FIMER

Solar Inverter Plus; Plus-HV

Product Manual

IMPORTANT SAFETY INSTRUCTIONS

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

SAVE THESE INSTRUCTIONS!

This manual must be considered as an integral part of the equipment, and must be available at all times to everyone who interacts with the equipment.

The manual must always accompany the equipment, even when it is transferred to another user.

Operators are required to read this manual and scrupulously follow the indications reported in it, since FIMER cannot be held responsible for damages caused to people and/or things, or the equipment, if the warranty conditions are not observed.

Further information

For more information on FIMER products and services for solar applications, navigate to www.fimer.com.

Product Manual

PLUS; PLUS-HV central inverters

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PLUS;PLUS-HV-Product manual EN Rev C (M000012BG)
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Introduction and general information

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Warranty and Supply Conditions

The warranty conditions are described in a special certificate supplied with the equipment. Furthermore, the warranty conditions are considered to be valid if the customer adheres to the indications in this manual; any conditions deviating from those described herein must be expressly agreed in the purchase order.

The equipment complies with the pertinent legislation currently in force in the country of installation and it has issued the corresponding declaration of conformity.

Not included in the supply

FIMER accepts no liability for failure to comply with the instructions for correct installation and will not be held responsible for systems upstream or downstream the equipment it has supplied. 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 re-sult in the immediate cancellation of the warranty.
The Customer is fully liable for any modifications made to the system.

Given the countless array of system configurations and installation environments possible, it is essential to check the following: sufficient space suitable for housing the equipment; airborne noise produced depending on the environment; potential flammability hazards.

FIMER will NOT be held liable for defects or malfunctions arising from: im-proper use of the equipment; deterioration resulting from transportation or particular environmental conditions; performing maintenance incor-rectly or not at all; tampering or unsafe repairs; use or installation by unqualified persons.

FIMER will NOT be held responsible for the disposal of: displays, cables, batteries, accumulators etc. The Customer shall therefore arrange for the disposal of substances potentially harmful to the environment in accor-dance with the legislation in force in the country of installation.

