.) might significantly reduce the reach of the device which, even in optimal conditions, is approximately 40 meters in free space.

Before installing the inverter, it is therefore recommended to check the strength of Wi-Fi signal by means a mobile device (smartphone, tablet or notebook) by connecting it to the Wi-Fi router from a position which is close to the intended installation position of the inverter.

The radio signal level between the inverter and the Wi-Fi router can be improved in different ways:

1. Change the direction of the antenna.

The antenna has a dead zone at its tip, which should not be positioned facing the Wi-Fi router.

2. Find a new position for the router considering the different types of materials which the radio signal will have to pass through

3. Install a Wi-Fi signal repeater and place it in an area between the inverter and the router, trying in this way to skip the most critical obstacles.

| Material | Relative signal reduction |
|---|---|
| Open field | 0% (strength of approximately 40 metres) |
| Wood / Glass | From 0 to 10% |
| Stone / Plywood | From 10 to 40% |
| Reinforced concrete | From 60 to 90% |

## 5.2.6 Installations at high altitudes

Due to the rarefaction of the air (at high altitudes), particular conditions may occur, and it should be considered when choosing the place of installation:

Less efficient cooling and therefore a greater likelihood of a device power reduction (derating) occur due to high internal temperatures.

Reduction in the dielectric resistance of the air which, in the presence of high operating voltages (DC input), can create electric arcs (electrical discharges) that may damage the device.

When the altitude increases, the failure rate of some electronic components increases exponentially due to cosmic radiation.

**NOTE** - Installations of PowerTRIO over 2000m (6560 ft) must be valued taking in consideration the derating reported in “Power derating due to altitude”.

**FORBIDDEN** - Installation over 3000m (9842 ft) are not allowed.

## 5.2.7 Installations with a high level of humidity

**ATTENTION** - Never remove the Hypercap **(24)** in the case of rain, snow or a level of humidity > 95%.

**ATTENTION** - Always carefully seal all unused openings.

Even though the device is equipped with an anti-condensation valve, air with extremely high levels of humidity can lead to the creation of condensation inside the inverter. As the inverter is almost completely insulated from the outside, condensation can also form after installation in certain weather conditions.

## 5.3 Mounting Instructions

⚠ **ATTENTION** - The installation operations must be carried out by qualified personnel, and 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 authorized to carry out the installation must be specialized and experienced in PV plant installation and specifically PV inverters installation. MA Solar Italy can provide training on the product to provide suitable knowledge for the installation.

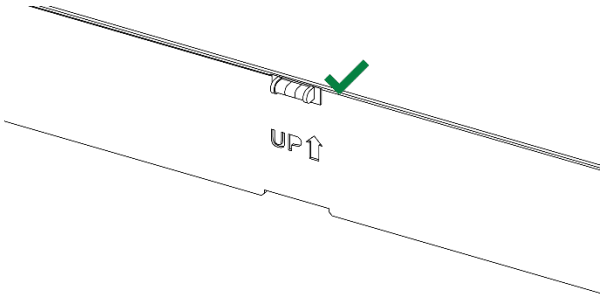
⚠ **ATTENTION** - The installation must be performed by qualified installers and/or licensed electricians in accordance with the existing regulations in the country of installation.

⚠ **ATTENTION** - The installation must be carried out with the equipment disconnected from any voltage sources. Refer to "**Inverter total de-energization and Isolation**" paragraph on the product manual to know all the necessary step to safely operate on the inverter.

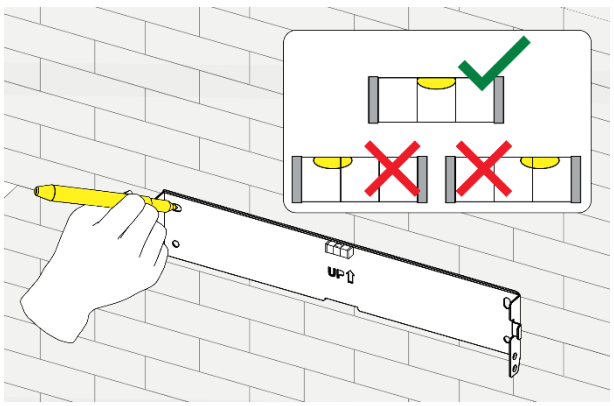
### 5.3.1 Bracket installation

The mounting bracket **(03)** can be used to install the inverter on a vertical support.

Install the magnetic spirit level **(02)** on the dedicated slot of mounting bracket **(03)**.

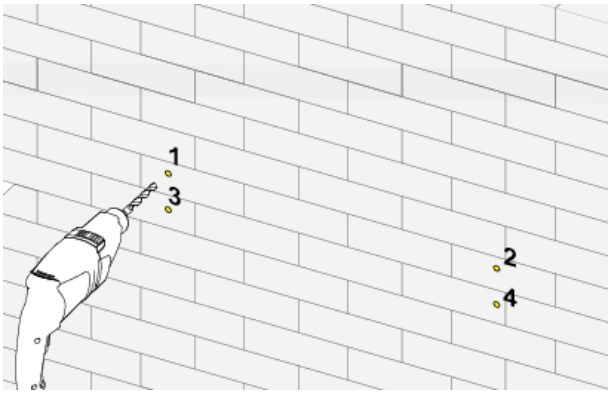



Position the mounting bracket **(03)** perfectly level on the support using the integrated spirit level **(02)**. Use the bracket as drilling template.

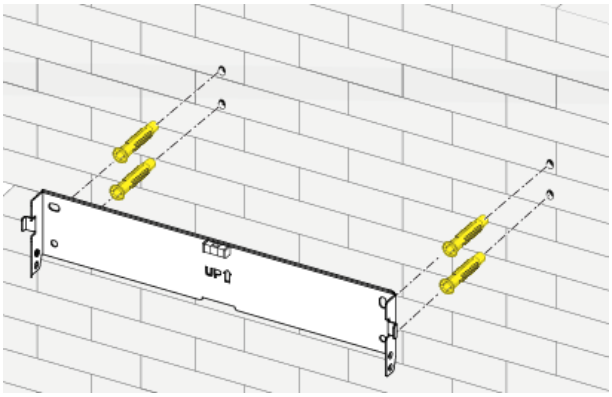


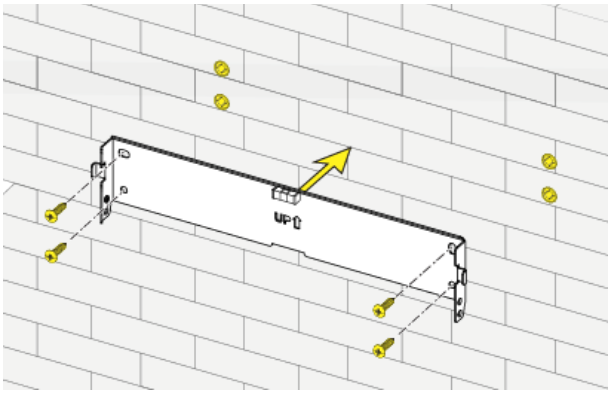

Choose an appropriate number and distribution of attachment points. The choice must be based on the type of support (wall, frame or other support), the type of anchors to be used, and their ability to support 4 times the inverter's weight (4 × 18 kg / 40 lbs = 72 kg / 160 lbs for all models).

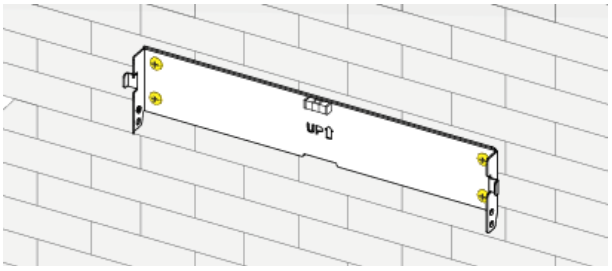
Depending on the type of anchor chosen, drill the required holes (2 minimum) to mount the bracket. Put at least 2 screws in the upper side.



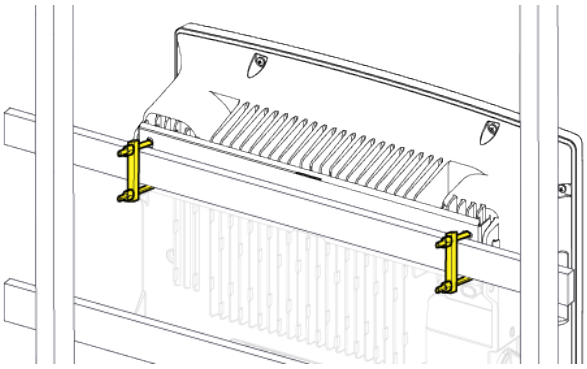

Attach the bracket **(05)** to the support.



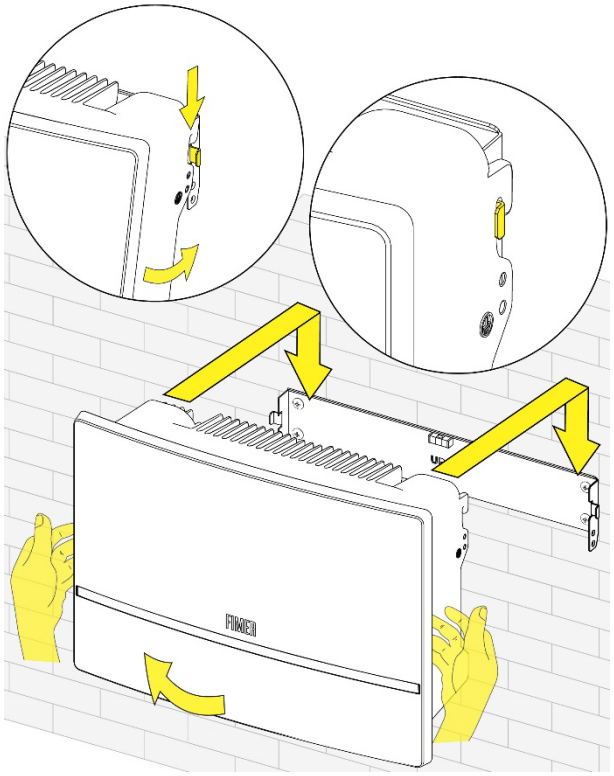
In case of use of “frame fixing brackets” it will be possible to fix the bracket to the frame structure without drill any holes.



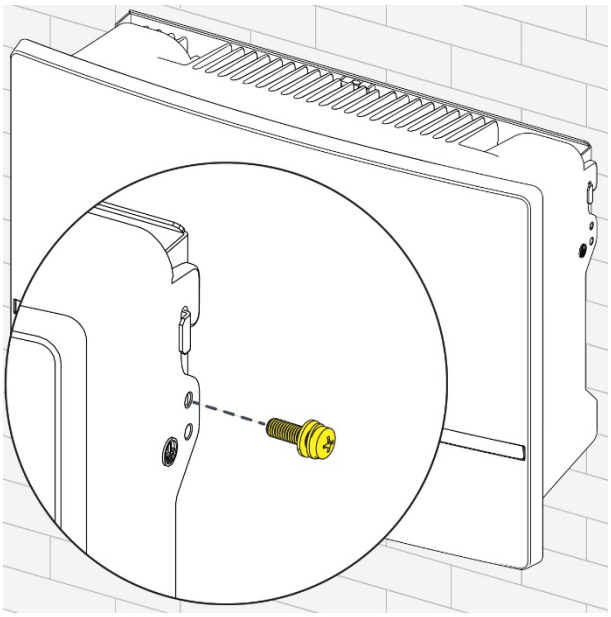
## 5.3.2 Assembly the Inverter to the bracket

Lift the inverter **(01)** up to the bracket **(03)** and insert the two sides anchor points (placed on sides of the wall bracket) into the two slots on the inverter. Check that the anchor points has been correctly inserted in the slots before releasing the inverter.

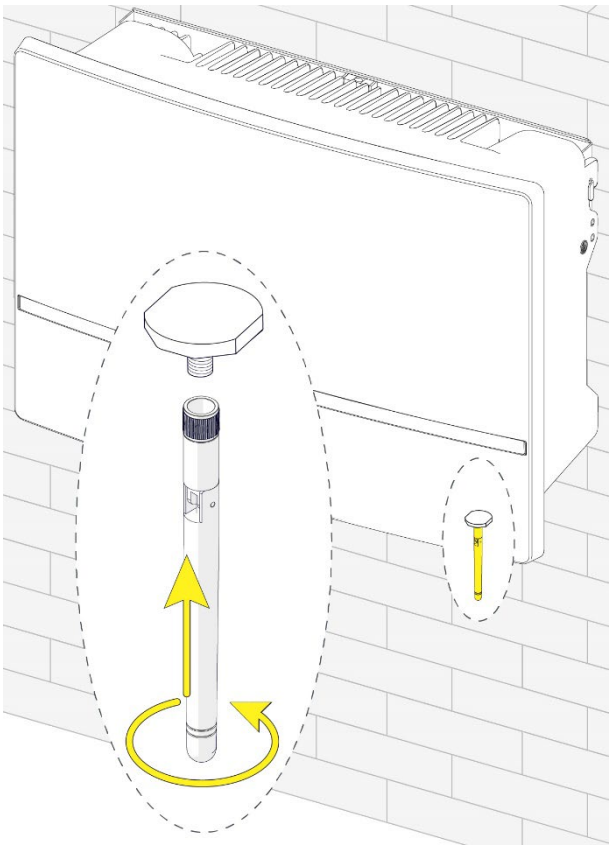
⚠ **ATTENTION** - Risk of injury due to the heavy weight of the equipment. Always consider the centre of gravity of the enclosures while lifting.



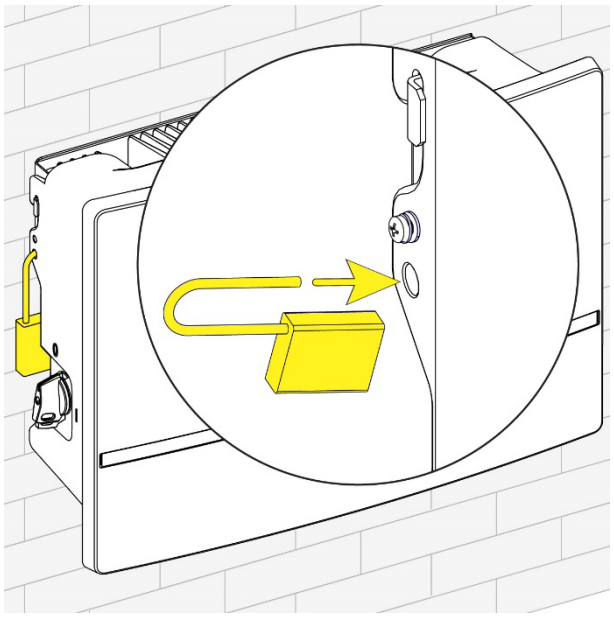
Tighten the supplied two side bracket screws **(04)** (see paragraph 3.5.2).



A padlock can be installed to secure the inverter to the bracket, preventing disassembly by unauthorized outsiders.



Install the Wi-Fi antenna **(30)** by screwing it into the specific Wi-Fi antenna connector **(20)**.



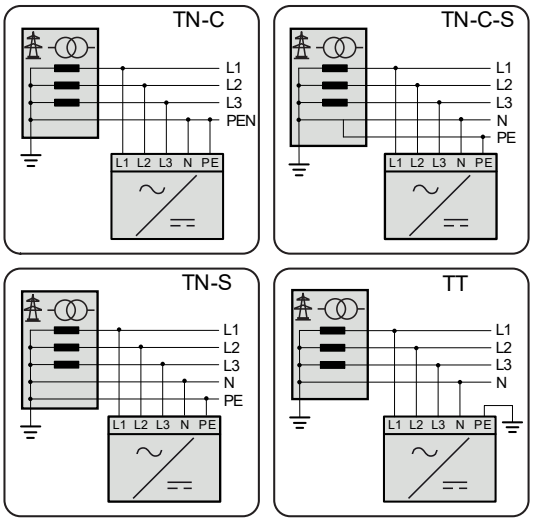
## 5.4 AC GRID connection

To avoid risks of electrical shock, all wiring operations must be carried out with the disconnect switch downstream of the inverter (grid side) opened and applying LOTO procedure on it. Be careful not to mistakenly exchange the phases with neutral!

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.

### 5.4.1 Three-phase grid system

The inverter must be connected to a three-phase system with the centre of the star connected to ground: TN-C, TN-C-S, TN-S, TT:




**NOTE** - The connection of the neutral (N) on the inverter is optional (dashed line on the above schematics); the inverter will automatically detect the presence or absence of the connection without any setting by the user.

The connection of the inverter to the grid could be done using a cable:

- **3W + PE** (3 phases without neutral **N** wire)
- **3W + N + PE** (3 phases with neutral **N** wire).

**ATTENTION** - In any case, the inverter's earth **(PE)** connection is mandatory.

### 5.4.2 Load protection breaker (AC disconnect switch)

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

| **Load protection breaker** | | |
|---|---|---|
| Type | Automatic circuit breaker with thermal-magnetic protection | |
| Voltage/current rating | FIM-HY-4.0 | 400Vac min. 10A (*) |
| | FIM-HY-5.0 | 400Vac min. 10A (*) |
| | FIM-HY-6.0 | 400Vac min. 10A (*) |
| | FIM-HY-7.5 | 400Vac min. 16A (*) |
| | FIM-HY-8.0 | 400Vac min. 16A (*) |
| | FIM-HY-8.5 | 400Vac min. 16A (*) |
| | FIM-HY-10.0 | 400Vac min. 20A (*) |
| Magnetic protection characteristic | Magnetic curve B/C | |
| Number of poles | 3W (3 phases without neutral wire) | |
| | 4W (3 phases with neutral wire) | |

(*) please consider thermal and other derating factors when selecting the current rating of the protective equipment for your application.

### 5.4.3 Differential protection downstream of the inverter

The solar inverters of the **PowerTRIO** family are equipped with a device for protection against ground faults in accordance with the safety standard **IEC 62109-2** (please refer to sections § 4.8.2 and § 4.8.3 of the standard). MA Solar Italy inverters are equipped with a reading redundance for the ground leakage current sensitive to all components of both direct and alternating current. In fact, the measurement of the ground leakage current is carried out simultaneously and independently by 2 different processors: it is sufficient for either of them to detect an anomaly to trip the protection, with consequent disconnection from the grid and to stop the conversion process.

Furthermore, there are other three tripping levels with limit set respectively at 30 mA, 60 mA and 150 mA to cover the "rapid" changes in fault current induced by accidental contact with leaking live parts. The max. tripping times are progressively shortened as the speed of change in the fault current increases and starting from the 300 msec/max for the 30-mA change, they are reduced respectively to 150 msec and 40 msec for 60 mA and 150 mA changes.

To protect the AC GRID connection line of the inverter, an external RDC device must be installed and must meet the following characteristics to prevent nuisance tripping due to capacitive leakage current of photovoltaic modules:

| **Residual current protection device requirements** | |
|---|---|
| Type | A / AC |
| Sensitivity | 300 mA |

**NOTE** - For protection of the AC line, based on the information above about the differential protection integrated in MA Solar Italy inverters, it is not necessary to install a type B ground fault switch.

**NOTE** - In accordance with article 712.413.1.1.1.2 of Section 712 of IEC Standard 64-8/7, we hereby declare that, because of their construction, MA Solar Italy inverters do not inject ground fault direct currents.

**NOTE** - In the case of systems which consist of several inverters connected to a single switch with differential protection, it is recommended to install a device which allows the adjustment of the tripping value and the tripping time.

### 5.4.4 Characteristics and sizing of the protective earthing cable

MA Solar Italy inverters must be earthed via the connection points marked with the protective earth symbol and using a cable with an appropriate conductor cross-section for the maximum ground fault current that the generating system might experience

**ATTENTION** - Any failure of the inverter when it is not connected to earth through the appropriate connection point is not covered by the warranty.

In compliance with the standards IEC 62109-1 / IEC 62109-2, ensure that the PE connection is made using the following method:

1. On one of the two Protective Earth (PE) external connection point **(05)** on the inverter, and

**WARNING** - The cross section of the protective earthing conductor **must be at least 10 mm²** (Copper wire)

2. on the AC quick-fit connector **(29)** using cables having same cross section as the phase's cables.

**ATTENTION** - Installation of a second protective earth cable is also required by regulations in force in certain countries of installation.

**WARNING** - The PE connection point on the AC quick fit connector **(29)** cannot substitute the Protective Earth (**PE**) external connection point **(05)**.

### 5.4.5 Characteristics and sizing of the AC GRID line cable

The cross-section of the AC line conductor cables must be sized to prevent unwanted disconnections of the inverter from the grid due to the high impedance of the line connecting the inverter to the power supply.

**WARNING** - If the impedance is too high it causes an increase in the AC voltage which, on reaching the limit set by the standards in the country of installation, causes the inverter to switch off.

The AC cables must be connected to the AC grid connector **(22)** using the supplied AC quick-fit connector **(29)**.

| AC quick fit connector | Characteristics of the cable |
|---|---|
| | Based on the seals (supplied) installed: |
| Cable diameter range | 10...12 mm<br>12...16 mm<br>16...21 mm |
| Conductor cross section | 4 ... 6 mm2 |
| Conductor material | copper or aluminium |

The table shows the maximum length of the line conductor in relation to its cross-sectional area:

| Inverter model | Line conductor maximum length (m) | |
|---|---|---|
| | 4 mm² | 6 mm² |
| **FIM-HY-4.0** | 63 m | 94 m |
| **FIM-HY-5.0** | 50 m | 76 m |
| **FIM-HY-6.0** | 42 m | 63 m |
| **FIM-HY-7.5** | 34 m | 50 m |
| **FIM-HY-8.0** | 31 m | 47 m |
| **FIM-HY-8.5** | 30 m | 44 m |
| **FIM-HY-10.0** | 25 m | 38 m |

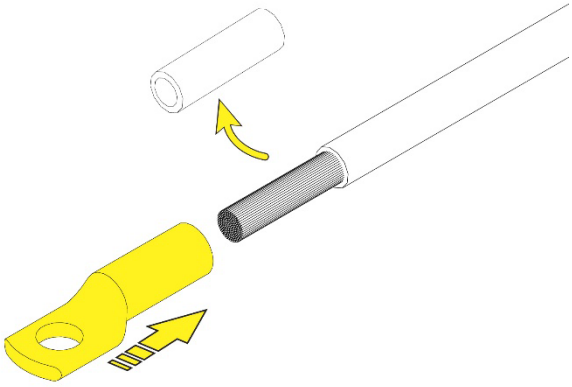
The values are calculated in nominal power conditions, considering:

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

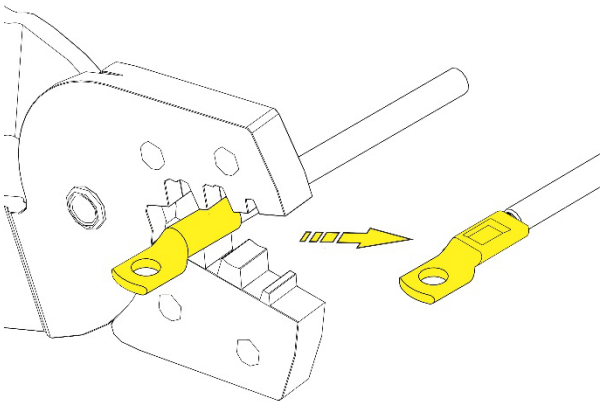
### 5.4.6 Protective earthing (PE) cable connection

Installation procedure

Strip the earth cable.