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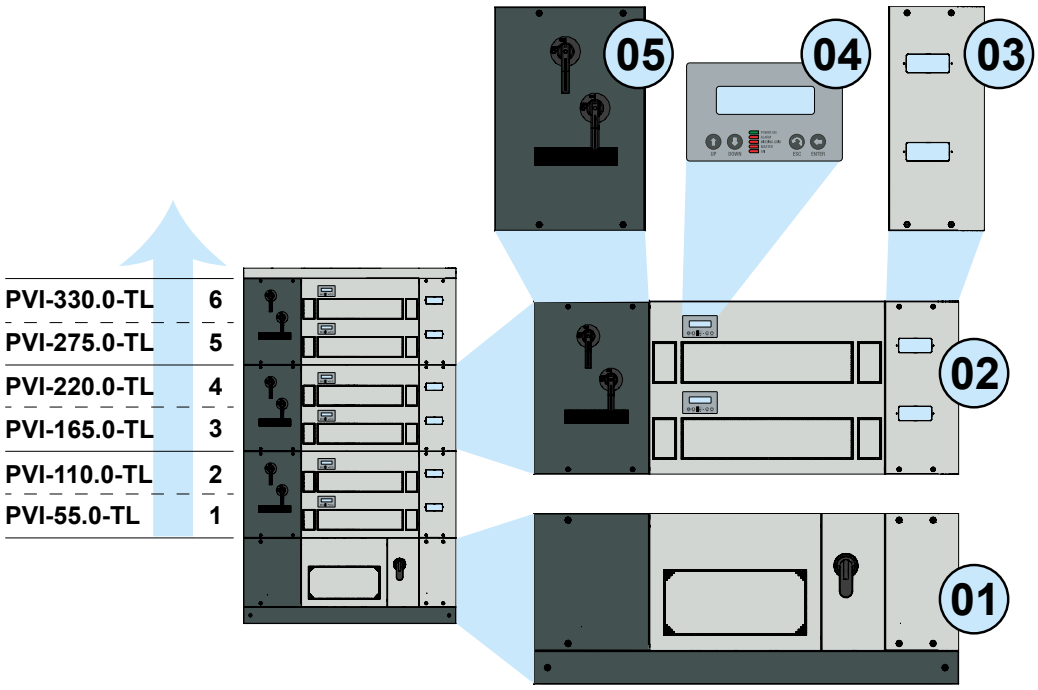
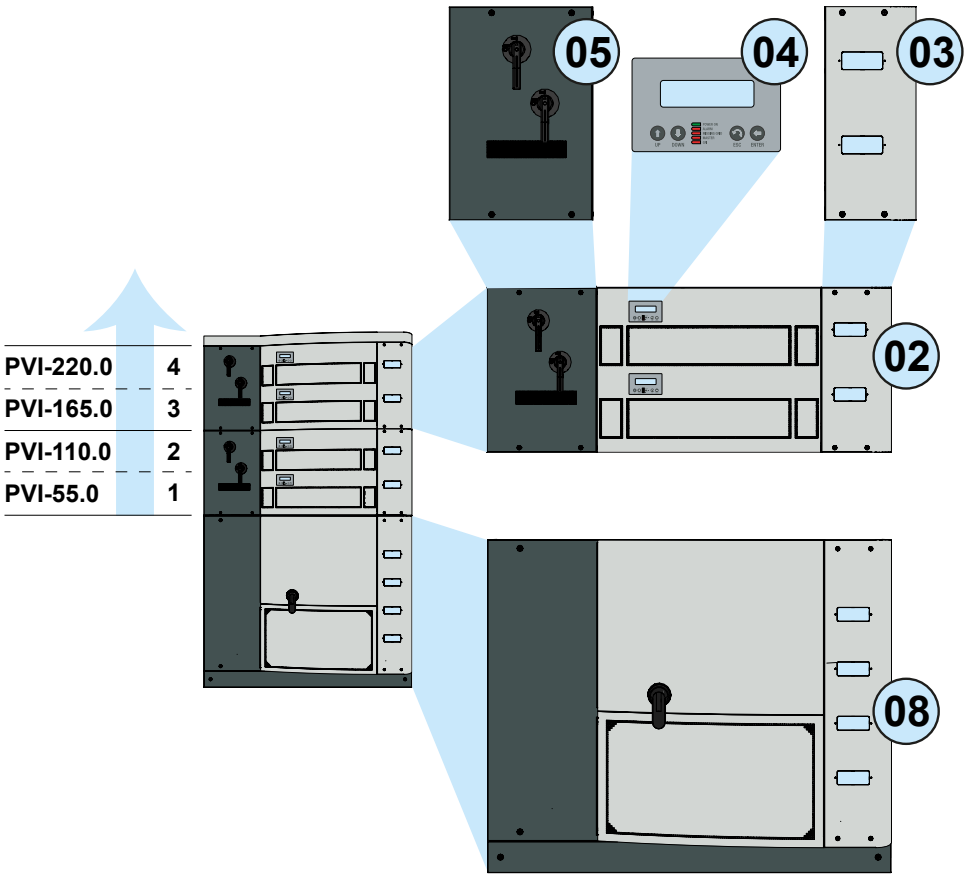
Graphical representation of references

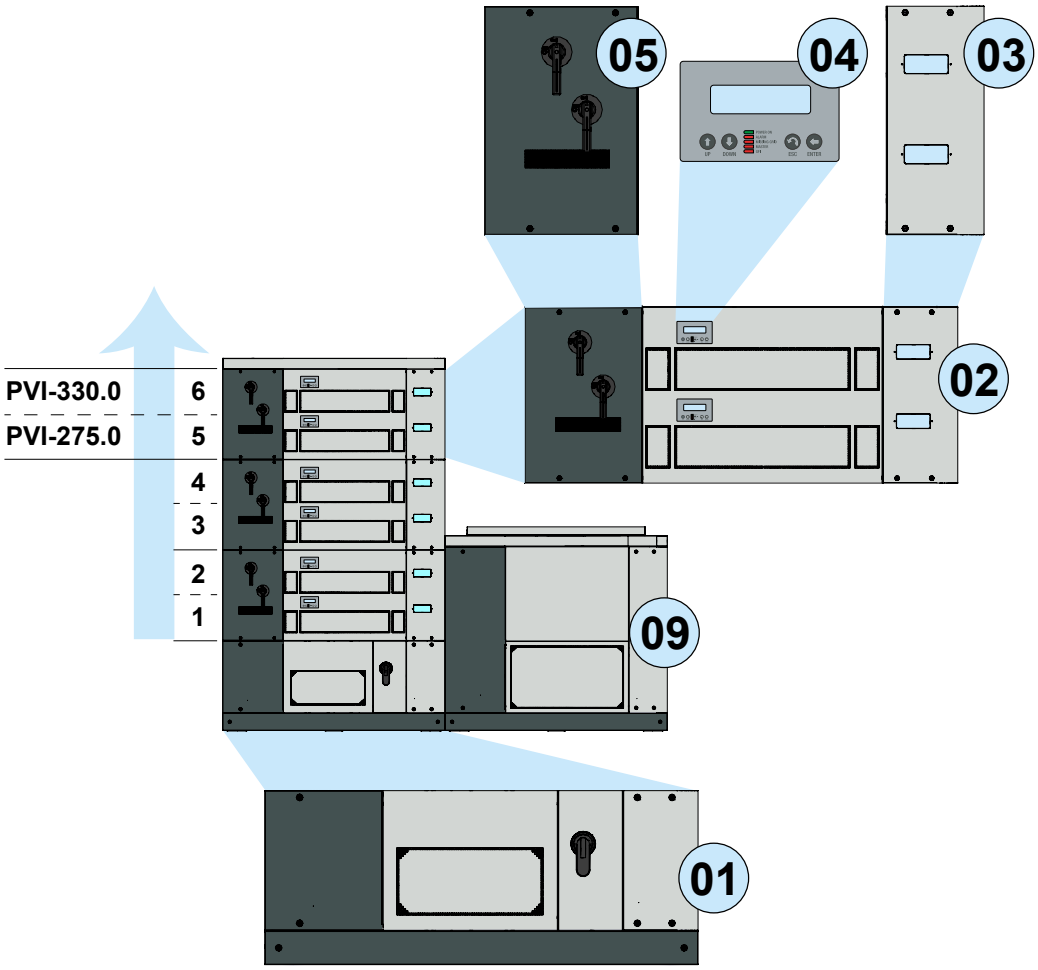
General view: PLUS (TL, transformerless)



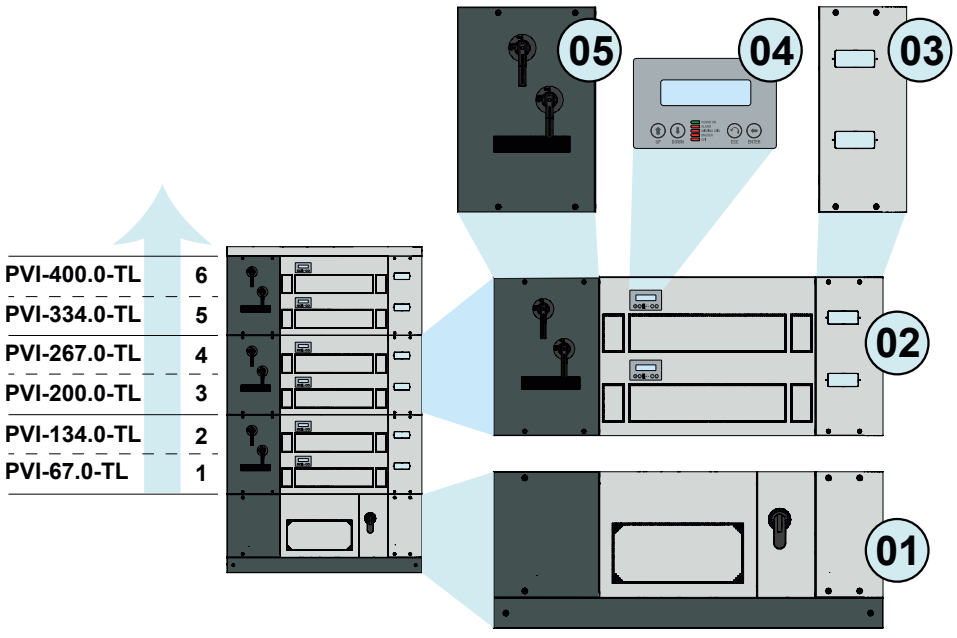
General view: PLUS (with transformer)