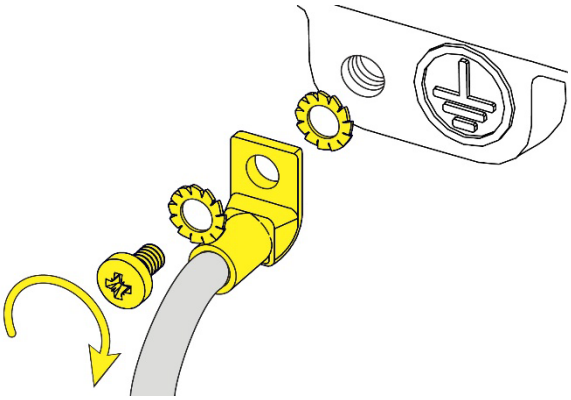


Install an eyelet cable lug on the earth cable.



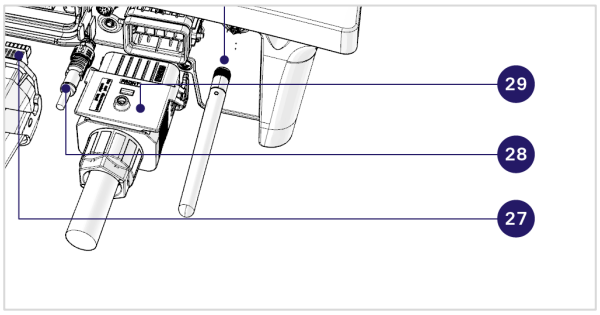
Install the earth cable (one or both) on the Protective earth (PE) external connection point **(05)** following the installation sequence (see paragraph 3.5.2 “Tightening torques”):

- Serrated washer
- Earth cable
- Serrated washer
- M5 screw



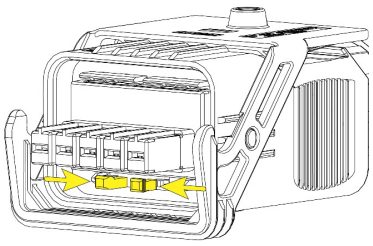
## 5.4.7 AC GRID cables connection

The connection of the AC cable must be made on the AC GRID output connector **(22)** located on the bottom side of the inverter using the supplied counterpart **(29)**.

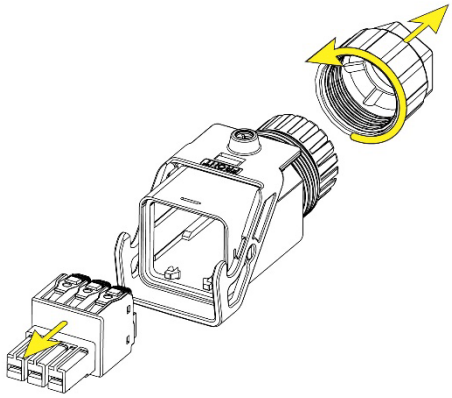



⚠ A power supply cord for connection to the AC. mains shall comply with all of the following, as appropriate: if rubber insulated, be of synthetic rubber and not of a lighter grade than ordinary tough rubber sheathed flexible cord according to IEC 60245-1 (designation 60245 IEC 53); and if PVC insulated: be not of a lighter grade than light PVC sheathed flexible cord according to IEC 60227-1 (designation 60227 IEC 52).

Press the two locking tabs to unlock the terminal block from the counterpart.



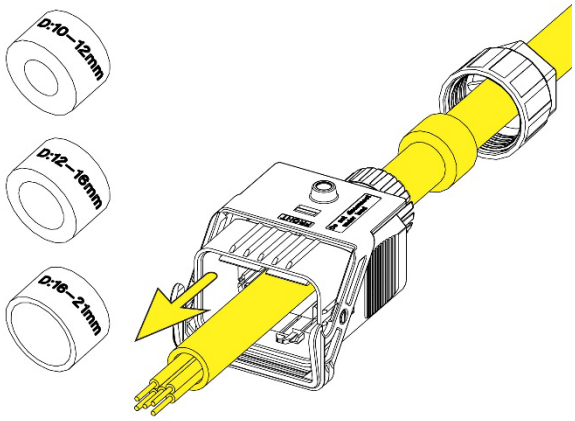
Remove the terminal block and unscrew the AC cable gland.



Pass the AC cable (diameter 10...21 mm) through the:

- the cable gland
- the seal. Choose the right seal between the 3 supplied based on the cable diameter (written on each seal).
- the connector body

The cable colours shown in the figures are for reference only. Select an appropriate cable according to local standards.

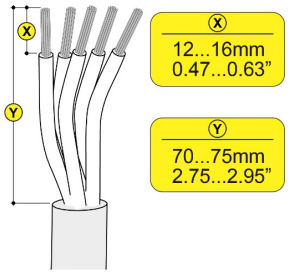



Connection of the wires to the terminal block should be made based on the AC three-phase system type, as follow:

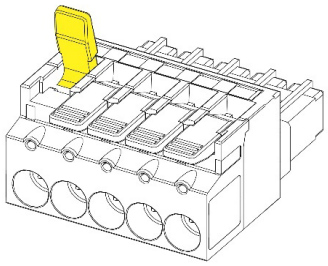
- Three-core cable (L1, L2, and L3)

- Four-core cable (L1, L2, L3, and PE)
- Four-core cable (L1, L2, L3, and N)
- Five-core cable (L1, L2, L3, N, and PE)

Strip the cable

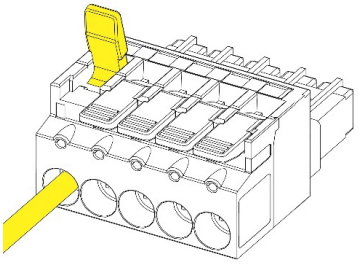



Open the connection system on the terminals to be connected

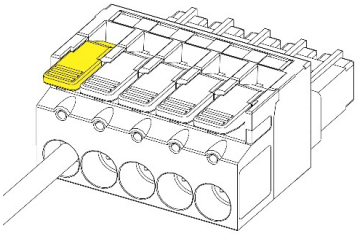


Insert the stripped wire respecting the connections as indicated below

In case of a wrong phase sequence the inverter will not connect to the grid and it will provide an error state.

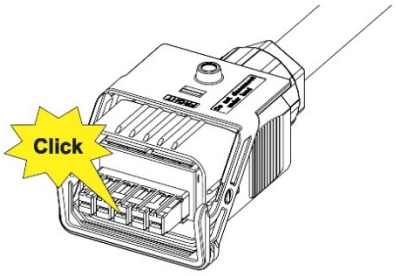


Close the connection system

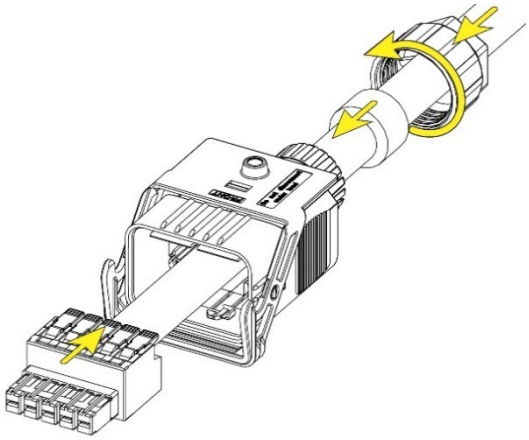


**NOTE** - When connections are complete, give each wire a pull test

Insert the terminal block inside the connector body



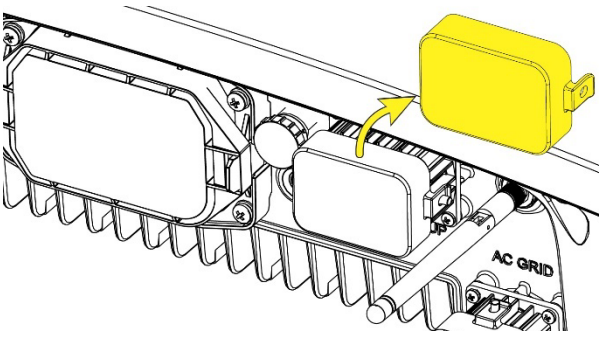

Insert the seal inside the connector body and screw the cable gland (6.5Nm)



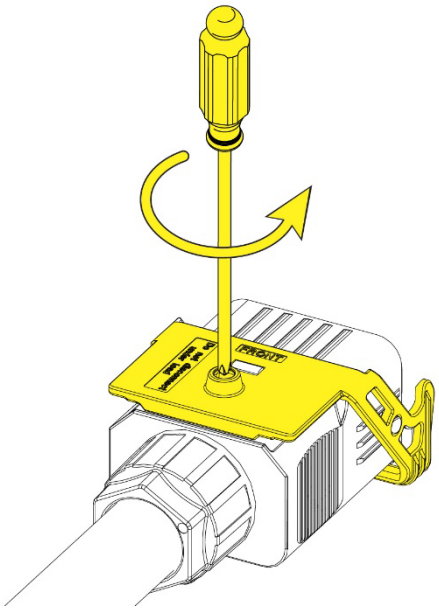
**ATTENTION** - Make sure the cable glands are properly sealed to ensure IP65 protection degree.

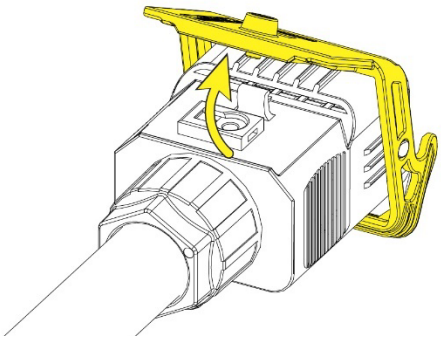
The AC grid quick fit connector - supplied counterpart **(29)** - assembled on the AC cable must be connected on the AC grid connector **(22)** on the bottom side of the inverter.

Remove the cap on the AC grid connector **(22)**

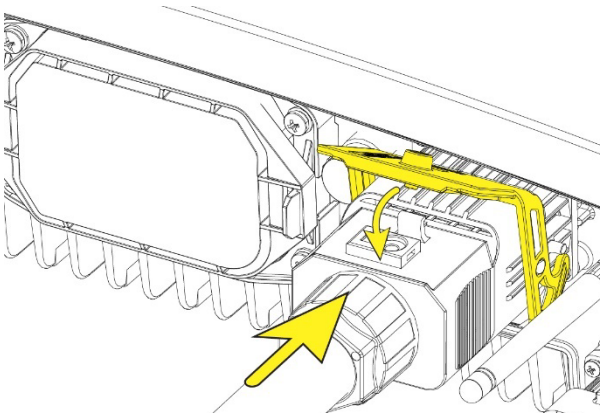



Unscrew the leverage system of the connector and open it

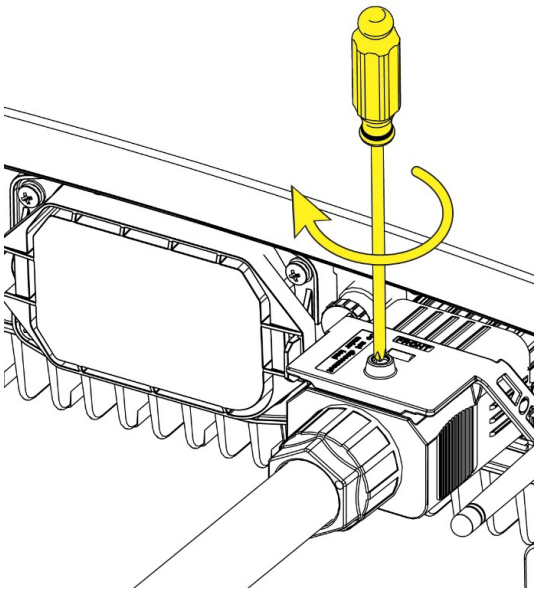




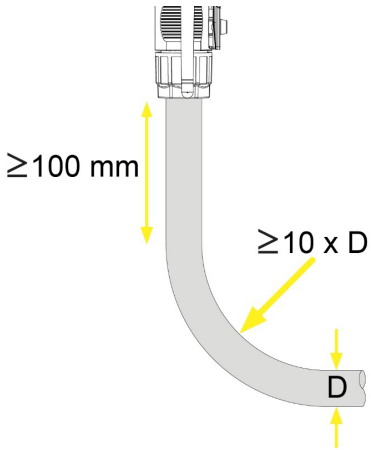
Insert the AC grid quick fit connector – supplied counterpart **(29)** - on the AC grid connector **(22)**



Close and secure the connector by screwing the leverage system (0.55Nm)



The AC cable routing must be done to avoid damage at the connector and to ensure IP65 protection degree



## 5.5 DC Input connection

⚠ **WARNING** - Check absence of any leakage to ground in the PV generator.

⚠ **WARNING** - The input strings connected to an input channel must have the same installation conditions (number of panel sets, panel type, orientation and tilt).

⚠ **WARNING** - When the photovoltaic panels are exposed to sunlight they provide continuous DC voltage to the inverter. To avoid risks of electrical shock, all wiring operations must be carried out with the DC disconnect switches (internal **(08)** and external to the inverter) and external AC disconnect switches OFF.

⚠ **WARNING** - The inverters referred to in this document are **WITHOUT AN ISOLATION TRANSFORMER** (transformer less). This topology implies the use of isolated PV panels (IEC 61730 Class A rating) and the need to keep the PV array floating with respect to ground: no terminal of the PV array must be connected to ground.

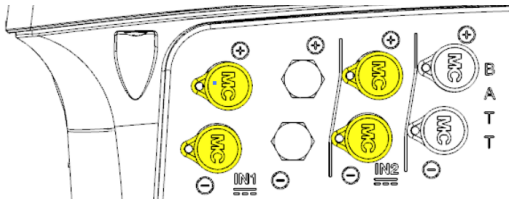
⚠ **WARNING** - Comply with the maximum input current relating to the quick-fit connectors as indicated in the technical data.

⚠ **WARNING** - The reverse polarity can cause severe damage and electric arc hazards! In case of reverse input strings do not disconnect them while under load and do not turn the DC disconnect switches **(08)** to OFF position. Wait until input current are below 0.5A (when solar irradiance declines at night) and turn the DC disconnect switches **(08)** to OFF position, disconnect the DC input MC4 connectors **(11) (12)** and correct the wrong polarity of the string.

For the string connections it is necessary to use the quick fit input connectors for MPPT1 and MPPT2 **(11) (12)**, located on the bottom side of the inverter.

For each channel are available respect the Maximum DC input power for each MPPT as follow:

| | IN1 | IN2 |
|---|---|---|
| **FIM-HY-4.0** | 16 A<br>1 connector pair | none |
| **FIM-HY-5.0** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |
| **FIM-HY-6.0** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |
| **FIM-HY-7.5** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |
| **FIM-HY-8.0** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |
| **FIM-HY-8.5** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |
| **FIM-HY-10.0** | 16 A<br>1 connector pair | 16 A<br>1 connector pair |

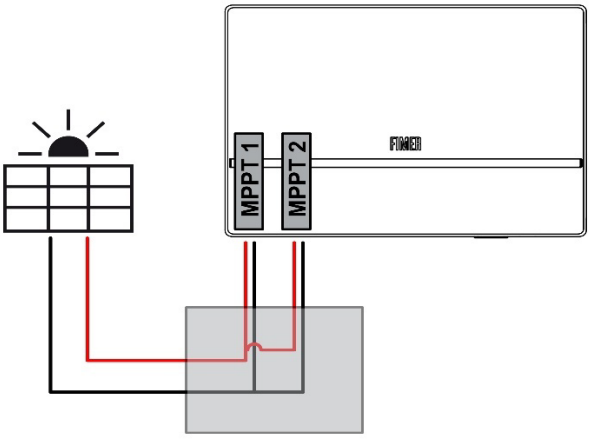



**NOTE** - Do not use the battery connectors to connect the input string.

In case of a single-string installation or retrofit, the MPPTs can be connected in parallel outside the inverter using an external Y-splitter.

For example, the Staubli **PV-K/SPL-Y-6-15/15-15-ESS/EP-0050** and **PV-K/SPL-Y-6-15/15-15ESS/EP-0050** Y-splitters are suitable for parallel connections. Refer to paragraph 5.5.4 for further details.

The parallel configuration must be set through the Web UI during the commissioning process.




**NOTE** - Generally, the parallel connection of the two input channels is used when the generator consists of a single array with a power output higher than the maximum allowed for one channel. In this case, the power (current) is distributed between the two input channels. To avoid mismatch losses, when the array is made up of parallel strings, these must be homogeneous, meaning they should consist of modules with the same specifications, the same number of modules in series and parallel, and similar orientation.

### 5.5.1 Preliminary operations to the connection of the PV generator

⚠ **WARNING** - To safely perform the preliminary operations before the connection to the PV generator, the connection of the ground protection cable to the inverter is mandatory.

⚠ **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. This activity is allowed ONLY with the appropriate PPE for carrying out this check (overall resistant to electric arc, dielectric helmet with visor, insulating gloves class 0, Protective over glove in leather EN420 – EN388, Safety shoes).

**Checking the correct polarity of the strings**

Using a voltmeter, check that the voltage of each string observes the correct polarity.

The reverse polarity can cause severe damage.

**Checking of leakage to ground of the photovoltaic generator:**

Measure the voltage present between positive and negative pole of each string with respect to ground.

If a voltage is measured between an input pole and ground, it may be that there is a low isolation resistance of the photovoltaic generator, and the installer will have to carry out a check to solve the problem.

Do not connect the strings if a leakage to ground has been detected, as the inverter might not connect to the grid.

Refer to "Verification of ground leakage" paragraph on this manual to know how to verify the leakage to ground of the photovoltaic generator.

**Checking of strings voltage:**

Measure the voltage present between positive and negative pole of each string.

If the open circuit voltage of the string is near the maximum value accepted by the inverter, consider that low ambient temperatures cause an increase in the string voltage (different according to the photovoltaic module used). In this case it is necessary to carry out a check of the sizing of the system and/or a check on the connections of the modules of the system (e.g.: number of modules in series higher than the design number).

Verify that the string voltage is the same in all the strings that are connecting to the same input channel. Voltage differences (of the strings connected in parallel) could reduce performance.

Input voltages higher than the maximum value accepted by the inverter (see technical data table) may occur the damage of the inverter.

## 5.5.2 Installation procedure for quick-fit connectors

The model of connectors installed on your inverter must be matched by the same model of the respective corresponding parts to be used.

The following procedure is valid for connectors:

- **32.0015P0001-UR** (male connector)
- **32.0014P0001-UR** (female connector)

According to IEC 62548 (Photovoltaic (PV) arrays – Design requirements), connectors mated together in a PV system shall be of the same type from the same manufacturer, i.e. a plug from one manufacturer and a socket from another manufacturer or vice versa shall not be used to make a connection. Refer to document “String inverters - Product manual appendix” available on the website to find out the manufacturer and model of quick fit connector used on the inverter.

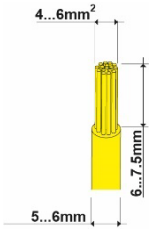
Using mating parts that are not compliant with the quick fit connector models on the inverter could cause serious damage to the unit and lead to invalidation of the warranty.

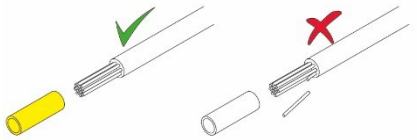
Complete assembly instructions and specification of quick-fit connectors could be found on manufacturer website.

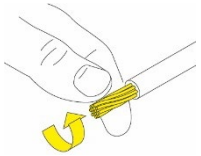
Input cables must meet the connector requirements and depends on connector models (see "3.5.3 Cable gland clamping range" and "3.5.4 Connectors cross section range").

**Assembly procedure:**

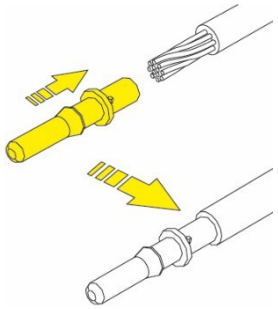
Strip the cable over a length of 6,0 to 7,5mm using suitable equipment.



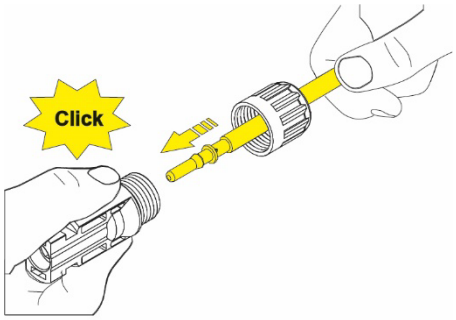


Crimp the terminal to the conductor using the designated pliers.

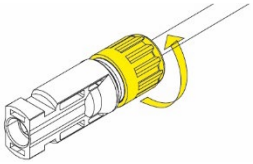


**WARNING** - To avoid damage to the equipment, when crimping cables to the connectors, pay particular attention to polarity.

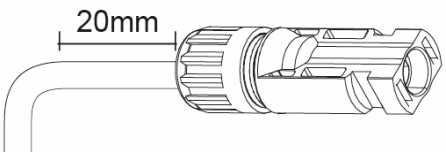
Insert the crimped terminal contact into the insulator body of the connector, until you hear the click indicating that the terminal is engaged inside the connector.




Firmly tighten the cable gland using the relevant tool to finish the operation (3.4...3.5Nm).

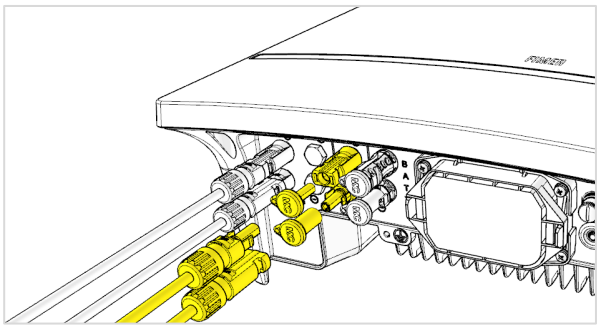


The cable routing must be done to avoid damage at the connector and to ensure IP65 protection degree (minimum 20 mm of straight cable).




## 5.5.3 Connection of DC inputs

Connect all the strings required by the system by pushing the MC4 connectors in the right position.



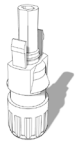
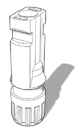
**WARNING** - Do not use the connectors reserved for the battery to connect the DC inputs.

**WARNING** - Check that protective caps are installed on unused connectors. This is necessary for the inverter seal and to avoid any damage to the unused connectors which may be used later.

**WARNING** - The MC4 connectors must be properly installed. After the installation make sure the connectors are correctly locked through the clips.

**NOTE** - For proper sizing of the PV system, it is recommended to use calculation software configured according to the technical parameters specified in the product documentation.

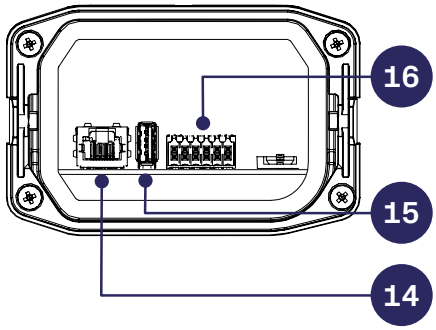
### 5.5.4 MC4 connectors (PV inputs)

| DESCRIPTION | POLARITY | COLOR (cable) | BRAND | Serie | Article/type | ratings | image |
|---|---|---|---|---|---|---|---|
| Female MC4 cable connector | (+)<br>IN1+<br>IN2+ | ROSSO | Staubli | **MC4** original | 32.0014P0001-UR<br>PV-KBT4/6I-UR<br>82000005549-G<br>(CAD 10019335) | 1100 Vdc<br>39 A |  |
| Male MC4 cable connector | (-)<br>IN1-<br>IN2- | NERO | Staubli | **MC4** original | 32.0015P0001-UR<br>PV-KST4/6I-UR<br>82000005550-G<br>(CAD 10019346) | 1100 Vdc<br>39 A |  |

## 5.6 Communication and control signals connection

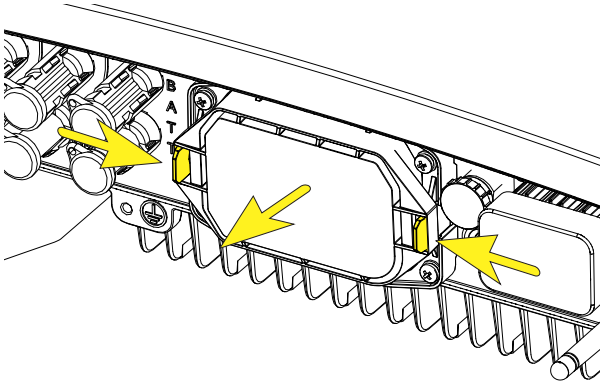
The communication and control signals cables must be connected to the dedicated connectors placed on the bottom side of the inverter:

- Ethernet connector **(14)**.
- USB connector **(15)**.
- Smart port **(16)**.

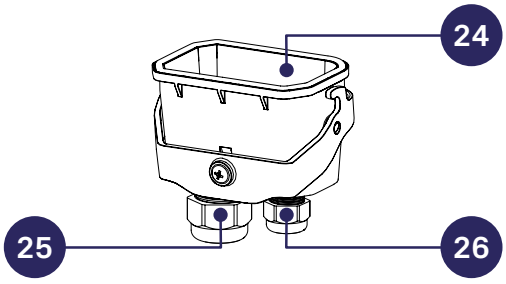



To access the connectors the protective cap must be removed.

Press the two locking tabs to unlock cap and remove it from the inverter.

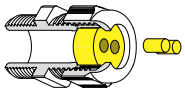



Before being connected, the cables must be passed through the cable glands of the Hypercap **(24)**:



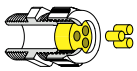

- Connectivity cable gland M25 **(25)**.

This M25 cable gland is equipped with a two-holes gasket. Each hole can accept a cable with a diameter with a suggested diameter in the range of **3.5 to 5.5 mm**.



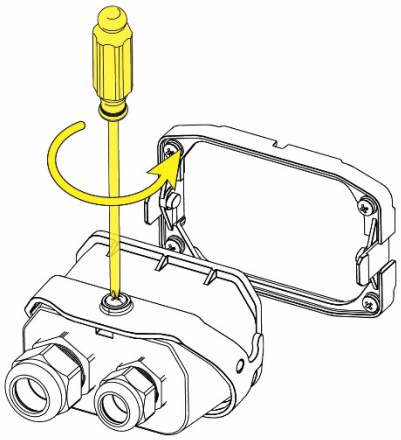
- Connectivity cable gland M20 **(26)**.

This M20 cable gland is equipped with a three-holes gasket. Each hole can accept a cable with a diameter with a suggested diameter in the range of **3.5 to 4.5 mm**.

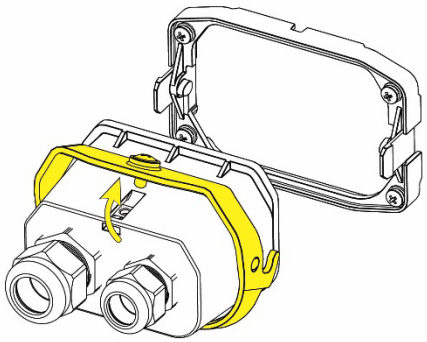


### 5.6.1 Hypercap installation

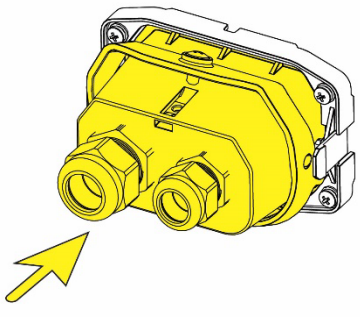
Unscrew the leverage system of the Hypercap **(24)**.



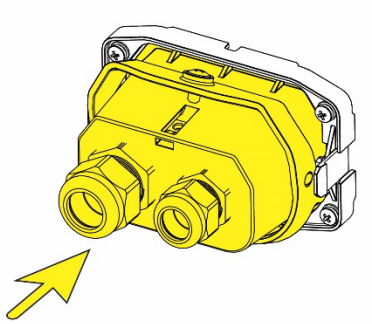
Open the leverage system.



Place the Hypercap **(24)** in the inverter housing.



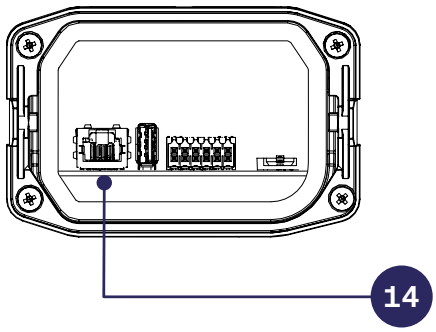
Close and secure the Hypercap **(08)** by screwing the leverage system (0.55Nm)



## 5.6.2 Ethernet connection

The Ethernet connection allows a direct data transfer to the Fimer server for monitoring purpose. When the inverter will be powered on, network parameters are automatically set, and the inverter starts the transmission of telemetry data to the Aurora Vision® CLOUD platform.

**Ethernet port**




### 5.6.2.1 Ethernet cable specification

The cable should be compliant to the following specification:

| Ethernet cable specification | |
|---|---|
| Cable category | CAT5, CAT5e or CAT6 (or higher) (1) |
| Cable shielding | - SF/UTP total braid and foil shield, no shielding of the twisted pair.<br>- SF/FTP total braid and foil shield, with twisted pair shields (preferable) |
| Type of plug | Metallic shielded RJ45 plug. |
| Maximum cable length | 100 m |
| Shield Grounding | Proper grounding requires to connect the Ethernet cable's shield to inverter chassis on both sides. This is done adopting shielded cables with metallic shielded RJ45 plugs. (2) |

1. Max line length between two network nodes, depends on what type of cable is used:

• 100m using rigid cables.

• 50m using patch cables.

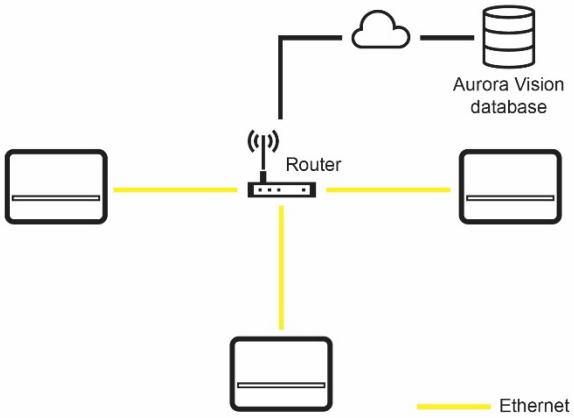
2. Ensuring a proper metallic continuity between cable and plug shields for the best performance.

It is always recommended not to let ethernet cables pass by the power cords to avoid interference with data transmission.

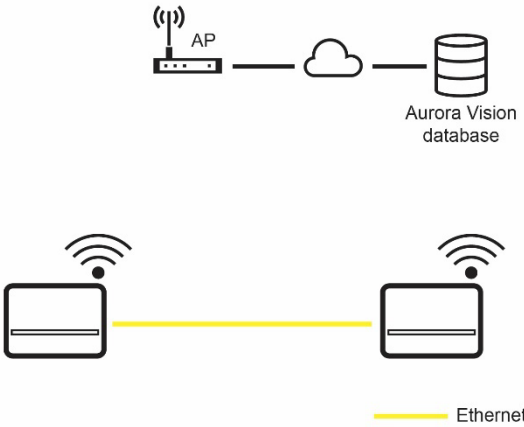
For outdoor application and/or in presence of adverse weather/strong electromagnetic events it is advisable to use additional overvoltage protective devices.

### 5.6.2.2 Ethernet system configuration

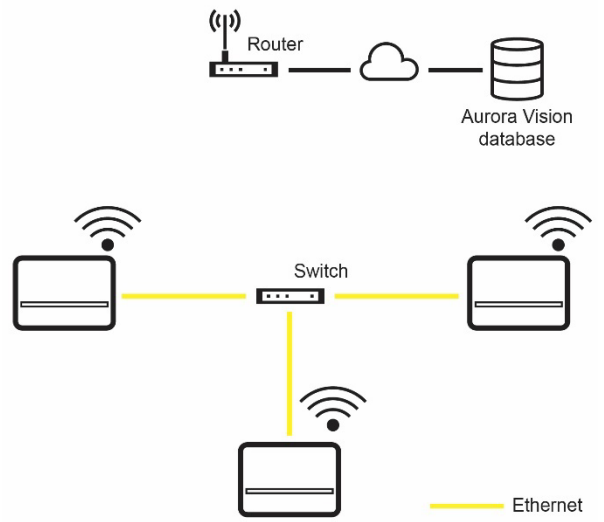
Star configuration: the ethernet cable, of one or more inverters, could be connected directly to a router or a switch.




Mixed configuration (2 inverters): inverters connected to each other via ethernet and to a router via Wi-Fi.




Mixed configuration (multi-inverters): inverters connected to each other via ethernet and to a router via Wi-Fi.




**NOTE** - For further information on the Ethernet connection refer to the Local Area Network standard IEEE802.3

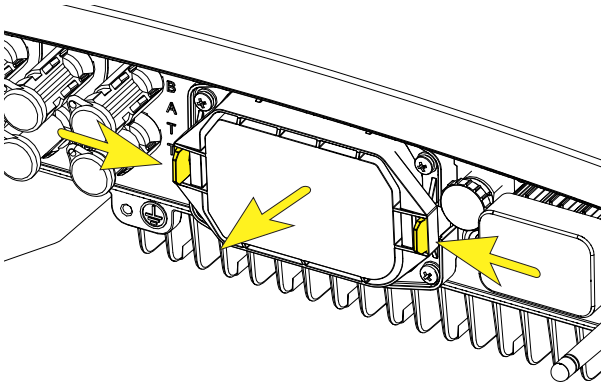
**NOTE** - No initial setup is required to start data transmission to Aurora Vision.

**NOTE** - Internet connection is required to use all the Aurora Vision remote functionalities.

**NOTE** - Please refer to Aurora Vision documents available on Fimer website for further information how to get an Aurora Vision account for remotely monitoring and managing the installed solar assets.

#### 5.6.2.3 Ethernet cable connection procedure:

Press the two locking tabs to unlock cap and remove it from the inverter.



Unscrew and remove the connectivity cable gland M25 **(25)** ring.

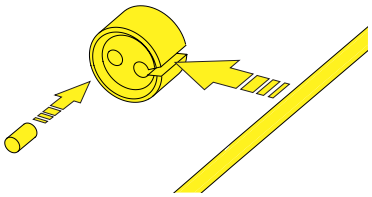
Remove the two-holes gasket from the gland **(25)**.

Remove one plug (plastic cylinder) from the two-holes gasket.

Insert the cable through the connectivity cable gland M25 **(25)** ring.

Route the ethernet cable through the two-holes gasket and reinstall it inside the cable gland.

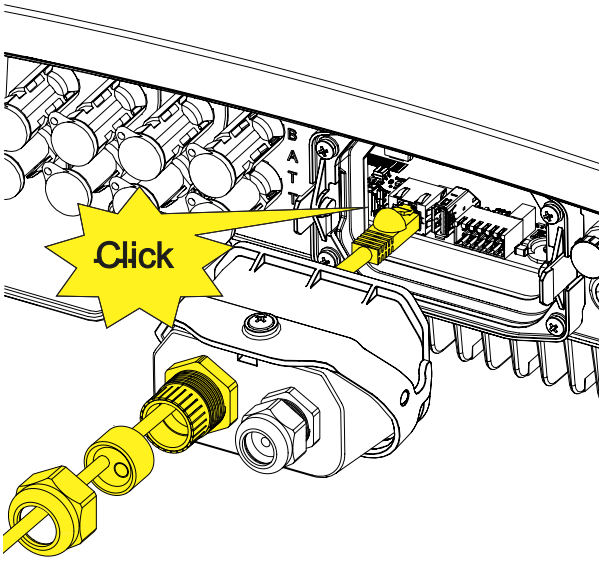
If the cable used already has a connector installed, it is necessary to make a cut in the gasket corresponding to the hole chosen for the cable passage.



Check that in any unused hole of the gasket is installed the plastic plug (supplied)

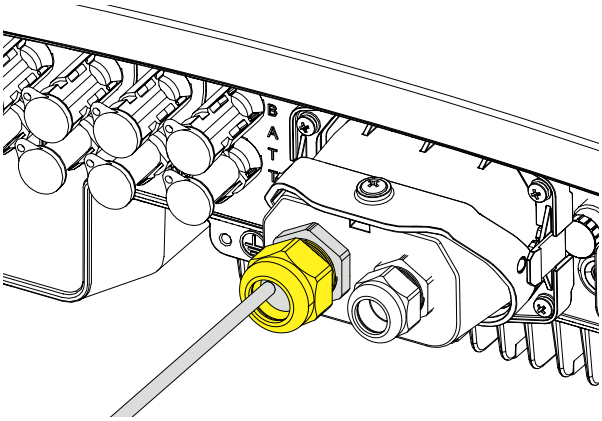
Reinstall the cable gland ring without firmly tighten it.

Connect the cable on the ethernet connector **(14)**.




Install the Hypercap **(24)** (see "Hypercap installation").

Firmly tighten the connectivity cable gland M25 **(25)** ring (see paragraph 3.5.2)



### 5.6.3 Multi-signal connection

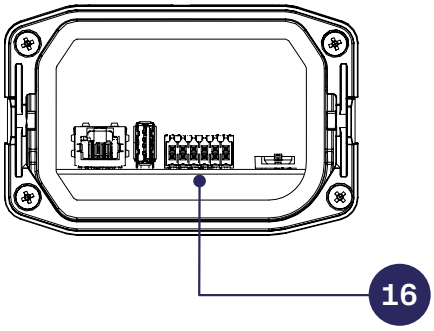
The multi-signal connector **(16)** can be used for the connection of:

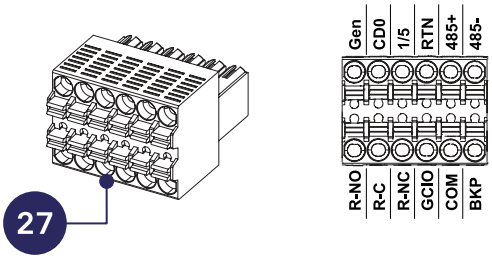
- DRM0 or remote ON/OFF
- DRM1
- DRM5
- RS-485

- Backup external control
- Load manager relay

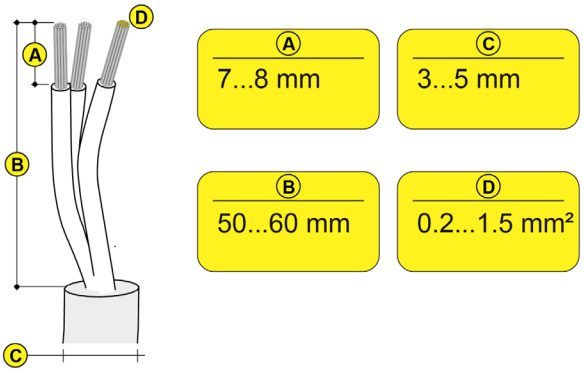
**NOTE** - The enabling or setting of the functionality connected must be set via the WEB UI.

The connection of the cable must be made on the specific multi-signal connector **(16)** (located on the bottom side of the inverter) using the smart plug **(27)**.



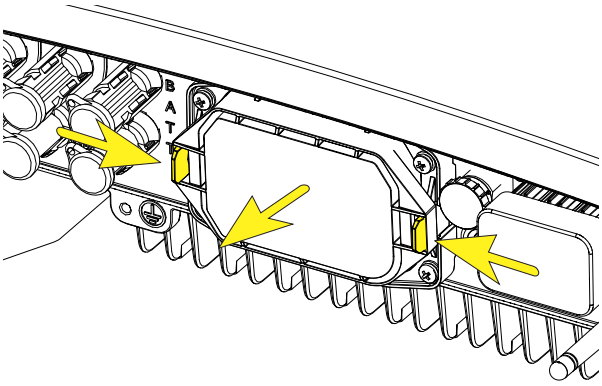




Since these are digital inputs, there are no requirements to be observed as regards cable cross-section (it only needs to comply with the sizing requirement for passing cables through the connectivity cable gland M20 **(26)** and the terminal connector).




### 5.6.3.1 Multifunction cable connection procedure:

Press the two locking tabs to unlock cap and remove it from the inverter.



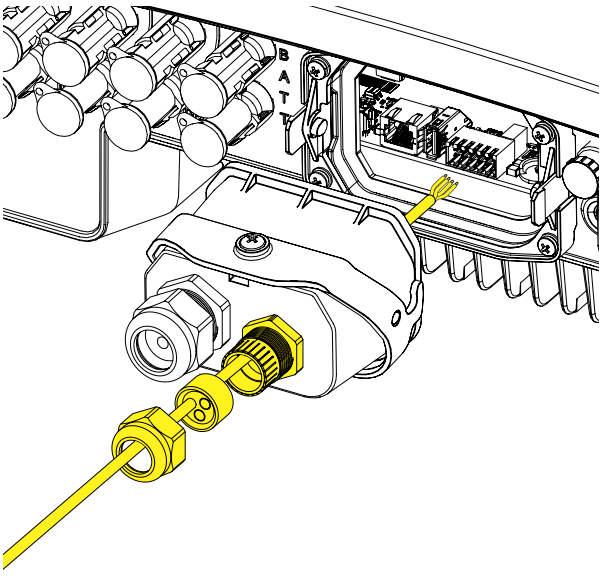

Unscrew the Connectivity cable gland **(26)** ring.

Remove the three-holes gasket from the gland **(26)**.

Remove one plug (plastic cylinder) from the three-holes gasket.

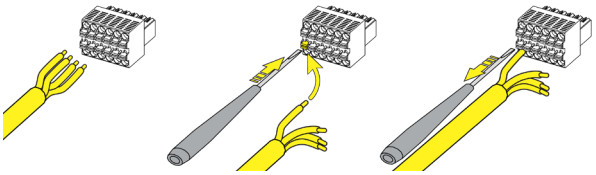
Insert the cable through the connectivity cable gland M20 **(26)** ring.

Route the multifunction cable through the three-holes gasket and reinstall it inside the cable gland **(26)**.




Check that in any unused hole of the gasket is installed the plastic plug (supplied)

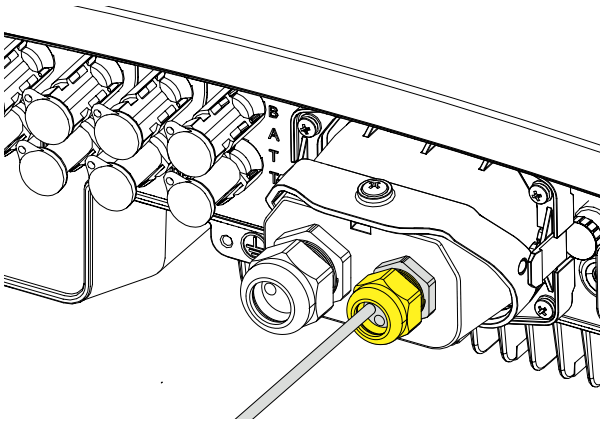
- Install the wires on the smart plug **(27)** (supplied).
- Open the internal spring by pressing on the clip with a flat screwdriver and insert the wire.
- Remove the flat screwdriver to close the internal spring and install the wire.



Connect the wired smart plug **(26)** to the multi-signal connector **(16)**.

Install the Hypercap **(24)** (see "5.6.1 Hypercap installation").

Firmly tighten the connectivity cable gland M25 **(25)** ring (see paragraph 3.5.2)



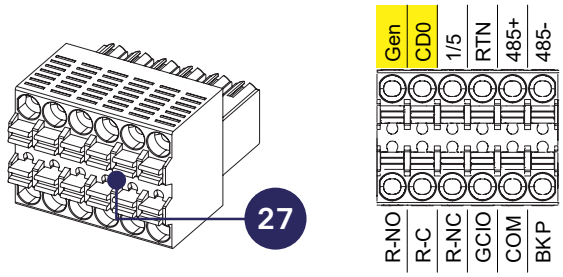

#### 5.6.3.2 Remote ON/OFF

The remote ON/OFF functionality is useful to manage remotely the connection and disconnection of the inverter from the grid.

The function must be enabled via the WEB UI and:

- If the remote-control function is disabled, the inverter switching on is dictated by the presence of the normal parameters that allow the connection to the grid.
- If the remote-control function is ON, besides being dictated by the presence of the normal parameters that allow the connection to the grid, the inverter switching on also depends on the state of the Gen and CD0 terminals of smart plug **(27)**.

**NOTE** - The remote ON/OFF function is enabled by default.




When Gen and CD0 terminals are brought to the same potential (i.e. by using a switch to make a short circuit between the two terminals), the inverter disconnects from the grid.

**NOTE** - The external switch used for Remote ON/OFF should be rated for DC low voltage, low current application (the minimum switching current capability should be 1mA or lower).

**NOTE** - The remote ON/OFF and the DRM0 command use the same connection terminals and therefore can be used alternatively. The desired function must be set via the WEB UI

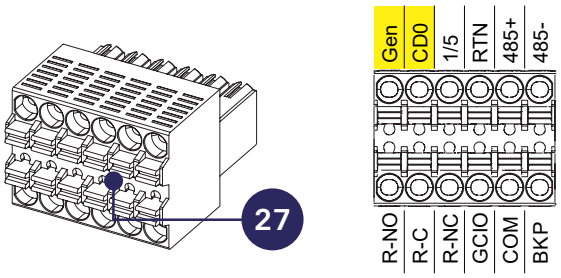
#### 5.6.3.3 Demand Response (AS/NZS 4777.2)

The Demand Response (DRM0/1/5) functionality could be requested by the AS/NZS 4777.2 standard.

**DRM0**

This functionality operates the disconnection of the inverter to the grid.

Connect the command signal between Gen and CD0 terminals of smart plug **(27)**.

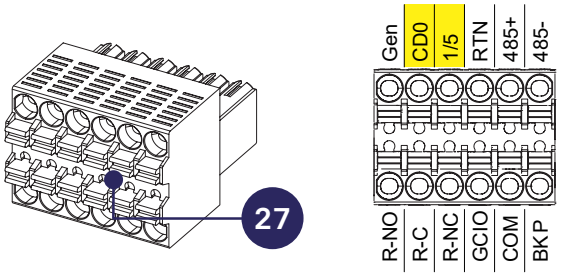



**NOTE** - The DRM0 command and the remote ON / OFF use the same connection terminals and therefore can be used alternatively. The desired function must be set via the WEB UI

**DRM1**

This functionality forces the inverter to not consume power from the grid.

Connect the command signal between 1/5 and CD0 terminals of smart plug **(27)**.

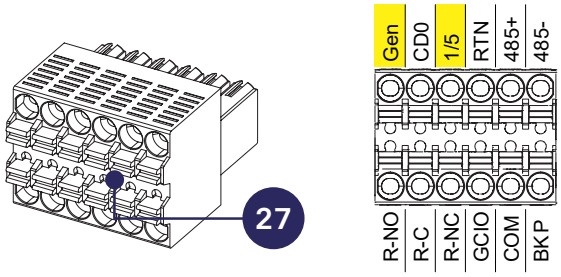



**NOTE** - The DRM1 functionality is not implemented at the software level and is reserved for future use.

**DRM5**

This functionality forces the inverter to not inject power to the grid.

Connect the command signal between 1/5 and Gen terminals of smart plug **(27)**.




#### 5.6.3.4 RS-485 serial communication line

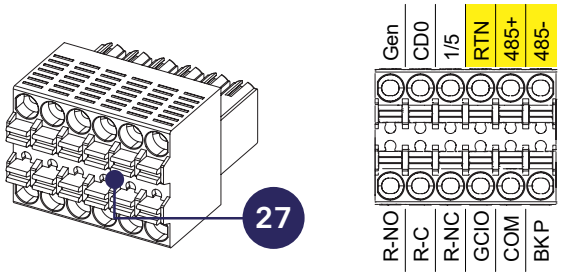
The RS-485 line can be used for connection of supported external devices:

- Meter
- VSN800 Weather Station.

**NOTE** - When an accessory is connected to the RS-485 line it must be added and configured into the "Connectivity → Additional devices" menu on the WEB UI.

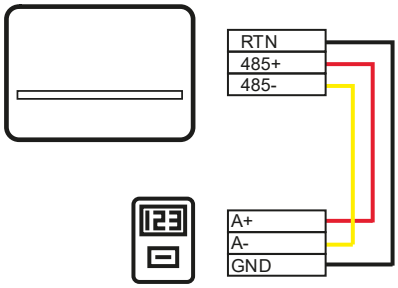
**NOTE** - Currently, **the RS485 bus can support only one additional device**.

The RS-485 serial communication line is available on the smart plug **(27)** terminals 485+, 485-, RTN.




| | Signal | Symbol |
|---|---|---|
| | Positive data | 485+ |
| | Negative data | 485- |
| | Reference | RTN |

**NOTE** - Use a shielded twisted pair cable with characteristic impedance of Z0 = 120Ω in case of long-distance connection.




**NOTE** - The RS-485 line must be terminated (120 Ω termination resistor) on the last element of the chain.

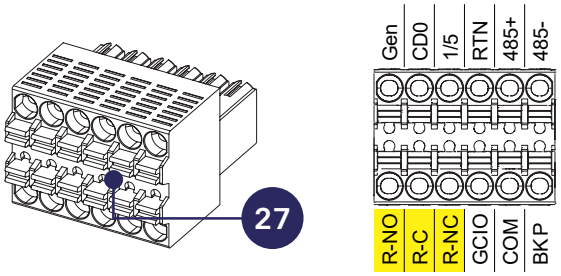
#### 5.6.3.5 Load manager relay

A load manager has the main objective of increasing direct self-consumption from renewable sources. The operating modes of the digital outputs vary according to the configuration of the system and therefore to the presence of the meter and / or battery. The options available are:

| Operating mode | Meter | No Meter | Meter + Battery |
|---|---|---|---|
| Solar production | √ | - | - |
| Self-consumption boost | - | √ | √ |
| Self-consumption boost preserving battery | - | - | √ |
| Low priority load disconnection | - | √ | √ |

The operating mode must be enabled and configured via WEB UI.

The Load manager relay is available on the smart plug **(27)** terminals R-NC, R-C, R-NO:



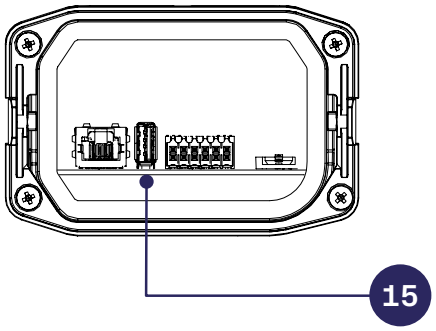

| Terminal | Description |
|---|---|
| R-NC | Normally close contact |
| R-C | Common |
| R-NO | Normally open contact |

### 5.6.4 USB port connection

The type A USB port **(15)** can be used for the connection of accessory device.

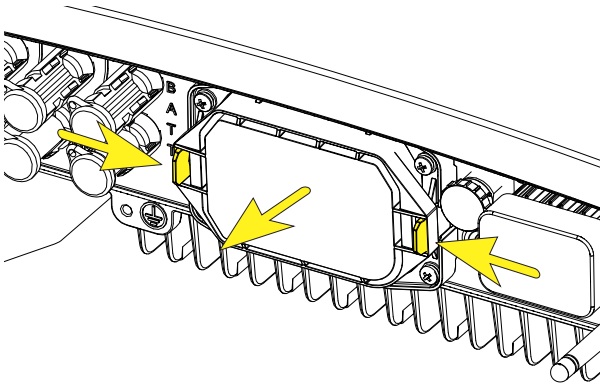
Visit www.fimer.com for availability of accessory device.

The connection cable of the accessory device must be passed through the connectivity cable gland **(26)** of the Hypercap **(24)**:



#### 5.6.4.1 USB port cable connection procedure:

Press the two locking tabs to unlock cap and remove it from the inverter.



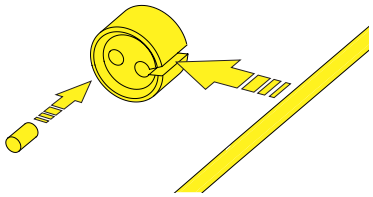

Unscrew and remove the connectivity cable gland M25 **(25)** ring.

Remove the two-holes gasket from the gland **(25)**.

Remove one plug (plastic cylinder) from the two-holes gasket.

Insert the cable through the connectivity cable gland M25 **(25)** ring.

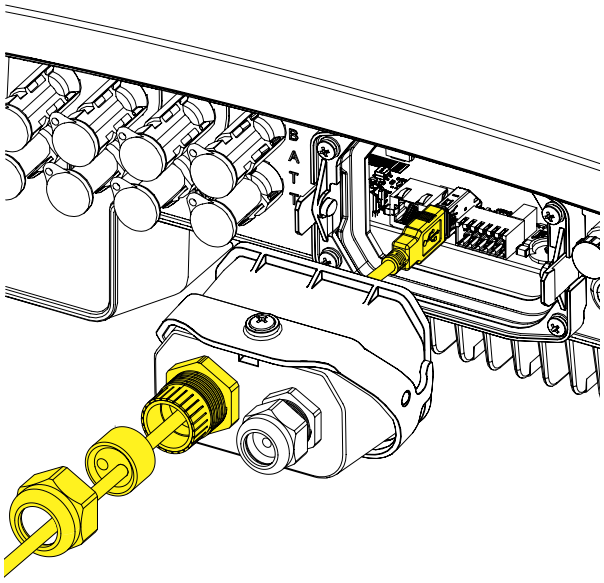
Route the multi-signal cable through the two-holes gasket and reinstall it inside the cable gland.



Check that in any unused hole of the gasket is installed the plastic plug (supplied)

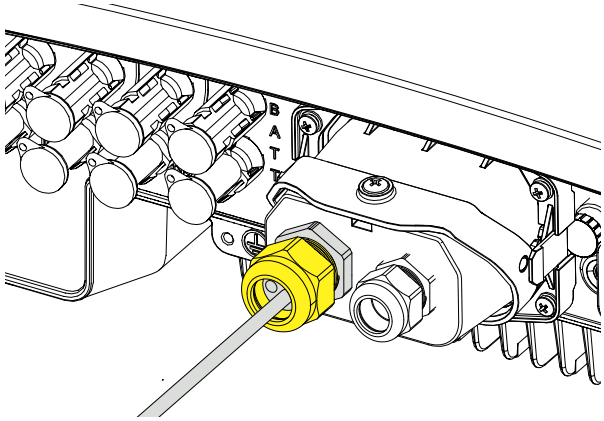
Reinstall the cable gland ring without firmly tighten it.

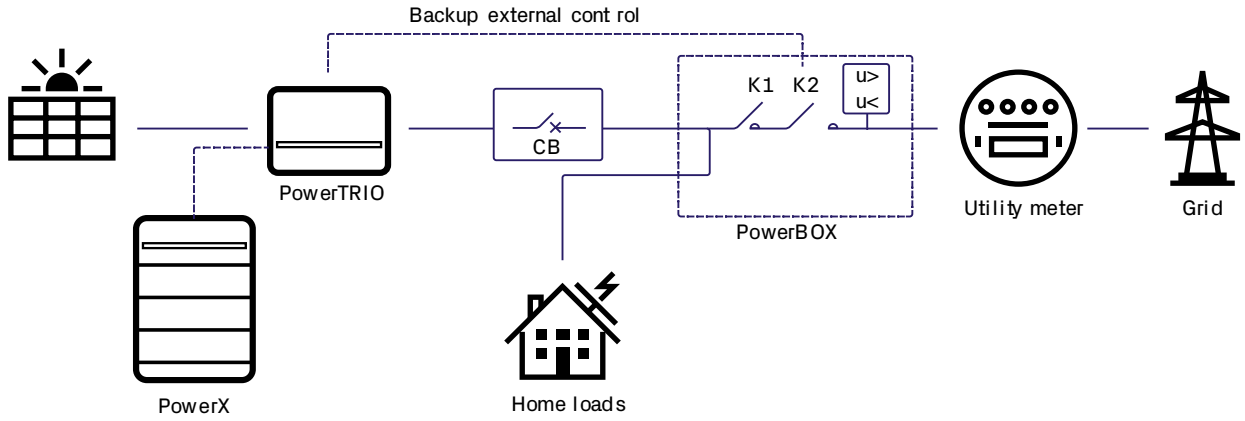
Connect the cable on the USB plug **(15)**.




Install the Hypercap **(24)** (see "5.6.1 Hypercap installation").

Firmly tighten the connectivity cable gland M25 **(25)** ring (see paragraph 3.5.2).






## 5.7 AC BACKUP Mode

⚠ **WARNING** - To avoid risks of electrical shock, all wiring operations must be carried out with the disconnect switch downstream of the inverter (grid side) opened and disconnect the DC side and open the PowerX switch when working on the AC wiring. Applying LOTO procedure on it. Be careful not to mistakenly exchange the phases with 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.

### 5.7.1 AC Backup

PowerTRIO is capable of operating while connected to the electrical grid and of powering critical loads in island mode in case of blackouts or off-grid installation through the AC GRID port **(21/22)**.

In any case, the inverter's earth (PE) connection is mandatory.

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.

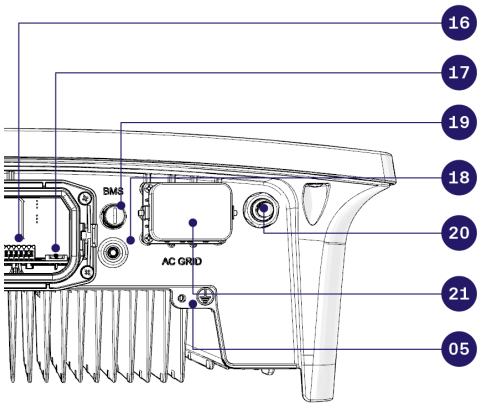
In general terms, the AC backup and off-grid operating modes are also referred to as stand-alone mode. In stand-alone mode, the inverter is capable of supplying both linear and non-linear loads, provided that the power drawn does not exceed the maximum allowable power per phase.

For example, in the case of the FIM-HY-10.0-SE-A-3PH inverter, the maximum apparent power output is 10 kVA in three-phase operation, and 3.3 kVA per single phase. For the inverter to supply the connected loads, sufficient power must be available from the solar source and/or the battery.

The stand-alone operating mode must not be used to supply critical loads, such as medical devices intended to support human life. When sizing loads for stand-alone operation, it is essential to allow a margin below the rated maximum power, to prevent shutdowns caused by overloads, such as those due to heavy inrush currents or temporary energy shortfalls.

It is also very important to consider the nature of the loads. PowerTRIO is equipped with an internal neutral-point balancing device. The inverter's internal neutral point can become unbalanced due to the characteristics of the connected loads. For instance, a unidirectional load composed of a diode and a resistor causes current to flow only during the positive half-cycle of the voltage waveform, resulting in asymmetric current draw that contributes to the neutral-point imbalance.

The integrated hardware balancer in PowerTRIO can correct such imbalances up to a maximum of 2.5 A RMS.




### 5.7.2 Precautions for Island Mode Operation

For operating in backup mode, it is necessary to refer to the existing regulations in the country of installation; a minimum set of requirements includes:

Interlock: the user must install a suitable interlock between the inverter and any switch with the characteristics and functions required to separate the part of the system consisting of the inverter and the critical loads from the electrical grid during islanded operations.

**WARNING** - It is necessary to install a notice indicating that the plant has an emergency power supply.

Neutral State Considerations: The user must also take appropriate precautions considering the possible changes to the neutral state of the network when operating in island mode.

These set of requirements are fulfilled by our PowerBOX.

### 5.7.3 Load protection breaker (AC disconnect switch)

To protect the AC grid connection line of the inverter (ref. 22 page 16), 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):

| **Load protection breaker** | | |
|---|---|---|
| Type | Automatic circuit breaker with thermal-magnetic protection | |
| Voltage/current rating | FIM-HY-4.0 | 400Vac min. 10A (*) |
| | FIM-HY-5.0 | 400Vac min. 10A (*) |
| | FIM-HY-6.0 | 400Vac min. 10A (*) |
| | FIM-HY-7.5 | 400Vac min. 16A (*) |
| | FIM-HY-8.0 | 400Vac min. 16A (*) |
| | FIM-HY-8.5 | 400Vac min. 16A (*) |
| | FIM-HY-10.0 | 400Vac min. 20A (*) |
| Magnetic protection characteristic | Magnetic curve B/C | |
| Number of poles | 3W (3 phases without neutral wire) | |
| | 4W (3 phases with neutral wire) | |

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

### 5.7.4 Differential protection downstream of the inverter

The residual current protection device, this shall meet the following characteristics to prevent nuisance tripping due

| Residual current protection device requirements | All PowerTRIO models |
|---|---|
| Type | A / AC |
| Sensitivity | 300 mA |

**NOTE** - For protection of the AC line, based on the information above about the differential protection integrated in MA Solar Italy inverters, it is not necessary to install a type B ground fault switch.

**NOTE** - In accordance with article 712.413.1.1.1.2 of Section 712 of IEC Standard 64-8/7, we hereby declare that, because of their construction, MA Solar Italy inverters do not inject ground fault direct currents.

**NOTE** - In the case of systems which consist of several inverters connected to a single switch with differential protection, it is recommended to install a device which allows the adjustment of the tripping value and the tripping time.

### 5.7.5 Characteristics and sizing of the backup line cable

The same prescriptions as those in paragraph 5.4.5 apply.

### 5.7.6 AC cables connection

The same prescriptions as those in paragraph 5.4.7 apply.

### 5.7.7 Connection 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:

| Terminal | Description |
|---|---|
| BKP | Backup mode inhibition |
| GCIO (+12V) | Grid Connection Inhibition Output (+12V) |
| RTN | Common return path |

**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.

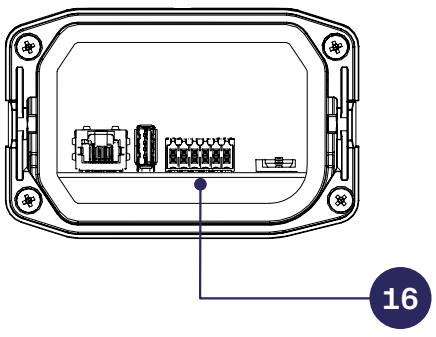
When the signal is floating (HIGH) the backup is inhibited.

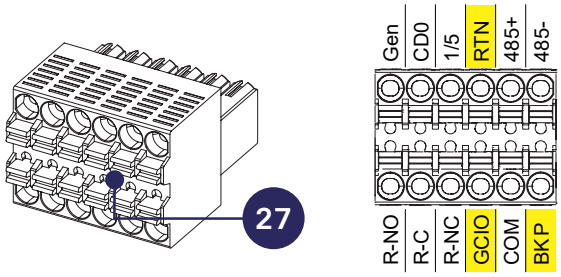
**+12V: grid connection inhibition**

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.






## 5.7.8 Transition from on-grid operation to operation in backup mode

1. The public grid is monitored through the network and plant protection integrated into the inverter and an external voltage relay (U1) installed in the external panel (from now on the external panel will be called PowerBOX).

2. If the public grid experiences a fault or if various grid parameters are not met or exceeded, the voltage relay (U1) installed in the PowerBOX disconnects the grid interface (K1-K2) and enables the backup mode (BKP signal goes LOW). In the PowerBOX the line neutral, on the inverter side, is connected to PE.

3. The inverter disables the grid interface reclosing through the GCIO +12V signal that goes ON and after a self-check, starts operating in emergency power mode.

4. All household loads connected to the emergency power circuit are powered by the inverter from battery and solar modules. Other loads are not powered and are safely disconnected.

## 5.7.9 Transition from operation in back-up mode to on-grid operation

1. The inverter operates with backup power, in the PowerBOX the grid interface (K1-K2) is open. The line neutral on the inverter side, is connected to PE.

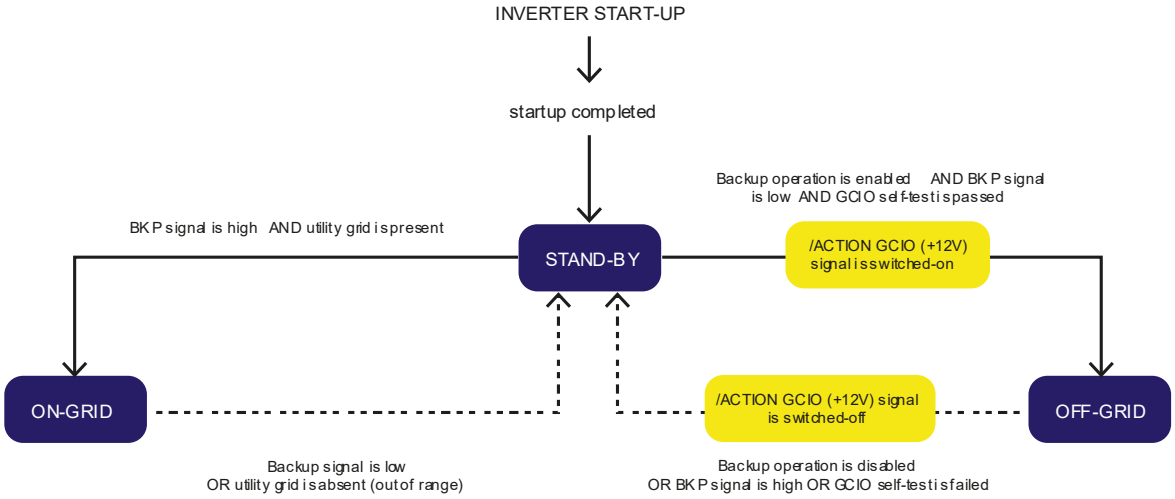
2. The public grid is functioning correctly again.

3. The voltage relay (U1) checks the parameters of the public grid and transmits the grid OK information to the inverter, inhibiting the backup circuit (BCK signal goes HIGH).

4. The inverter interrupts the backup operational mode, suspends the power supply, and grants permission for the reclosure of the grid interface (K1-K2) of the PowerBOX (the GCIO +12V signal goes OFF). The line neutral on the inverter side, comes back to its default state.

5. All electrical circuits are reconnected to the public grid and are supplied by the grid.

6. After the network checks required by the regulations, the inverter can resume operation with grid power.



## 5.8 Off-grid installation

A system that is “off-grid” is one that operates independently from the main electricity grid; when PowerTRIO is installed in off-grid systems and parallel operation with the electrical grid or other AC sources is not feasible, the installation of a PowerBOX is not necessary.

The operational mode of the inverter in off-grid systems is referred to here as “stand-alone” mode. In this case, PowerTRIO acts as an AC voltage source, relying on PV modules and batteries for energy.

Off-grid systems must adhere to the local regulations in the country of installation; this document does not replace any locally applicable standards or directives.

### 5.8.1 Load protection AC breaker (AC disconnect switch)

The same prescription as in 5.7.3 applies.

### 5.8.2 Differential protection downstream of the inverter

The same prescription as in 5.7.4 applies.

Characteristics and sizing of the inverter line cable

The same prescription as in 5.4.5 applies.

### 5.8.3 AC cables connection

The same prescriptions as those in paragraph 5.4.7 apply.

### 5.8.4 Neutral point of the inverter grounding

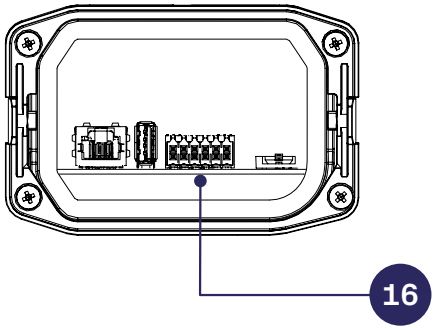
Grounding serves to protect individuals in all grid configurations. It ensures that no hazardous voltages appear on exposed parts during fault conditions. It's essential that there is minimal resistance between the grounding electrode and the earth in every grid setup.

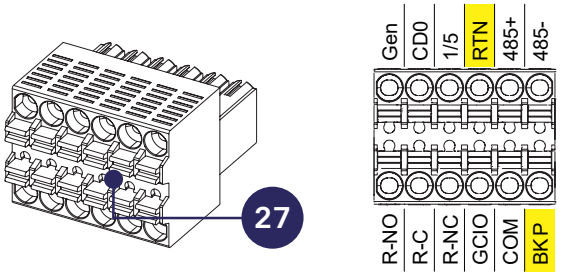
PowerTRIO can operate in TN and TT systems, and the TN-S system is the preferred grid configuration for a new off-grid system.

Use a suitably rated and insulated conductor to connect the neutral point of the inverter to the earth busbar. Ensure the connection is secure and meets local electrical codes and standards.

When using an RCD, ensure that it is properly installed in the distribution board. The RCD should be positioned so that it will monitor the connection between the neutral and the live conductors, so the neutral must be connected to ground on the inverter side, before the RCD.

### 5.8.5 Connection Terminal Signals




To enable the off-grid operational mode, short BKP and RTN terminals of the terminal block **(27)**:

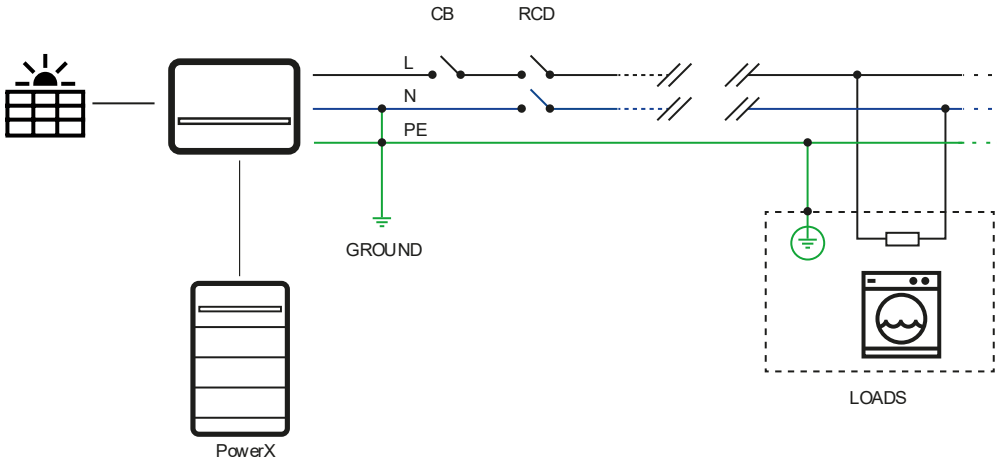
| Terminal | Description |
|---|---|
| BKP | Backup mode inhibition |
| RTN | Common return path |

⚠ **WARNING** - Do not short-circuit BKP and RTN in the case of operation in parallel with the electrical grid. In this case, if backup mode is activated, refer to paragraph 5.7 “**AC BACKUP Mode**”.

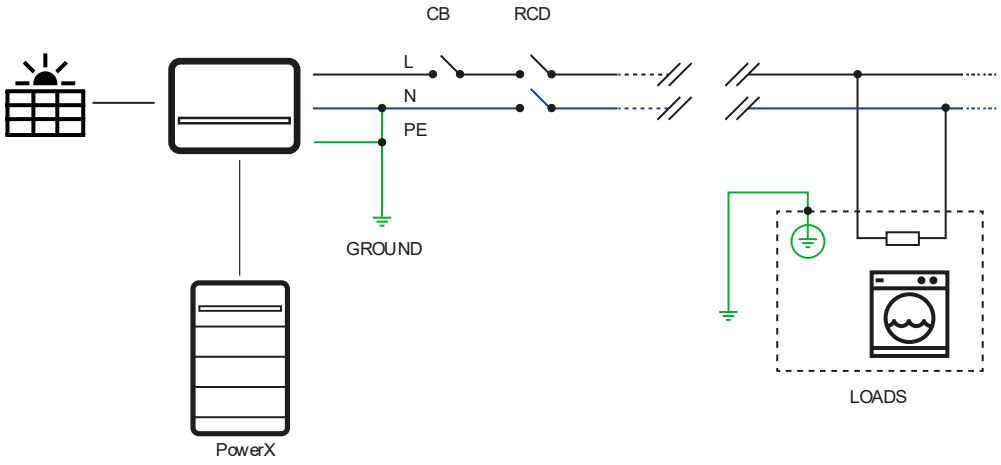
### 5.8.6 Enable the stand-alone operation mode though the WEB UI

To enable the stand-alone operational mode, see paragraph 7 “**Operation**”.

### 5.8.7 Off-grid TN-S system




### 5.8.8 Off-grid TT system



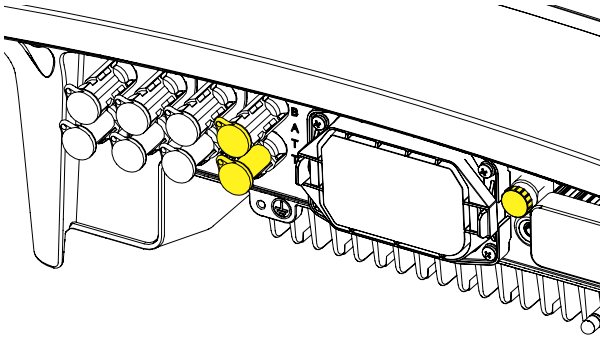
## 5.9 Battery (PowerX) connection

The connection of the PowerX (battery) must be made using:

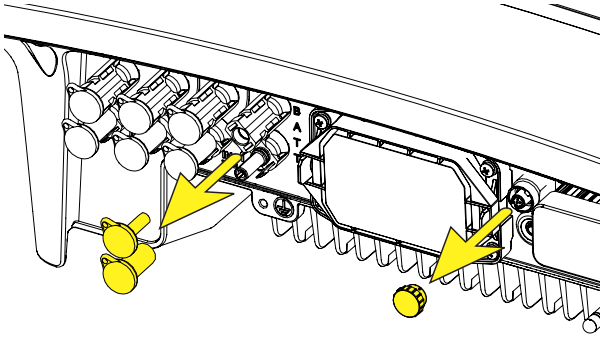
- Quick fit battery power connectors **(13)** for the power connection

- BMS connector **(19)** for the battery management signals

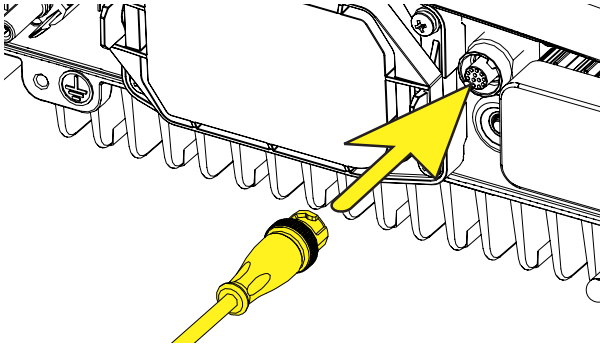
The cables are supplied with PowerX Genius box.



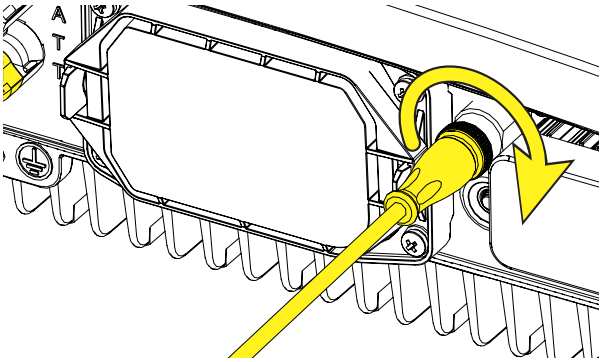
Remove the caps from the connectors



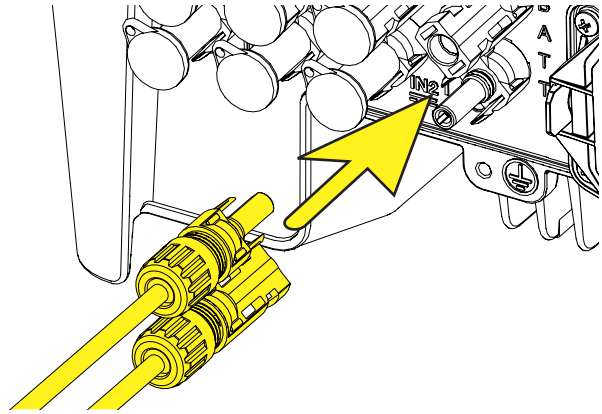
Connect the BMS cable **(28)**



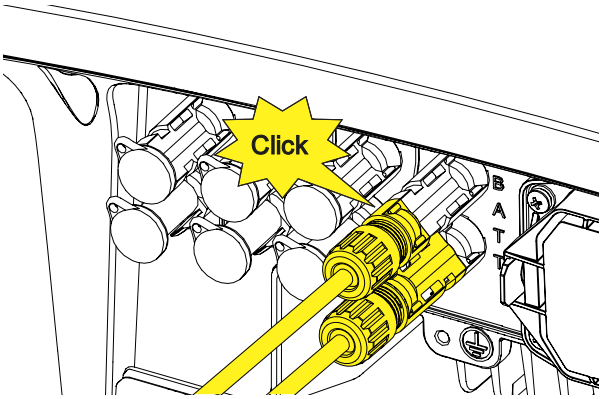
**NOTE** - Before connecting the cable to the inverter make sure it is connected to the battery (PowerX)



Connect the Battery power cable (23).



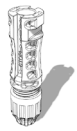
**NOTE** - Before connecting the cable to the inverter make sure it is connected to the battery (PowerX)




### 5.9.1 Battery Port Protection

The battery power connection is protected by a fuse (F1) located inside the inverter. In the event of failure, the fuse F1 may only be replaced authorized service personnel only qualified by MA Solar Italy (the users are not authorized to remove inverter front cover).

### 5.9.2 MC4-Evo stor connectors (battery port, inverter side)

| DESCRIPTION | POLARITY | COLOR (cable) | BRAND | Serie | Article/type | ratings | image |
|---|---|---|---|---|---|---|---|
| Female MC4 cable connector | (+)<br>BATT + | ROSSO | Staubli | MC4-Evo stor | 32.0262P0001<br>PV-KBT4-EVO ST/6I<br>ZES.01482<br>(CAD 10101598) | 1500Vdc<br>42 A (4 $mm^2$)<br>47 A (6 $mm^2$) |  |
| Male MC4 cable connector | (-)<br>BATT - | NERO | Staubli | MC4-Evo stor | 32.0263P0001<br>PV-KST4-EVO ST/6I<br>ZES.01483<br>(CAD 10101599) | 1500Vdc<br>42 A (4 $mm^2$)<br>47 A (6 $mm^2$) |  |

# 6 Instruments

## 6.1 General conditions

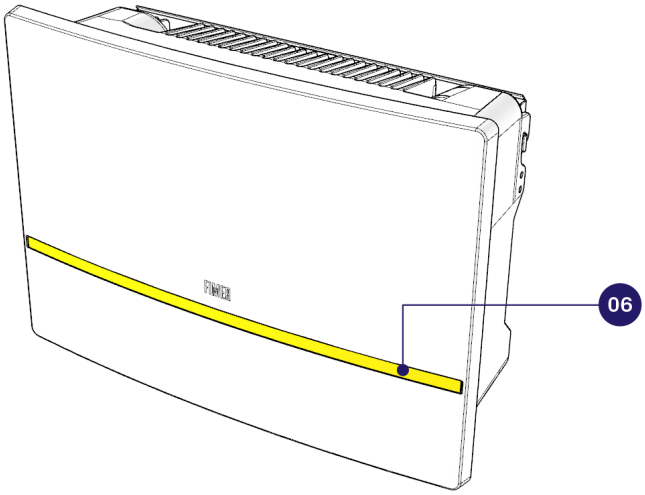
The first rule to prevent damage to the equipment and ensure operator safety is to have a thorough understanding of the instruments. Therefore, we recommend that you read this manual carefully. If you have any doubts about the information provided, please contact MA Solar Italy Service for further clarification.

Do not use the equipment if:

- you do not have suitable qualifications to work on this equipment or similar products.
- you are unable to understand how it works.
- you are not sure what will happen when the buttons or switches are operated.
- you notice any operating anomalies.
- there are doubts or contradictions between your experience, the manual and/or other operators.

MA Solar Italy cannot be held responsible for any damage to the equipment or to the operator resulting from of lack of knowledge, insufficient qualifications, or inadequate training.

## 6.2 Description of LED strip

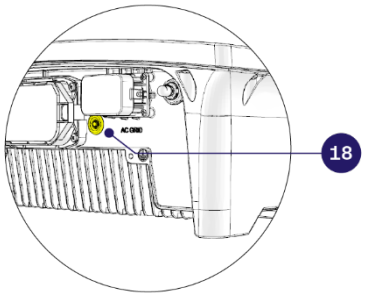



| | |
|---|---|
|  | **POWER**<br>Indicates that the inverter is functioning correctly.<br>When the unit is commissioned, while the grid is checked, this icon blinks. If a valid grid voltage is detected, the icon remains continuously lit, if there is sufficient sunlight to activate the unit. Otherwise, the icon will continue to blink until the sunlight is sufficient for activation. |
|  | **WLAN/LAN**<br>Indicates the status of the Wi-Fi or Ethernet communication lines. |
|  | **ALARM**<br>Indicates that the inverter has detected an anomaly. This type of problem is highlighted in the Web User Interface. |
|  | **GFI**<br>The “GFI” (ground fault) indicates that the inverter has detected a ground fault in the DC side photovoltaic generator. When this fault is detected, the inverter immediately disconnects from the grid. |

The icons, in various multiple available combinations, can signal multiple conditions other than the original single condition; see the various descriptions explained in the “**LEDs behaviour**” paragraphs on this manual.

## 6.3 Wi-Fi/AFCI button

The Wi-Fi/AFCI button is paced on the bottom side of the inverter.




This button allows the user (installer or homeowner) to:

- Enable the Wi-Fi access point by pressing the button for about 1 second (it will remain active if already enabled).
- Reset the ARC fault error by pressing the button for 5 seconds.

## 6.4 User interface

### 6.4.1 Fimer WEB UI

The Fimer WEB UI provides a comprehensive platform for managing your inverter, offering the following key functionalities:

1. Inverter Commissioning:

- Streamlined setup process to configure your inverter according to specific requirements.

- Step-by-step guidance for efficient and error-free commissioning.

- Accessible interface for adjusting parameters and settings to optimize performance.

2. Firmware Updates:

- Seamlessly update the inverter firmware to ensure compatibility with the latest features and enhancements.

- Simple interface for initiating and monitoring firmware update processes, minimizing downtime.

Experience intuitive control and efficient management of your inverter system through the versatile features of the Fimer WEB UI.

### 6.4.2 Aurora Vision®

Integrated logging capability allows remote monitoring of the plant without the needs of any additional external loggers.

Aurora Vision is a cloud-based platform enabling remote monitoring and asset management of MA Solar Italy devices in range of solar power application.

Aurora Vision consists of two different products, designed to meet different market needs, an APIs Service (RESTful architecture) to enabled third party data integration and a KIOSK view to show publicly solar plant benefits and performances:

Plant Portfolio Manager. An advanced professional web-portal that allows stakeholders (such as installers/operators/managers) to monitor and control fleets of photovoltaic systems installed for final customers.

Energy Viewer. A smart and easy-to-use mobile app for monitoring the main power generation and self-performances indicators, for owners of residential and commercial PV plants, to keep energy use and savings in check.

APIs Service. Harness the power of data from MA Solar Italy photovoltaic systems to design solutions and provide opportunities.

KIOSK View. A public and customizable web page based on HTML5 (self-updating and embeddable in external frames) to show the benefits and performances of a solar power plant.

## 6.5 Measurement tolerance

The data supplied by the inverter may differ from measurements taken by certified measuring instruments (e.g. output meters, mustimeters and grid analysers); since the inverter is not a measuring instrument it has wider tolerances for the measurements it makes.

The tolerances are generally:

- ±5% for real-time measurements with output power below 20%
- ±3% for real-time measurements with output power above 20%
- ±4% for all statistical data.

# 7 Operation

## 7.1 General conditions

Before performing any operation on the equipment, it is essential to thoroughly understand the "**Instruments**" chapter and the functions that may have been enabled during the installation process. The equipment operates automatically without the need for an operator; its operating state should be monitored through the equipment's instrumentation.

⚠ **ATTENTION** - The interpretation or variation of some data is reserved exclusively for specialized and qualified staff.

During operation, ensure that environmental and storage conditions have remained constant over time and that the equipment is not exposed to adverse weather conditions (refer to the "Installation" chapter)

## 7.2 Commissioning (Via internal Web User Interface)

⚠ **WARNING** - Qualified person required.

Inverter commissioning is the process of configuring and starting up the inverter after installation to ensure it runs correctly according to specifications. It involves checking connections, configuring parameters, and performing tests to ensure the inverter runs efficiently and safely.

⚠ **ATTENTION** - Inverter operations cannot start without commissioning it.

Commissioning is preferably done via a wireless connection to the inverter's internal web interface, using a smartphone or a notebook. The configuration wizard has 5 simple steps, 2 optional.

⚠ **WARNING** - Do not place objects of any kind on the inverter during operation! Do not touch the heat sink while the inverter is operating! Some parts may be very hot and could cause burns.

⚠ **WARNING** - Before proceeding with commissioning, ensure that all checks and verifications outlined in the section on preliminary checks have been completed.

**After completing installation and checks, switch ON in order:**

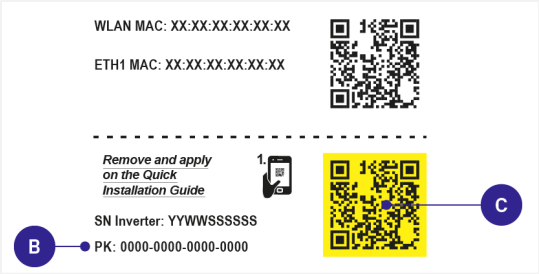
- **The PowerX battery DC switch (if present).**
- **The inverter DC switch.**
- **The inverter line AC circuit breaker.**

⚠ **ATTENTION** - With DC supply, make sure that the irradiation is stable and adequate for the inverter commissioning procedure to be completed

Once supplied, the inverter may take a few minutes to be ready. The LED STRIP shows that the inverter is ready; in the pre-commissioned state the led are as follow:

**NOTE** - In the pre-commissioning phase:
- The **Alarm** YELLOW LED flashes rapidly.

### 7.2.1 Pre-commissioning phase 1 - Connection to the local Wi-Fi network




**NOTE** - The "**Communication Identification Label**" is located on the side of the inverter; this part of the label can be detached and placed in a more accessible location for later use, such as on the front cover of the quick installation guide.

Device used TABLET/SMARTPHONE:

- Once the inverter is powered, launch a QR reader for mobile and SCAN the QR code [C] marked with [1] symbol content on the "Wireless Identification Label".
- Connect to inverter network (tap connect). The name of the wireless network created by the system that the connection should be established with will be: **Fimer-YYWWSSSSSS**, where YYWWSSSSSS is the 10-digit inverter SN that can be found on the "Communication Identification Label".
- After this step wait 10 seconds to allow the WLAN connection.

Device used LAPTOP:

- Enable the wireless connection on the laptop which is being used for the board setup and connect it to the Access Point created by the inverter system: The name of the wireless network created by the system that the connection should be established with will be: **Fimer-YYWWSSSSSS**, where YYWWSSSSSS is the 10-digit inverter SN that can be found on the "Communication Identification Label".
- When prompted, type the "product key" [B] (including the dashes. Example: 1234-1234-1234-1234) as the network password to access the inverter's access point (AP). The product key is printed on the "Wireless Identification Label".

### 7.2.2 Pre-commissioning phase 2 – Internal WEB UI access

Device used TABLET/SMARTPHONE:

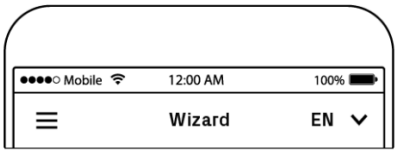
- SCAN the following QR code (it is also reported in the Quick installation guide and in the pre-commissioning flyer inside the box of the inverter):


Device used LAPTOP:

- Open an internet browser (recommended browser: Chrome versions from v.55, Firefox versions from v.50) and enter the pre-set IP address 192.168.117.1 to access the setup pages (web user interface).

### 7.2.3 Step by step commissioning wizard

The language of the wizard could be changed by clicking on the upper status bar.




#### 7.2.3.1 Step 1 (Optional) – Network connection

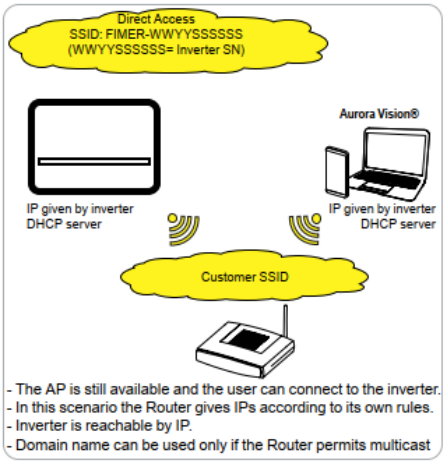
In this first step, you can configure the inverter's network interfaces.

**NOTE** - This step can be skipped and performed later via the web user interface (WEB UI).

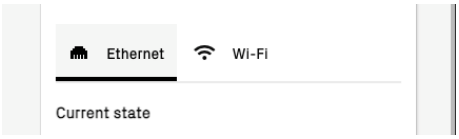
The inverter is equipped with an Ethernet LAN port and a Wi-Fi module that operates in two modes through two channels: "Station Mode" or "Access Point Mode" (also known as "AP Mode").

**NOTE** - By selecting the "**Skip**" button the second radio channel will be kept off and you will need to use a wired Ethernet daisy chain bus to allow the inverters to communicate with Aurora Vision.

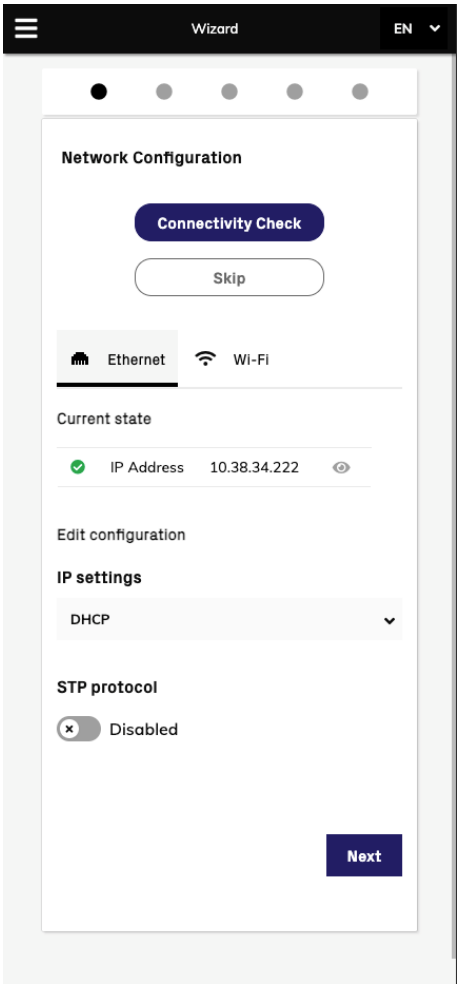
The label containing the connectivity information is described in section 3.2.2 and is provided here for convenience.




Choose the connection type (Ethernet or Wi-Fi) and set the related parameters.




Ethernet connection (TAB):




The Ethernet tab allows you to configure the LAN port. Select DHCP mode if there is a DHCP server present. Choose STATIC mode if you wish to assign a static IP address to the interface. In DHCP mode, If the Ethernet cable is connected will be showed the related IP Address and settings:

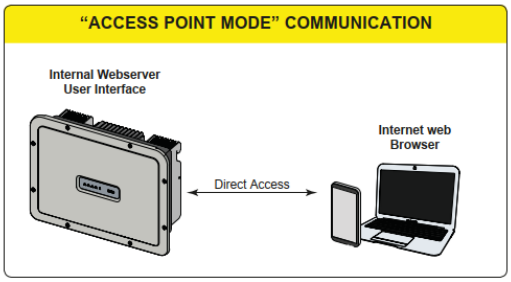
The parameters relating to the home wireless network (set on the router) that must be known and set during this step are:

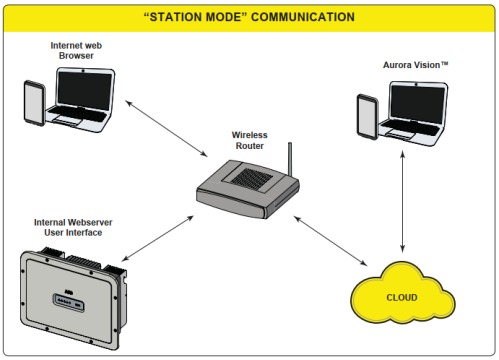
- IP Settings: **DHCP** or **STATIC**:
  - If you select the DHCP function (default setup) the router will automatically assign a dynamic IP address to the inverter whenever it tries to connect to the user network.
  - If you choose the Static option, you can assign a fixed IP address to the system. The fields required for IP static address assignment will appear. Complete the additional fields at the bottom of the screen (all fields are mandatory except for the secondary DNS server).

Wi-Fi connection (TAB):

The inverter WLAN board can operate in two different operating modes:

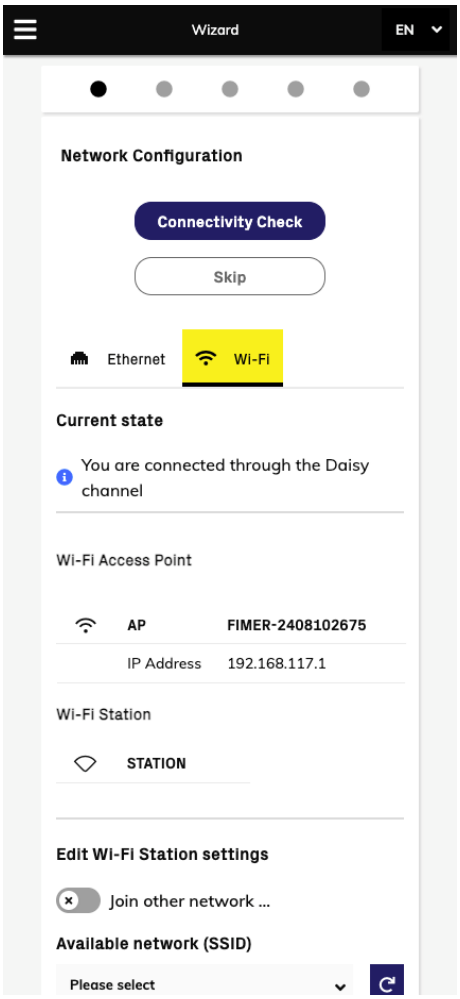
1. “AP mode”: Only local communication is enabled in this mode; In particular, the WLAN board acts like an «access point» generating a wireless network to which the user can connect locally, to monitor or configure the inverter / photovoltaic system, using the direct access to the Internal Web user interface integrated in the WLAN board
2. “Station Mode”: In this operating mode, not only local but also remote monitoring is enabled through access to the LAN connection or through the Aurora Vision® CLOUD platform.




**NOTE** - Where possible, connecting the inverter in "Station Mode" is always preferable. Thanks to the internet connection, this mode ensures better operation.

This setup stage relates to connecting the inverter to your residential wireless network. If it is not possible to connect the inverter to the wireless network, or you do not wish to do so, select the "**Skip this step**" button. In this situation, communication between the inverter and the tablet/smartphone/PC can only be performed with a point-to-point ("AP Mode") connection.

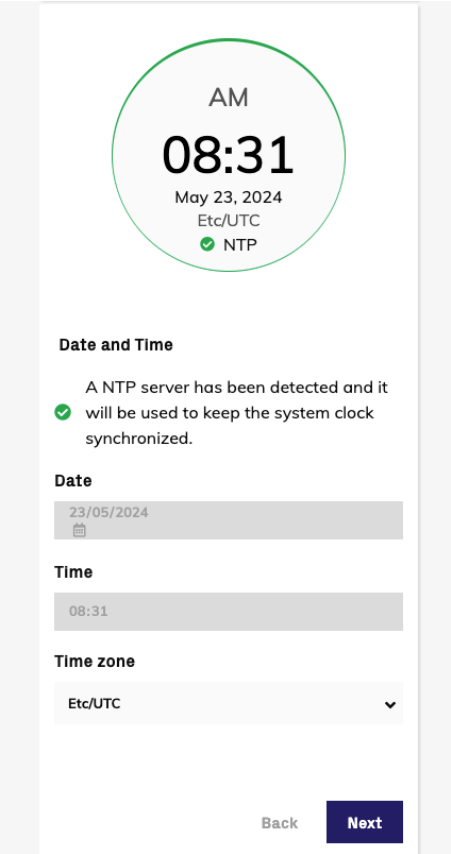



To configure STATION mode, fill in the following fields:

- Available networks (**SSID**): Identify and select your own (home) wireless network from all those shown in the SSID field (you can carry out a new search of the networks that can be detected with the Update button). Once the network has been selected, confirm.
- **Password**: Wireless network password: Enter the password for the destination network (if necessary) and start the connection attempt (it will take a few seconds).
- Click on "Connect" button to connect the inverter to the home wireless network.
- Click on "Next" button to continue the configuration wizard.

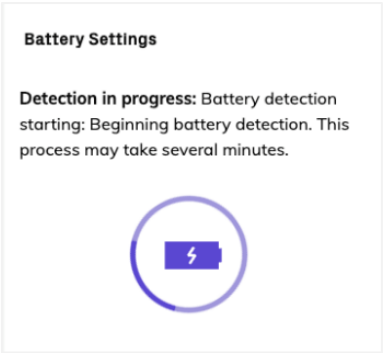
#### 7.2.3.2 Step 2 Date, Time and Time zone.

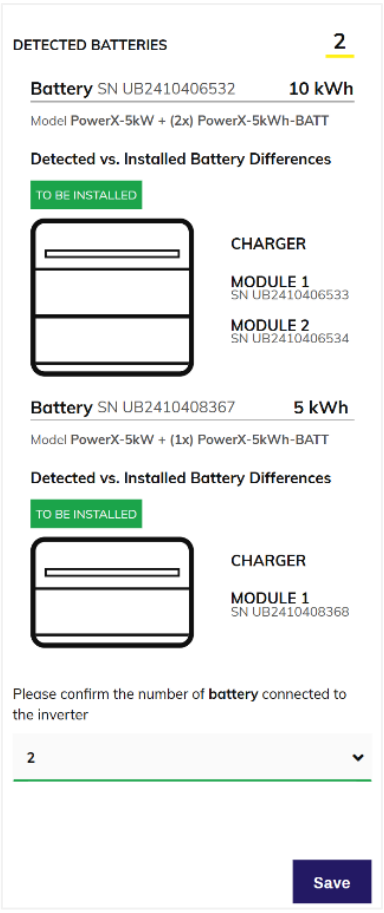
- Set the Date, Time, and Time Zone. The inverter will automatically populate these fields when the time protocol is available. If the inverter is unable to detect the time protocol, these fields must be entered manually.
- Click on "**Next**" button to continue the configuration wizard




#### 7.2.3.3 Step 3 - Battery settings

- In this step, the inverter checks if up to two PowerX battery energy storage systems are connected. For the installation of the PowerX system, please refer to the dedicated manual.
- If the search operation is successful, the UI will display the detected models along with the system composition: validate the installation entering the number of PowerX BESS installed in the plant.



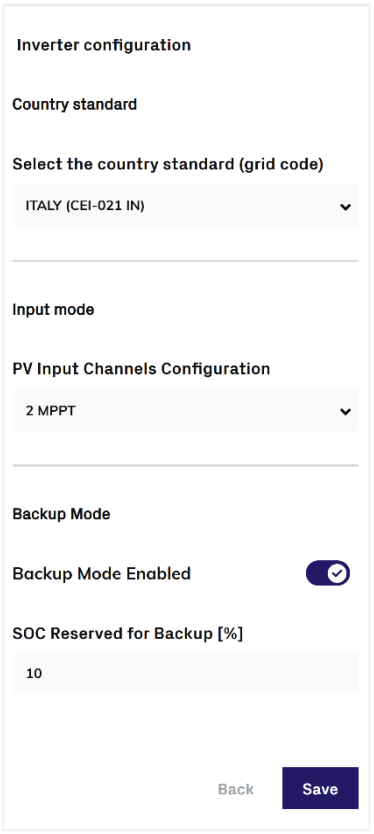




- Click on "**Next**" button to complete the configuration wizard.

**NOTE** - The PowerTRIO inverter can be paired with none, one or two PowerX **storage systems**, each comprising a Genius Box charge/discharge controller and the associated battery energy storage modules. In this step, battery stands for storage systems. For example, if you have 2 systems with 1 and 2 batteries each, you must confirm 2.

#### 7.2.3.4 Step 4 - Inverter configuration

- **Country Standard** (selection of grid standard): Set the grid standard of the country in which the inverter is installed.
- **PV Input Channels Configuration**: Choose 1 MPPT if your input channels are connected in parallel. Choose 2 MPPT if your input channels are independent.
- **Backup Mode**: In this step of the wizard, it is possible to enable or disable the backup mode. If you choose to enable the backup, you can assign a minimum state of charge (SOC) percentage to reserve for backup purposes. The minimum configurable value is 10%. Further information on backup mode can be found in section 5.7 of this manual.



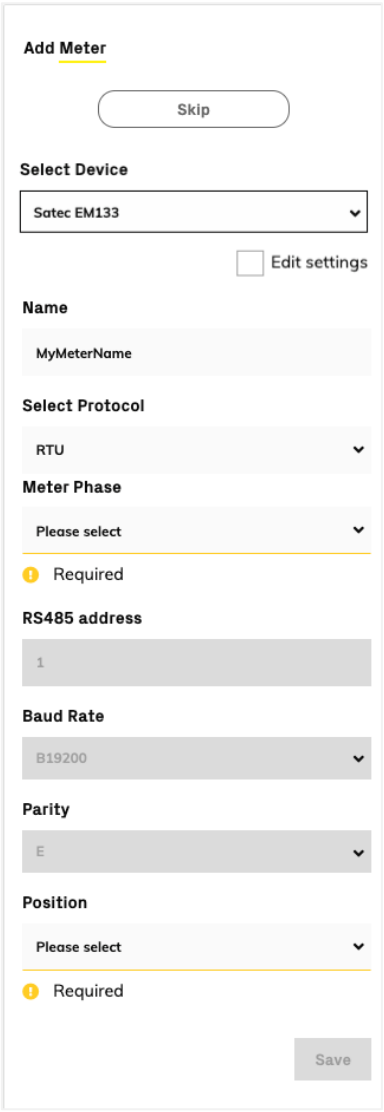

- Click on "**Save**" button to complete the Inverter configuration step.

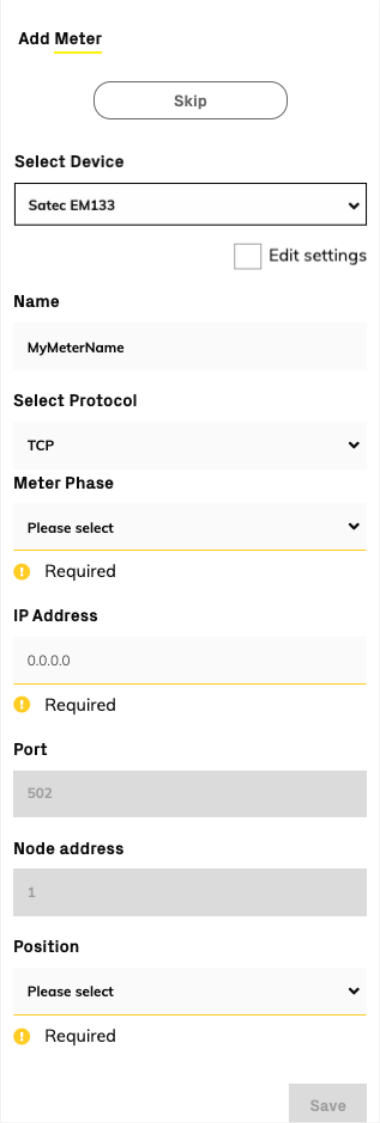
⚠ **ATTENTION** - At the end of the inverter configuration wizard, the inverter will store the settings and reboot to apply the configuration. This process will take a few minutes. Do not turn off the inverter and wait for the operation to complete.

**NOTE** - **After the reboot, the inverter is ready for operation and may connect to the electrical grid**, regardless of whether the next configuration step involving the addition of additional devices has been completed.


### 7.2.3.5 Step 5 – METER

- In this final step, if the installation includes a METER dedicated to managing energy policies, you must select the type of meter installed from the available options in the drop-down menu.

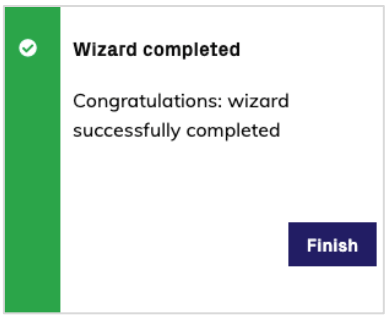





- To edit the disabled fields, check the "**Edit settings**" box.
- Click on "**Next**" button to complete the configuration wizard.

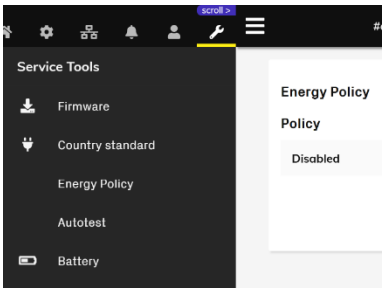
### 7.2.3.6 Wizard finalization

- A notification will confirm that the wizard is completed.
- Depending on the supply source used to complete the installation wizard steps, close the disconnect switch of any missing voltage sources.
- If the input voltage is sufficient to allow the connection to the inverter will perform preliminary checks of the AC and parameters and performs other auto-diagnostic checks.
- If the outcome of the preliminary checks to grid synchronization are positive, the inverter connects to the grid and starts to export power.




**NOTE** – To address any issues that may arise during the initial stages of system operation and to ensure the inverter remains fully functional, it is recommended to check for firmware updates in the "SERVICE TOOLS" section of the web user interface.

### 7.2.3.7 Configuring the energy policy

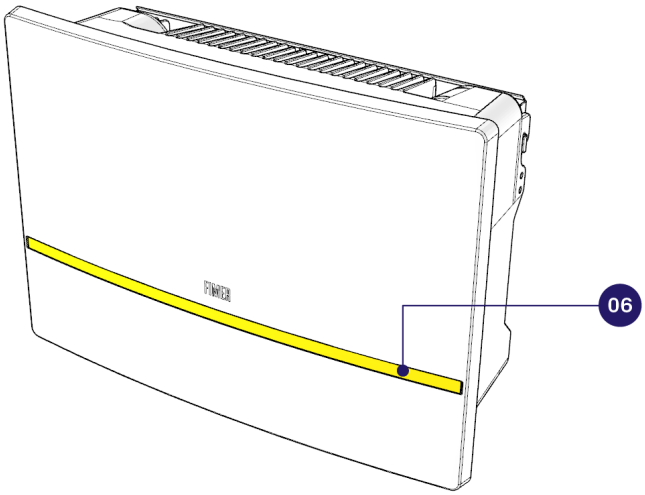



**NOTE** - If a meter is installed, after completing the wizard, access the WEB User Interface as ADMIN (default password is **0010**) to configure the chosen policy. The available options are Self-consumption or Export-limitation. You can download the "Power platform Energy Policy overview" application note from the FIMER website.

### 7.2.3.8 Updating the firmware

**NOTE** – To address any issues that may arise in the initial stages of system operation, and to keep the inverter running at its best with the latest features and improvements, check for firmware updates in the "SERVICE TOOLS" section of the web user interface.

## 7.3 LEDs behaviour




| | |
|---|---|
| | **POWER**<br>Indicates that the inverter is functioning correctly.<br>When the unit is commissioned, while the grid is checked, this icon blinks. If a valid grid voltage is detected, the icon remains continuously lit, if there is sufficient sunlight to activate the unit. Otherwise, the icon will continue to blink until the sunlight is sufficient for activation. |
| | **WLAN/LAN**<br>Indicates the status of the Wi-Fi or Ethernet communication lines. |
| | **ALARM**<br>Indicates that the inverter has detected an anomaly. This type of problem is highlighted in the Web User Interface. |
| | **GFI**<br>The “GFI” (ground fault) indicates that the inverter has detected a ground fault in the DC side photovoltaic generator. When this fault is detected, the inverter immediately disconnects from the grid. |

The following table shows the possible activation combinations of “Power” “Alarm” and “GFI” LED icons on the Synoptic **(03)** according to the operating status of the inverter.

Each LED icon could behave in one of the following ways:

| | | |
|---|---|---|
| ● | ON | |
| ⊗ | Flashing slow | (2 seconds on / 2 seconds off) |
| ⊗ | Flashing fast | (0.2 seconds on / 0.2 seconds off) |
| ○ | OFF | |
| ✱ | Any one of the conditions described above | |

| LED icon status | Operating state |
|---|---|
| POWER:<br>ALARM:<br>GFI:  | **Firmware programming**<br>The inverter firmware is being programmed (never turn off the inverter during this phase). |
| POWER:<br>ALARM:<br>GFI:  | **Nighttime**<br>The inverter is in nighttime switch-off mode (input voltage less than 70% of the set start-up voltage and AC grid is missing) |
| POWER:<br>ALARM:<br>GFI:  | **Inverter initialization / Waiting Sun**<br>This is a transitional state due to verification of the operating conditions. During this stage the inverter checks that the conditions for connecting to the grid are met. |
| POWER:<br>ALARM:<br>GFI:  | **The inverter is connected and is feeding power into the grid**<br>Normal operation. During this stage, the inverter automatically tracks and analyses the photovoltaic generator's maximum power point (MPP). |
| POWER:<br>ALARM:<br>GFI:  | **Missing grid**<br>Indicates lack of grid voltage. This condition does not allow the inverter to connect to the grid. |
| POWER:<br>ALARM:<br>GFI:  | **Backup mode**<br>In backup mode, the green and yellow LEDs remain steadily on, regardless of the presence of input voltage. |
| POWER:<br>ALARM:<br>GFI:  | **Alert or Alarm indication**<br>Indicates that the inverter control system has detected an alert or alarm. It is possible to identify the type of problem generated in the dedicated section of integrated Web User Interface ("Event" section).<br>Indicates missing of connections in case of external meter. |
| POWER:<br>ALARM:<br>GFI:  | **Temperature protection trip**<br>Indicates that the trip relating to internal temperatures (insufficient or excessive temperature) may have been activated. |
| POWER:<br>ALARM:<br>GFI:  | **Ventilation anomaly**<br>Indicates anomaly in the operation of the internal ventilation system that could limit output power at high ambient temperatures. |
| | **Overvoltage surge arresters triggered (where fitted)**<br>Indicates that any class II overvoltage surge arresters installed on the AC or DC side have been triggered |
| | **Internal statistics memory anomaly**<br>Indicates an operating anomaly in the internal memory on which the inverter statistics are stored |
| | **Buffer battery discharged**<br>The buffer battery is low, and the inverter does not maintain the time setting |
| POWER:<br>ALARM:<br>GFI:  | **Pre-commissioning phase (first start-up of inverter)**<br>The commissioning of the inverter must be completed through the Installation wizard steps using the internal Web UI. |
| | **Initial configuration failure**<br>The inverter is in locked state due to a failure in the initial configuration of the equipment, such as the standard network setting for the country of installation |
| | **Incompatibility of the device firmware versions**<br>The firmware versions of the various devices comprising the equipment are incompatible and are being updated (this is an automatic operation) |
| | **Temperature sensor anomaly detected** |
| POWER:<br>ALARM:<br>GFI:  | **Remote OFF activated**<br>The Remote Off command has been activated.<br>The unit will not connect to the network until the remote ON command has been activated |
| POWER:<br>ALARM:<br>GFI:  | **Anomaly in the insulation system of the photovoltaic generator**<br>Indicates that a leakage to earth from the PV generator has been detected, causing the inverter to disconnect from the grid. |
| POWER:<br>ALARM:<br>GFI:  | **Arc fault Trip**<br>During the reset procedure (**via dedicated button or external command**), the LED becomes fixed for 10 seconds. After this time, the LED switch OFF (which means reset done) or start to blink again. |

The following table shows all the possible status of “WLAN/LAN” LED on the Synoptic **(06)** according to the operating status of the Wi-Fi or ethernet communication lines.

| LED icon status | | Operating state |
|---|---|---|
| **WLAN/LAN** | ○ | Wi-Fi not configured or/and ethernet cable not connected. |
| **WLAN/LAN** | ⊗ | Scanning for available Wi-Fi networks. |
| **WLAN/LAN** | ⊗ | Trying to reconnect to the Wi-Fi network (after pressing the smart button for 1 second). |
| **WLAN/LAN** | ● | Wi-Fi or ethernet network is connected to the inverter and IP address is obtained. |

## 7.4 Internal Web User Interface (WEB UI)

The inverter is equipped with an advanced integrated Web User Interface that allows full access to all configuration and commissioning parameters from any electronic device, including laptops, tablets, and smartphones.

### 7.4.1 Connection in "AP Mode"

- Enable the Wi-Fi connection on the device (tablet, smartphone or laptop)
- Connect to inverter network (tap connect). The name of the wireless network created by the system that the connection should be established with will be: **Fimer-YYWWSSSSSS**, where YYWWSSSSSS is the 10-digit inverter SN that can be found on the "Communication Identification Label".
- When prompted, type the "**product key"** (including the dashes. Example: 1234-1234-1234-1234) as the network password to access the inverter's access point (AP). The product key is printed on the "**Communication Identification label**".
- Open an internet browser (recommended browser: Chrome versions from v.55, Firefox versions from v.50) and enter the pre-set IP address 192.168.117.1 to access the login page.

**NOTE** – It's required to digit the dash "-" characters of the Product Key in the password field as well.

**NOTE** – In case of need, product key can be recovered by Aurora Vision Cloud or by calling the MA Solar Italy technical support.

### 7.4.2 Connection in "Wi-Fi Station Mode"

- Enable the Wi-Fi connection on the device (tablet, smartphone or laptop) and connect it to the same Wi-Fi network to which the inverter is connected.
- Open an internet browser (recommended browser: Chrome versions from v.55, Firefox versions from v.50) and enter the IP Address assigned to the inverter or the "Host Name" http://Fimer-YYWWSSSSSS.local (where YYWWSSSSSS is the SN of the inverter).

**NOTE** – The IP address assigned may vary for reasons connected to the Wi-Fi router setup (for example, a very brief DHCP lease time). If verification of the address is required, it is usually possible to obtain the client list (and the corresponding IP addresses) from the external Wi-Fi router administration panel.

**NOTE** – In order to use the "Host Name" the Wi-Fi router to which the inverter is connected (when operating in "Station Mode") must provide the Domain Name System (DNS) service (contact the network administrator for further information regarding the presence or absence of the DNS service in the Wi-Fi router or how to enable it). In this way, even if the IP address assigned to the inverter should change over time (dynamic IP), it will always be possible to use the same "Host Name" which will remain unchanged over time.

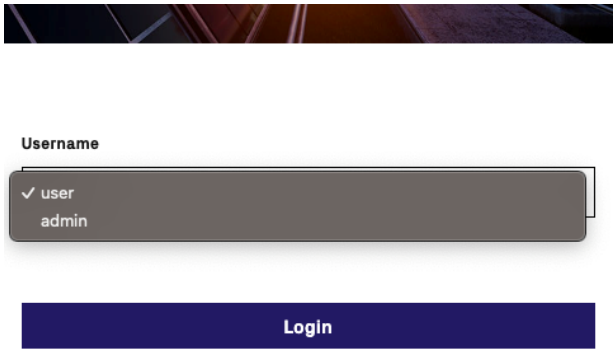
### 7.4.3 WEB UI login page

Open the WEB UI

**NOTE** – The access method depends on the channel used. If the inverter is connected to a STATION Wi-Fi network or LAN, enter the IP address assigned to the inverter in the browser's address bar. If you choose to use the Wi-Fi Access Point (AP) channel, follow the instructions provided in sections 7.4.1 and 7.4.2.


Two types of access are available:

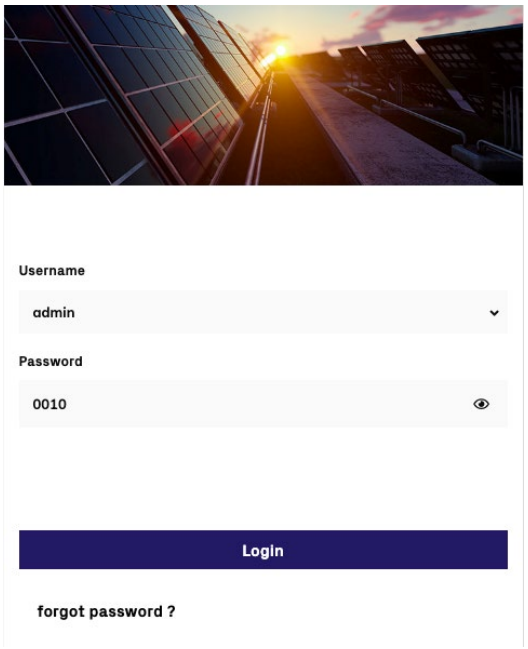
1. **User** (without password); grants basic access to the settings and visualization of the WEB UI parameters.
2. **Admin** (password: **0010**); Installer access to the settings and visualization of the WEB UI parameters.



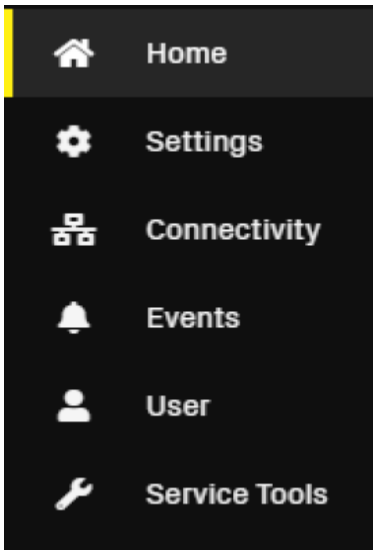

**NOTE** – By logging in as “Admin” and obtaining the token (on the https://registration.solar.fimer.com site and following the procedure "7.4.6.1" in this document) it is possible to obtain the “Admin Plus” access level which allows advanced configuration of the inverter parameters.

**NOTE** – If the Password is lost click on “Forgot your password?” to obtain the access to the Web User Interface (and it will be possible to change the password) by entering the PRODUCT KEY (printed on the “Communication Identification label” and applied during the commissioning phase to the plant documentation).

**NOTE** – The language of the wizard could be changed by clicking on the upper status bar.




### 7.4.4 WEB UI app main menus




**HOME**: Visualization of information related of inverter status, production and inverter parameters.

**SETTINGS**: Section dedicated to inverter parameters configurations.

**CONNECTIVITY**: Section dedicated to inverter communication settings and configurations.

**EVENTS**: Section dedicated to event log.

**USER**: Section dedicated to Admin Plus privileges and Password management.

**SERVICE TOOLS**: Section dedicated to Inverter configuration and Update Firmware.

EN

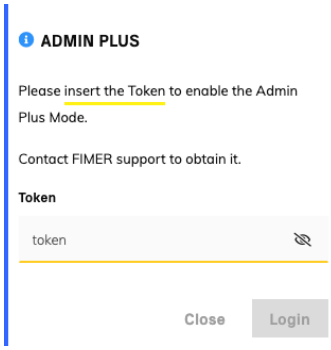
## 7.4.5 WEB UI menu structure

The structure of the menus changes according to the type of access. The table shows the structure of the user interface and explicitly specifies access rights for reading and writing (U = User, A = Admin, AP = Admin Plus). The menu structure of the WEB UI is available in the downloads section of the PowerTRIO page on fimer.com.

## 7.4.6 Inverter features detail

### 7.4.6.1 Admin Plus level access

In the WEB UI, to obtain the security token needed for “Admin Plus” privileges, it is necessary to go through the two following stages:




**Stage 1 - Collection of information relating to the inverter**

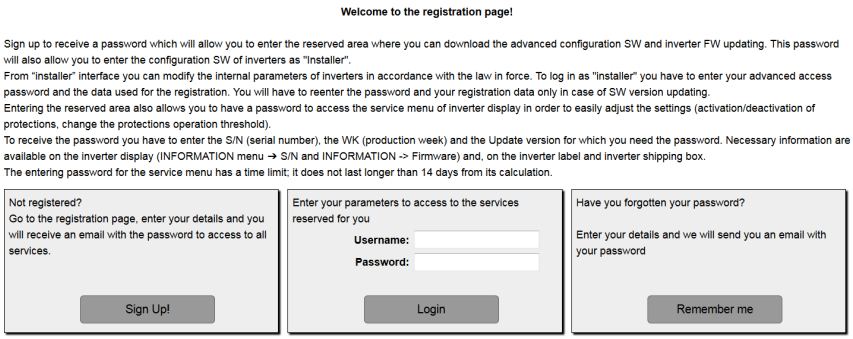
Collect the inverter serial number (SN) and its week of production.

This information can be found on the “Communication Identification label”.
The serial number consists of 10 digits (YYWWSSSSSS):
- YY = Year of manufacture
- WW = Week of manufacture
- SSSSSS = Progressive number Firmware update

**Stage 2 - Registration on https://registration.solar.Fimer.com**

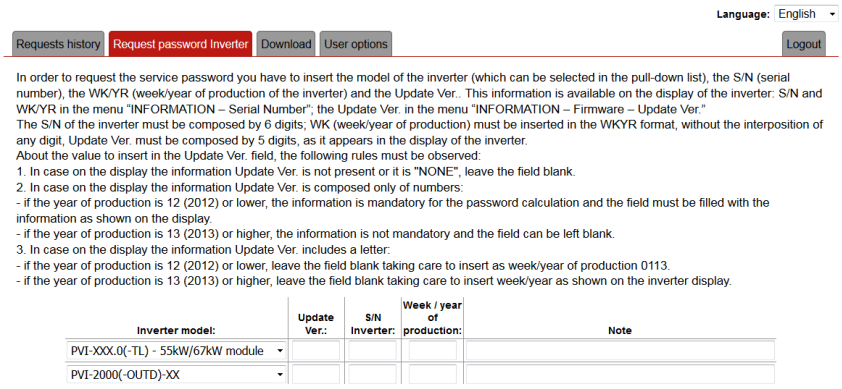
- Open registration site https://registration.solar.fimer.com
- Set the desired language
- Go to “Sign Up” or “Login” and insert the requested data.

– In case of new user an email will be sent to the email address used with a link to complete the registration process.
Once the registration process is over, a further email will be sent with the password to access the website.

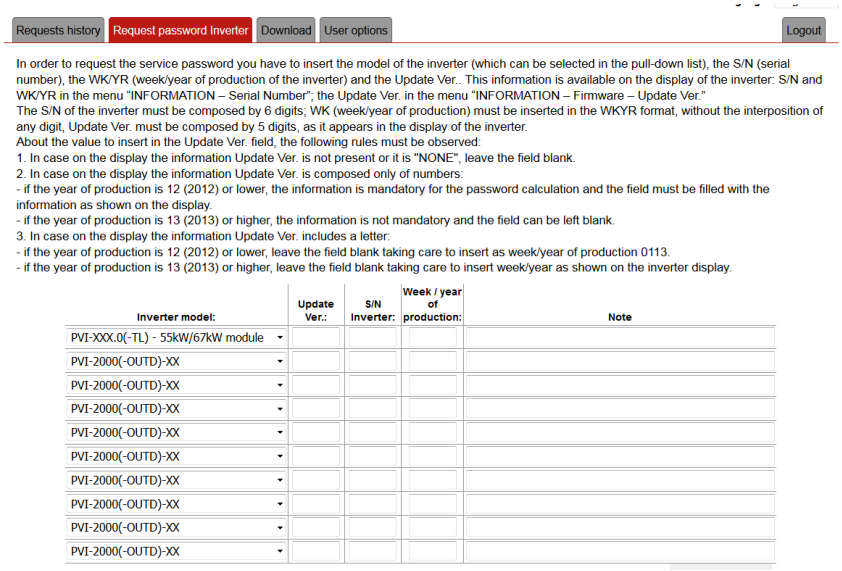



**Stage 3 - Admin Plus token request**

Access the section dedicated to requesting the security token.

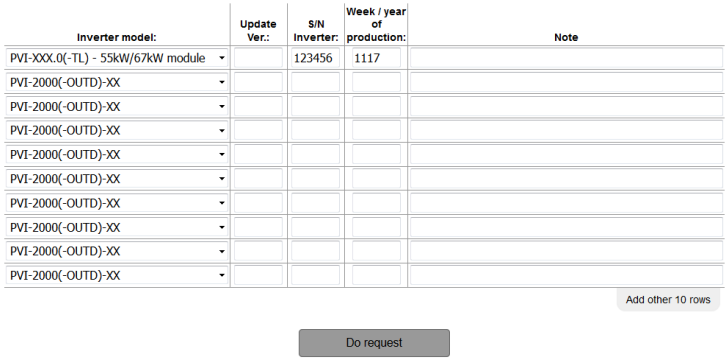



**NOTE** - Choose the inverter model from the drop-down list and insert Serial Number and Week of Production of the inverter (see Stage 1).




Click on "Do request".

**NOTE** – If there is an error in entering data, the fields containing the error will be highlighted in red. If, on the other hand, the data are correct, the passwords will be shown in a new window and at the same time sent to the email address used for registration.



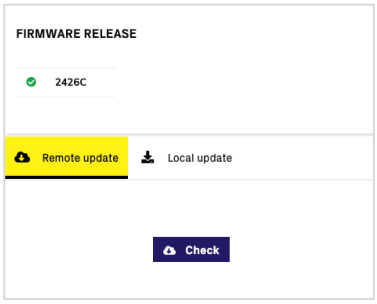

**NOTE** – The security token enables the "Admin Plus" privileges which allows the inverter's sensitive parameters to be changed. Proceed to changing the parameters only if necessary.

### 7.4.6.2 Firmware update

Is recommended to check the availability of new firmware in the dedicated section “**Service Tools > Firmware**”.

**Remote firmware update:**

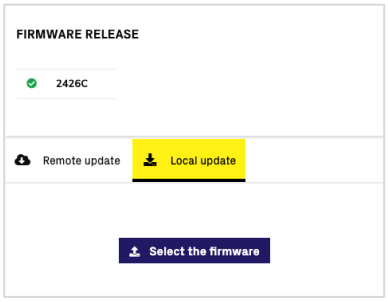
Inverter connected to Aurora Vision®. New firmware availability is displayed in the section “Remote Updates” and is necessary to authorize it.




**ATTENTION** - Do not perform any action while the update of the firmware is running. An interruption of updating process could damage the inverter!

**Local firmware update:**

Inverter not connected to Aurora Vision®. The firmware have to be selected and uploaded from local folder if the used devices to access to the web server.




**ATTENTION** - The latest firmware version is available from the download area of the website www.Fimer.com or from https://registration.solar.fimer.com

- Click on “Select the firmware” and select the firmware.
- Click on “UPDATE” button to start with the updating process.

**ATTENTION** - Do not perform any action while the update of the firmware is running. An interruption of updating process could damage the inverter!

#### 7.4.6.3 Arc Fault Detection (AFD)

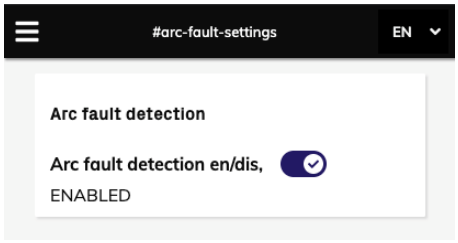
The AFD (Arc Fault Detection) performs a self-test when the system is started.

- If the self-test is successful, the inverter will proceed with connecting to the AC grid.
- If a potential issue with the AFD board is detected, the self-test will result in an E053 error code ("arc_fault_detector_self_test_failed"). During normal operation, the input current is continuously monitored and analysed.
- If a DC arc fault is detected during operation, the inverter will disconnect from the AC grid and generate an E050 error code ("arc_fault_detector_arc"), which can be viewed through the internal WEB UI. If Arc Fault Protection is triggered, the inverter will disconnect from the AC grid and, after 5 minutes, enter the recovery mode to attempt reconnection. After 5 arc fault events, the inverter will latch, and the error can only be cleared by pressing the Smart button for 5 seconds.

The AFD self-test can be manually initiated at any time using the following procedure:

1 Turn off the inverter by switching off both the DC switch and the external AC switch.
2 Wait for the unit to shut down completely (indicated by the LEDs stopping their blinking).
3 Turn on both the DC and AC switches and wait for the self-test result; The self-test does not provide success notifications; it only reports any errors to the UI.

Enabling and disabling of this feature can be addressed using the WEB UI.



# 8 Maintenance

## 8.1 General conditions

PowerTRIO has been designed and built to avoid the need for additional maintenance. However, we recommend that the maintenance personnel perform the operations described in paragraph "**Routine Maintenance**" at least annually.

All the maintenance operations must only be carried out by specialized staff with the knowledge required to perform these tasks. The operators must be skilled or trained in accordance with safety standards EN 50110-1 and EN 50110-2 (CENELEC/CEN) or equivalent standards.

⚠ **WARNING** - Some inverter parts may be subject to hazardous voltages for the operator. Before performing any work on the inverter, refer to "**Inverter Total Isolation and Safety Measures procedure**" paragraph on this manual to know all the necessary steps to safely operate on the inverter.

⚠ **WARNING** - Avoid temporary repairs. All repairs should be carried out using only genuine spare parts.

⚠ **WARNING** - The maintenance technician is to promptly report any anomalies.

⚠ **WARNING** - Always use personal protective equipment (PPE) provided by the employer and comply with local safety regulations.

**FORBIDDEN** - For cleaning, DO NOT use rags made of filamentary material or corrosive products that may corrode the equipment or generate electrostatic charges.

**FORBIDDEN** - DO NOT allow the equipment to be used if problems of any kind are found.

## 8.2 Inverter total de-energization and Isolation

The purpose of this document is to provide instructions for de-energization and isolation of the PowerTRIO single phase inverter with or without storage system integration (PowerX). The replacement of the inverter must follow the "**Inverter total de-energization and Isolation**" procedure.

⚠ **ATTENTION** - This procedure does not allow the access to active parts inside the PowerTRIO and/or PowerX.

⚠ **ATTENTION** - This procedure does not allow battery replacement. To perform battery replacement, refer to the PowerX product manual.

The procedure describes the steps to perform a total isolation and thus includes operations on devices that are located outside the inverter.

The approach considers the disconnection of the Storage System (PowerTRIO + PowerX) from any possible voltage source to which the inverter may be connected.

This procedure is intended exclusively to be used by skilled or trained persons in accordance with safety standards EN 50110-1 and EN 50110-2 (CENELEC/CEN) or equivalent standards. Furthermore, only these skilled or trained persons are permitted to carry out the procedure.

### 8.2.1 Operator and maintenance personnel skills/prerequisites

⚠ **WARNING** - 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.

⚠ **ATTENTION** - Personnel in charge of using and maintaining the equipment must be skilled for the described tasks 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 in accordance with the existing regulations in the country of installation and in accordance of all safety rules for performing electrical works. The installers must have demonstrated skills and knowledge of the inverter's structure and operation.

- **FORBIDDEN** - Maintenance operation carried out by a person who is NOT qualified, is intoxicated, or on narcotics, is strictly forbidden.

The following job requirements and qualifications are required to operate on the inverter:

- Compliance with all legal standard in force in the installation country to perform the electrical work described on this procedure.

### 8.2.2 Clothing and protection of personnel

The following Personal Protective Equipment (PPE) are required to perform any intervention on the inverter:

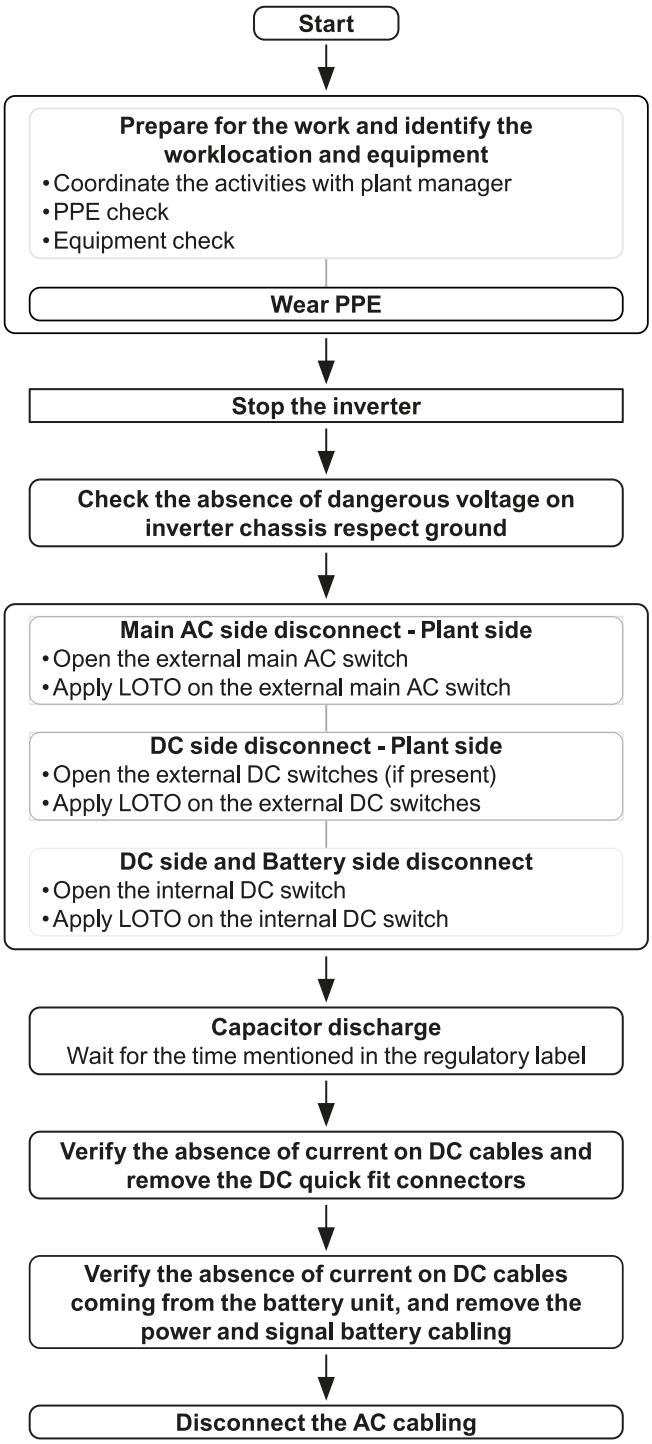
- Arc-flash IEC Class 2 (40 cal/cm2) rated head protection (arc hood) with helmet included.
- Insulating composite gloves class 0 EN60903 (1000Vac-1500Vdc) resistant to electric arc class 2 (7kA) EN61482-1-2 in combination with protective over glove in leather EN420 – EN388.
- IEC Class 1 (8 cal/cm2) basic arc-flash protection wear, combined with IEC Class 2 (25 cal/cm2) overall arc-flash protection.
- Safety shoes ISO 20345:2011.

### 8.2.3 Safety equipment and tools

The following equipment and tools are required to perform any intervention on the inverter:

- DC current clamp.
- Multi-meter (only to test the absence of short circuits).
- Safety tags “work in progress, do not operate”.
- Padlocks.

### 8.2.4 Inverter Total Isolation and Safety Measures procedure




⚠ **WARNING** - Some inverter parts may be subject to hazardous voltages for the operator. Before performing any work on the inverter, follow this procedure for safely isolate the inverter. The only permissible actions on the inverter are the installation of the hypercap **(24)** and the connection of the power and signal cables. Under no circumstances is it allowed to remove the cover.

⚠ **HOT SURFACE** - When the device has just been switched off, it may have hot parts because of overheating of the heated components (e.g.: transformers, accumulators, coils, etc.) so be careful where you touch. After switching off, wait at least **30 minutes** before touching the aluminium cover and heatsink.

#### 8.2.4.1 PRELIMINARY CHECKS

**Weather conditions:**

It is of paramount importance to evaluate the weather conditions in the risk assessment prior any intervention on the equipment. This procedure can be applied only in case of dry environment. Don't proceed in case of rain (even light) or high humidity.

**PPE Check:**

Verify the integrity of the PPE that is going to be used to perform the operations.

**Equipment checks:**

Check the voltage tester is working correctly:

- Perform a general integrity check of the instrument; examine the test terminals, its integrity and make sure they are properly fixed; make sure the batteries level is enough high or replace them (don't use the instrument in case the message "LOW BATTERY" is present).
- Perform test of the instrument using an energized AC socket and a DC voltage source (example: battery in the service car) with known voltage level; in case the instrument is provided with a self-test feature, follow the instructions provided in the instrument manual to carry out the self-test.
- Check the voltage tester is working correctly:
- Check the DC current probe is properly working, make sure to perform the "ZERO-OFFSET" procedure and to select suitable DC measurement range.

#### 8.2.4.2 PPE

⚠ - All the following activities (till the completion of the procedure) must be performed wearing the PPE.

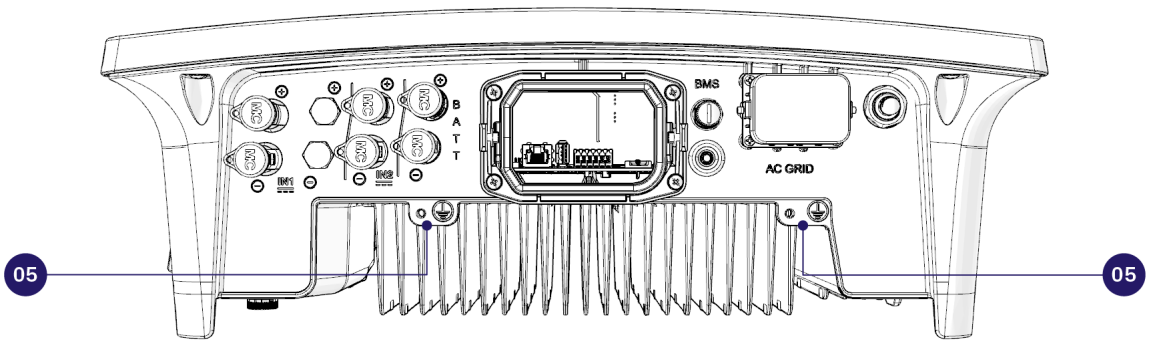
Wear the appropriate PPE for carrying out the operations (overall resistant to electric arc, dielectric helmet with visor, insulating gloves).

#### 8.2.4.3 Preliminary Operation

Disconnect the inverter from the grid using the Remote off functionality.

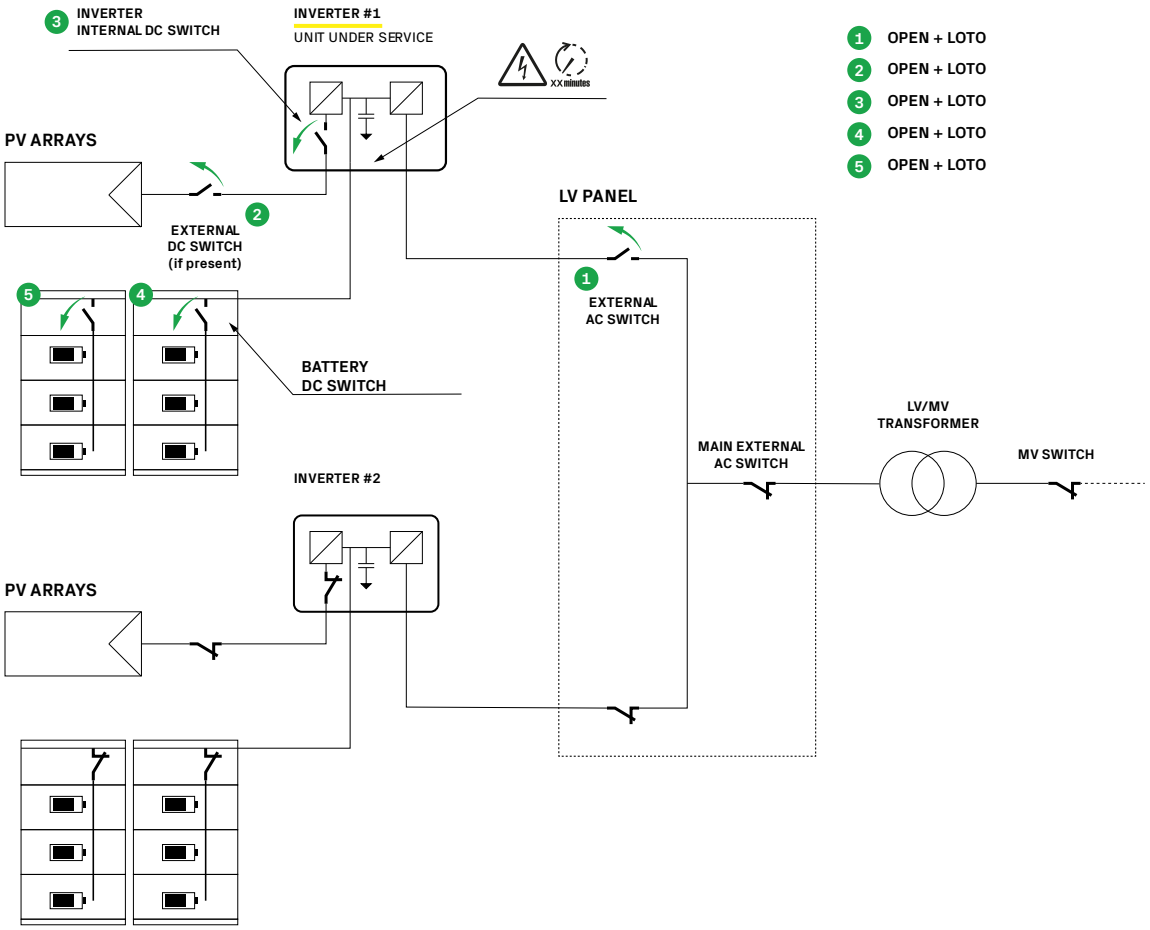
#### 8.2.4.4 Check the absence of dangerous voltages on inverter enclosure respect ground

Check the absence of dangerous voltage on the inverter chassis. The measurement point is between inverter chassis not-painted part and the Protective earth (PE) external connection point **(05)** outside the inverter.



### 8.2.4.5 Operations on external AC switches

The diagram below represents a possible arrangement of the PV plant. Depending on the design choices made by the developer of the plant some of the devices could not be present. Identify the external AC switch(es) in the plant with the support of the plant manager.




- Open the external AC disconnect switch or the main external AC disconnect switch outside the inverter (IEC 60364-7-712.536.2.2). In case none of the LV AC switches are present, the MV switch must be opened.
- Affix designated lock preventing operation onto any external AC disconnect device, affixing designated tags (LOTO procedure).

**NOTE** - Identification of the external switch may require the cooperation of the plant manager and it must be included in the switching plan defined during the preparation of the work.

- Check the LED behaviour on the LED strip **(06)**:
  - In case Back-up function is active: Power LED fixed ON (GREEN).
  - In case Back-up function is not active: Power LED blinking (GREEN).

### 8.2.4.6 Operations on external DC switches (if present)

**NOTE** - In case of absence of External DC disconnect device skip this step.

- Open the external DC disconnect switch (blue in previous picture) outside the inverter (IEC 60364-7-712.536.2.2)
- Affix designated lock preventing operation onto any external DC disconnect device, affixing designated tags (LOTO procedure).
- **NOTE** - Identification of the external switch may require the cooperation of the plant manager and it must be included in the switching plan defined during the preparation of the work.

#### 8.2.4.7 Operations on Internal DC disconnect switches (08)

Open the internal DC switches **(08)**.

- Affix designated lock preventing operation onto all DC disconnect switches **(08)**, affixing designated tags (LOTO procedure).

#### 8.2.4.8 Operations on internal DC switch of PowerX (Battery Unit)

**NOTE** - Only in the FIM-HY-XX 1PH/3PH hybrid version with storage system (battery unit)

- Open the internal DC disconnect switch inside the battery unit
- Affix designated lock preventing operation into the internal DC disconnect switch and affix designated tags (LOTO procedure).

**NOTE** - Perform the LOTO procedure for each battery unit connected at the inverter under service maintenance

In case of more battery unit installed, repeat the activity for each battery unit connected at the inverter under service maintenance

- Check the LED behaviour on the LED strip **(06)**:
  - In case Back-up function is active: Power LED fixed ON (GREEN).
  - In case Back-up function is not active: all the LED's will be turned OFF in less than 1 minute.

**NOTE** - The time needed for the complete shut-down of the LEDs depends by the input voltage of the inverter. The complete shut-down of the LED icons may require some minutes (see "**Regulatory and identification Label**" on the inverter).

#### 8.2.4.9 Discharge of the capacitor

Wait the internal capacitors to be discharged.

**WARNING** - The discharge time of the stored energy is indicated on the regulatory label.

#### 8.2.4.10 DC MC4 connectors disconnection

- Check with the current probe the absence of current on the string cables.
- Remove all quick fit DC connector (PV Connector) from the Inverter using the proper tool. To avoid mechanical interferences, use a cable tie to collect the disconnected cables.

**NOTE** - It is highly recommended to put labels on the cables in order to easily reconnect them to the correct connectors once completed the service activities.

#### 8.2.4.11 Verify the absence of current on DC cables coming from the battery unit, and remove the power and signal battery cabling

**NOTE** - Only in the FIM-HY-XX 1PH/3PH hybrid version with storage system

Using the current clamp, check the absence of current on each one of DC side cables that coming from the battery unit (check the correct setting of the current sensor).

#### 8.2.4.12 Battery cables disconnection

- Remove the battery communication from the inverter
- Remove the battery power connector from the inverter using the proper tool.

#### 8.2.4.13 Disconnect the AC and AC backup cabling

- Remove the AC grid connectors from the inverter
- Remove the AC backup connectors from the inverter.

#### 8.2.4.14 Check list to be filled prior the access to the inverter

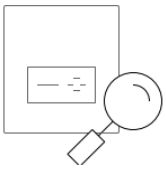
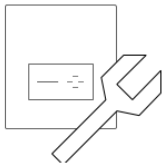
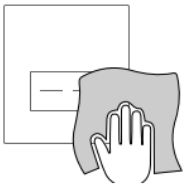
The purpose of checklist is to verify that all the operations mentioned in the procedure have been carried out. The checklist below must be attached to the intervention report.

| Check | STATUS (√ or X) |
|---|---|
| Prepare for the work and identify the work location and equipment | |
| PPE and Equipment Check | |
| PPE wearing | |
| **OPERATIONS AT PLANT LEVEL [1)]** | |
| Check the absence of dangerous voltages on inverter chassis respect ground | |
| Operations in External AC switch | |
| Operations in External DC Switch (If present) | |
| **OPERATIONS AT INVERTER/BATTERY LEVEL** | |
| DC disconnects – Inverter Side (opening and LOTO of DC switch) | |
| DC disconnects – Battery Side (opening and LOTO of DC switch) | |
| Wait the discharge of the internal capacitor | |
| Verify the absence of absence of current on DC cables and remove the DC quick fit connector | |
| Verify the absence of current on DC cables coming from the battery unit, and remove the owner and signal battery cabling | |
| Disconnect the AC grid and AC backup cabling | |
| **ISSUE WORK PERMIT** | |
| Issue work permit and “Walk the permit” – Check list filling | |
| **ONLY if all checks are POSITIVE (√) the ACCESS IS ALLOWED**<br>**Issue work permit and “Walk the permit” – Check list filling** | |

1. Identification of the external switch may require the cooperation of the plant manager, and it must be included in the switching plan defined during the preparation of the work.

## 8.3 Routine Maintenance

PowerTRIO has been designed and built to avoid the need for additional maintenance. However, to preserve long term proper operation of the inverter, we recommend that the maintenance personnel perform the operations listed in this paragraph at least annually.

| Routine Maintenance | |
|---|---|
| Visual inspection<br>  | • Check that the inverter is operating properly, without any alarm signals.<br>• Ensure all labels and safety symbols are visible.<br>• Check the integrity of the cables, connectors and cable glands outside the inverter.<br>• Check that the environmental conditions have not changed dramatically from those on installation.<br>• Check there are no obstacles (animals, insects, leaves or anything which could reduce the heat exchanging capacity of the heat sink) at the top, at the bottom. |
| Operations<br>  | • Check the tightening of the cable glands and of the screw on the external PE connection point (see paragraph 3.5.2).<br>• If there is no monitoring system, check the record of alarms and errors to verify recent notification of recent malfunctions. |
| Cleaning<br>  | • Clean the equipment; in particular, clean the top of the inverter and the heat sink.<br><br>**HOT SURFACE** – After switching off, **wait** at least **30 minutes** before touching the aluminium cover and heatsink.<br><br>**NOTE**: Clean the equipment with a **damp cloth**. Avoid using cleaning agents, abrasive materials, solvents, or similar substances to clean the inverter. |

## 8.4 Troubleshooting

⚠ **ATTENTION** - Operations on the inverter to identify and address any faults may only be performed by the installer or by qualified personnel.

### 8.4.1 Inverter troubleshooting

The events that could occur are classified by severity as follows:

- Alarm

Alarm or “supervised alarm” is an event causing stop of product operation (i.e. disconnection of the power converter from electrical grid). Only one alarm condition can be pending at a time.

- Alert

Alert is an event not causing stop of product operation but signalling an abnormal and potentially harmful condition (e.g. fault on auxiliary device like cooling fan). Multiple alert conditions can be pending at a time.

- Info

Info is an event not associated to abnormal product condition but just signalling relevant status change (e.g. operating mode change for specific control). Info events could be furthermore used for helping failure analysis together with alarms/alerts.

More details about the events can be found by accessing the Events menu of the Web UI.

### 8.4.2 Web User Interface and Wi-Fi communication troubleshooting

The following table gives a list of main and most common errors or problems relating to the Wi-Fi communication between inverter and user devices.

| Problem | Possible cause | Solution |
|---|---|---|
| The Web User Interface cannot be accessed. | ADMIN password forgotten. | Reset the passwords by clicking on “Forgot your password”; The passwords can be reset after having entered the “Product Key” code that can be found on the “Communication Identification Label”. |
| The inverter can identify a Wi-Fi network but is unable to connect to it. | The signal between the inverter and the Wi-Fi router to which the board wants to connect is too weak. | Modify the position of the Wi-Fi antenna, the inverter or the router. |
| | | Make sure that the inverter has not been installed near obstacles which could affect the communication with the Wi-Fi router (for example: metal cages or walls, walls in reinforced concrete, electromagnetic fields). |
| | | Move the router as close as possible to the inverter. |
| | | Install a Wi-Fi signal repeater to extend the network to which the inverter is to be connected; then connect the inverter to the repeater. |
| | The Wi-Fi network to which the inverter is to be connected, could require the user to enter a username and password to allow navigation (for example, with a public Wi-Fi network or a hotel). | Unfortunately, the inverter cannot be connected to these types of Wi-Fi networks. Connect the inverter to an alternative Wi-Fi network. |
| The Inverter has not identified the Wi-Fi network to which connection is required. | The Wi-Fi network to which the Inverter is to be connected, is set so as not to be identified (hidden network). | The Inverter is not able to connect to a hidden network. Set the Wi-Fi network to which the inverter is to be connected (visible network), then identify and connect the Inverter to the Wi-Fi network as normal. |
| | The signal between the inverter and the Wi-Fi router to which | Modify the position of the Wi-Fi antenna, the inverter or the router. |

| | | |
|---|---|---|
| | the board wants to connect is too weak. | Make sure that the inverter has not been installed near obstacles which could affect the communication with the Wi-Fi router (for example: metal cages or walls, walls in reinforced concrete, electromagnetic fields). |
| | | Move the router as close as possible to the inverter. |
| | | Install a Wi-Fi signal repeater in order to extend the network to which the inverter is to be connected; then connect the inverter to the repeater. |
| Alternating difficulties in the local connection to the Wi-Fi. | The inverter might not be correctly powered. | Access to the Web User Interface only when the inverter is correctly powered. |
| | The Wi-Fi connection signal between the router and the inverter, may not have sufficient power or it may be disturbed by obstacles which affect the communication. | Make sure that the signal between the inverter and the router is sufficiently high and that any obstacles such as metal cages or walls, walls in reinforced concrete or strong electromagnetic fields do not affect communication. |
| When working in “Access Point Mode”, it’s not possible to connect to the inverter using the WEB UI. | The Wi-Fi of the inverter could be damaged. | Request a service intervention to check that the inverter Wi-Fi board is working correctly. |
| | Wrong Inverter Date/Time settings. | Check if Date/Time has correctly set on the inverter; correct it if necessary. |
| Although the Inverter has been configured correctly in “Station Mode” and works correctly on the local network, no data has been transmitted to the Aurora Vision®. | The MAC address used to register the inverter on the Aurora Vision® platform is not the same as the actual address associated with the inverter. | Make sure that the MAC address registered on the Aurora Vision® platform is the one associated with the inverter. If it is not, modify the registered MAC address. |
| | The Wi-Fi network to which the Inverter is connected, could be protected by a Firewall which prevents the remote exchange of data with the Aurora Vision® platform. | Contact the network administrator to have the Firewall configured so that the remote exchange of data between the Inverter and the Aurora Vision® platform is allowed. |
| It is not possible to access the Web User Interface using the IP address when the inverter is operating in “Station Mode – DHCP”. | An incorrect dynamic IP address is being used to access the Web User Interface or the IP address could have been modified by the Wi-Fi router to which the inverter is connected. | Access the Web User Interface using via “AP Mode” (refer to “**Connection in “AP Mode”**” paragraph to know how to connect via “AP Mode”) and read the current IP Address in “CONNECTIVITY > Wi-Fi” section (“CONNECTIVITY menu”). |
| | | Access the Web User Interface using the “Host Name” that could be obtained writing this URL http://ABB-XX-XX-XX-XX-XX-XX.local replacing the “X” with the hex digits of the MAC address of the inverter (it can be found on the “Communication Identification Label” placed on the side of the inverter or applied during the commissioning phase to the plant documentation). The DNS or multicast service must be enabled on router. Note: This connection method doesn’t work on Android devices. |
| | The IP Address used to access the Web User Interface was lost. | If possible, access the pages of the Wi-Fi router web server to which the inverter is connected and read the new dynamic IP address assigned to the Inverter. |
| | The Wi-Fi router doesn’t allow the connection to local IP address. Typically, this | Contact the network administrator to allow the Wi-Fi router to connect to local IP address. |

| | | |
|---|---|---|
| | happens on company networks. | |
| | The device doesn't allow the connection to local IP address. Typically, this happens with company devices. | Contact the system administrator to allow the device to connect to local IP address. |
| Using an Android device, a notification advise that internet connection is missing when trying to connect to the Access Point Wi-Fi network created by the inverter and ask for connection confirmation. | Known behaviour of Android devices. Android OS always check if internet connection is available and ask for confirmation if it's not present. | Confirm the connection request in the notification of Android devices by clicking "Yes". |

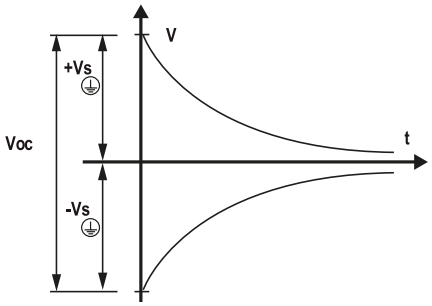
## 8.5 Verification of ground leakage

In the presence of anomalies or report of ground fault (where provided), there may be a ground leakage from the PV generator (DC side).

To check this, measure the voltage between the positive pole and ground and between the negative pole (of the PV generator) and ground using a voltmeter whose input accepts a voltage sufficient for the dimensions of the photovoltaic generator.

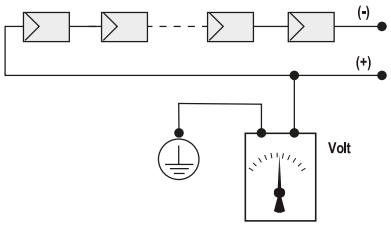
### 8.5.1 Behaviour of a system without leakage

Due to the capacitive effect of the PV generator, during the first moments that the voltmeter is connected between one of the two poles and ground, it will measure a voltage of about $V_{oc}/2$, which will tend to stabilize to around 0V if there is no ground leakage, as shown in the graph below:




NOTE - The internal impedance of the voltmeter tends to discharge the voltage due to the capacitive effect of the PV generator.

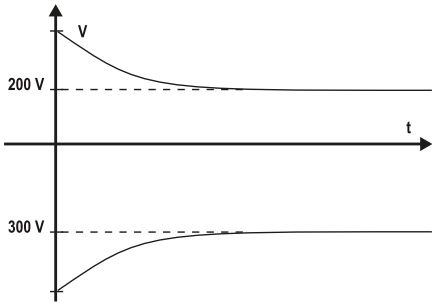
How to make the measurement:



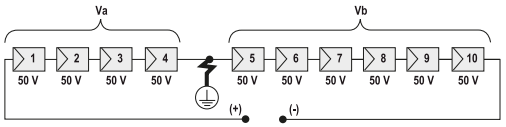

### 8.5.2 Behaviour of a system with leakage

If the voltage measured between one of the two poles and ground does not tend to 0V and stabilizes on a value, there is a ground leakage from the PV generator.

Example: When the measurement is made between positive pole and ground, a voltage of 200V is measured.




This means that if the system is made up of 10 modules in series and each one supplies 50V, the leakage can be located between the 4th and 5th PV module.




$V_a$ = voltage measured between + pole and ⏚ = 200V

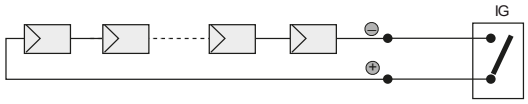
$V_b$ = voltage measured between - pole and ⏚ = 300V

In all measurements with ⏚, the ground of the inverter is indicated.

## 8.6 Measuring the isolation resistance of the PV generator

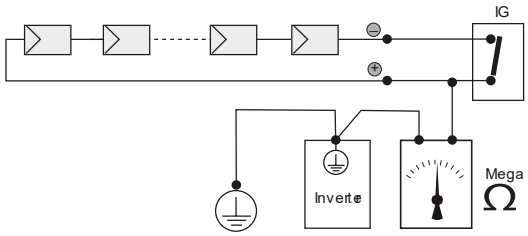
⚠ **WARNING** - The operator must always use the personal protective equipment (PPE) required by the laws of the country of destination and whatever is provided by their employer.

To measure the isolation resistance of the PV generator compared to ground, the two poles of the PV generator must be short-circuited (using a suitable sized switch).




⚠ **WARNING** - Use of unappropriated sized switch could cause risk of fire or electric arc! Use only 600V rated switch!

Once the short-circuit has been made, measure the isolation resistance (Riso) using a megohmmeter positioned between the two shorted poles and ground (of the inverter).




If the measured isolation resistance (Riso) is less than **500 kΩ**, the inverter may not connect to the grid because of low isolation of the PV generator to ground.

⚠ **ATTENTION** - The isolation resistance can be affected by the environmental conditions the PV generator is in (e.g.: PV modules wet from damp or rain), and therefore the measurement must be made immediately after the anomaly is detected.

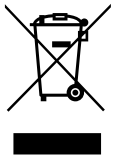
## 8.7 Storage and dismantling

### 8.7.1 Storage of the equipment or prolonged stop

If the equipment is not used immediately or is stored for long periods, check that it is correctly packed and contact MA Solar Italy for storage instructions. The equipment must be stored in well-ventilated indoor areas having no characteristics that could damage the components of the equipment. Restarting after a long or prolonged stop requires a check and, in some cases, the removal of oxidation and dust that will also have settled inside the equipment if not suitably protected.

### 8.7.2 Dismantling, decommissioning and disposal

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.



The symbol of the cancelled bin (where present) indicates that the product must not be disposed with domestic waste at the end of its useful life. This product must be delivered to the waste collection point of the local community for recycling. For further information, refer to the public body responsible for waste disposal in the country.

Inappropriate disposal of waste can have a negative impact on the environment and human health owing to potentially dangerous substances. By cooperating in the correct disposal of this product, you contribute to the reuse, recycling and recovery of the product, and the protection of our environment. Dispose of the various types of materials that the parts of the equipment consist of in dumps that are suitable for the purpose.

| COMPONENT | MATERIAL OF CONSTRUCTION |
|---|---|
| Frame, brackets, supports | Arc-welded steel FE37, aluminium |
| Casing or covers | ABS, plastic |
| Paint | RAL |
| Gaskets and seals | Rubber / Teflon / Viton |
| Electrical cables | Copper / Rubber |
| Cable trays | Polyethylene / Nylon |
| Batteries | Nickel / Lead/ Lithium |

### 8.7.3 Procedure for dismantling the equipment

⚠ **WARNING** - The dismantling operations must be carried out with the equipment disconnected from any voltage sources. Refer to "Inverter total de-energization and Isolation" paragraph on this manual to know all the necessary step to safely operate on the inverter.

⚠ **ATTENTION** - Never open the lower connection box in the case of rain, snow or a level of humidity >95%. Always carefully seal all unused openings.

Even though the device is equipped with an anti-condensation valve, air with extremely high levels of humidity can lead to the creation of condensation inside the inverter.

As the inverter is almost completely insulated from the outside, condensation can also form after maintenance interventions in certain weather conditions.

⚠ **ATTENTION** -During dismantling always protect the inverter parts that are installed and exposed to the weather elements!

⚠ **ATTENTION** -Staff authorised to carry out the dismantling operations must be specialised and experienced in this job. They must also have received suitable training on equipment of this type.

To dismantling and disassemble the inverter **(01)** follow these steps:

- Isolate the equipment referring to the "Inverter total de-energization and Isolation" paragraph.
- Disconnect any external voltage sources
- Lift and remove the inverter following the indications for the mounting procedure in the "Assembly the Inverter to the bracket" paragraph in the reverse order and the indication for lifting methods in "Lifting" paragraph.

To dismantling and disassemble the mounting bracket **(03)** follow the indications for the mounting procedure in the "Bracket installation" paragraph in the reverse order.

EN

# 9 Attachments

## 9.1 Port and network services used by the inverter

### 9.1.1 IP Network Services

Any network connected to the inverter must allow traffic to pass on the following ports. Network firewall rules (if present) must allow responses to the inverter over existing TCP connections.

| Direction | Service/Port | Protocol | Description |
|---|---|---|---|
| In | ssh/22 | TCP | For local debugging by MA Solar Italy service personnel, the inverter utilizes encrypted SSH. To allow service personnel local access to the inverter. |
| Out | domain/53 | TCP/UPD | The inverter must be able to resolve domain names, to ensure scalability and dynamic changes on the Internet (DNS). (required) |
| Out | https/443 | TCP | As an HTTP client, the inverter uses SSL/TLS protocol connections to Aurora Vision® servers for secure communication. The inverter uses this port for all services, including data transmission, firmware upgrade, configuration management, and remote command transmission. (required) |
| Out | dhcp/67, | UPD | If DHCP service is not available, static network information must be assigned to the inverter (preferred) |
| Out | dhcp/68 | UPD | The inverter uses this port for network time services (NTP). (preferred) |
| Out | ntp/123 | TCP | The inverter offers a Modbus TCP server connection on this port. |
| Out | Modbus/502 | UPD | The inverter uses this protocol to resolve the local IP address. |

### 9.1.2 Network Hosts

The inverter will connect to the following hosts. Some servers owned by MA Solar Italy, and others are customer or ISP servers. Servers listed as owned by “Customer IT/ISP” must be configured in the inverter using either DHCP or as static network information.

| Host | Purpose | Port | Owner/Manager |
|---|---|---|---|
| platform.auroravision.net | Data, configuration | TCP:443 | MA Solar Italy |
| gw1.auroravision.net and/or apt.fatspaniel.net | Inverter firmware upgrade | TCP:443 | MA Solar Italy |
| Site dependent | DHCP (optional) | UDP:67, UDP:68 | Customer IT/ISP |

### 9.1.3 Inverter network configuration

The inverter requires a valid network configuration to operate. This information can either be provided by a DHCP server provided by the customers network (the default), or the inverter can be configured with static network information. Regardless of how the inverter is configured, the following information is required.

| Configuration | Purpose |
|---|---|
| IP Address | Allows the inverter to take part in the local network. This does not need to be a public IP address. In most cases this is a private IP address. |
| Subnet mask | Used to determine if two computers are on the same network. |
| Gateway | The IP address of the computer which will forward network traffic from the local network to an external network |
| DNS Server | The IP address(es) of the computer(s) which resolve domain names. |

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