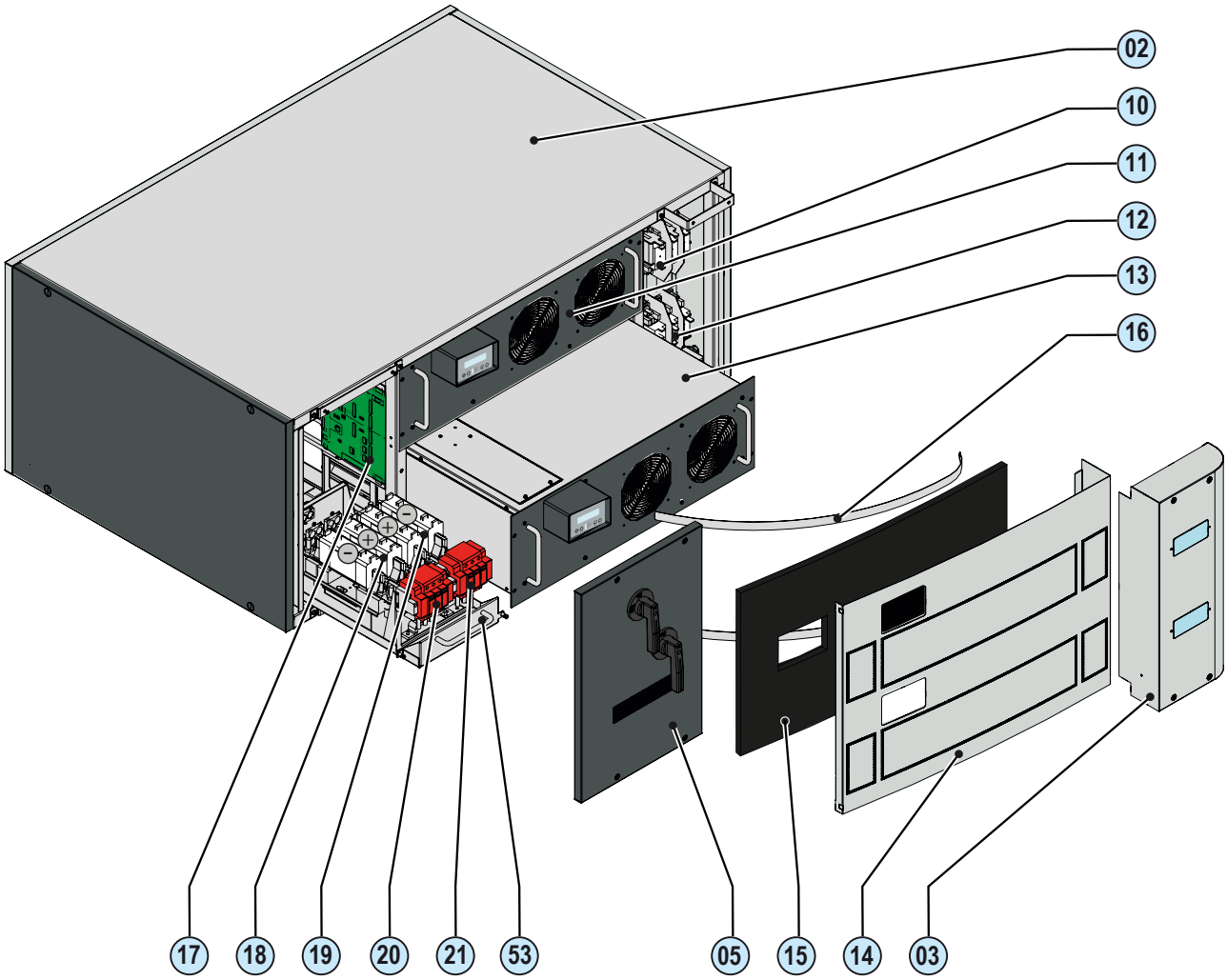
General view: PLUS (with external transformer)



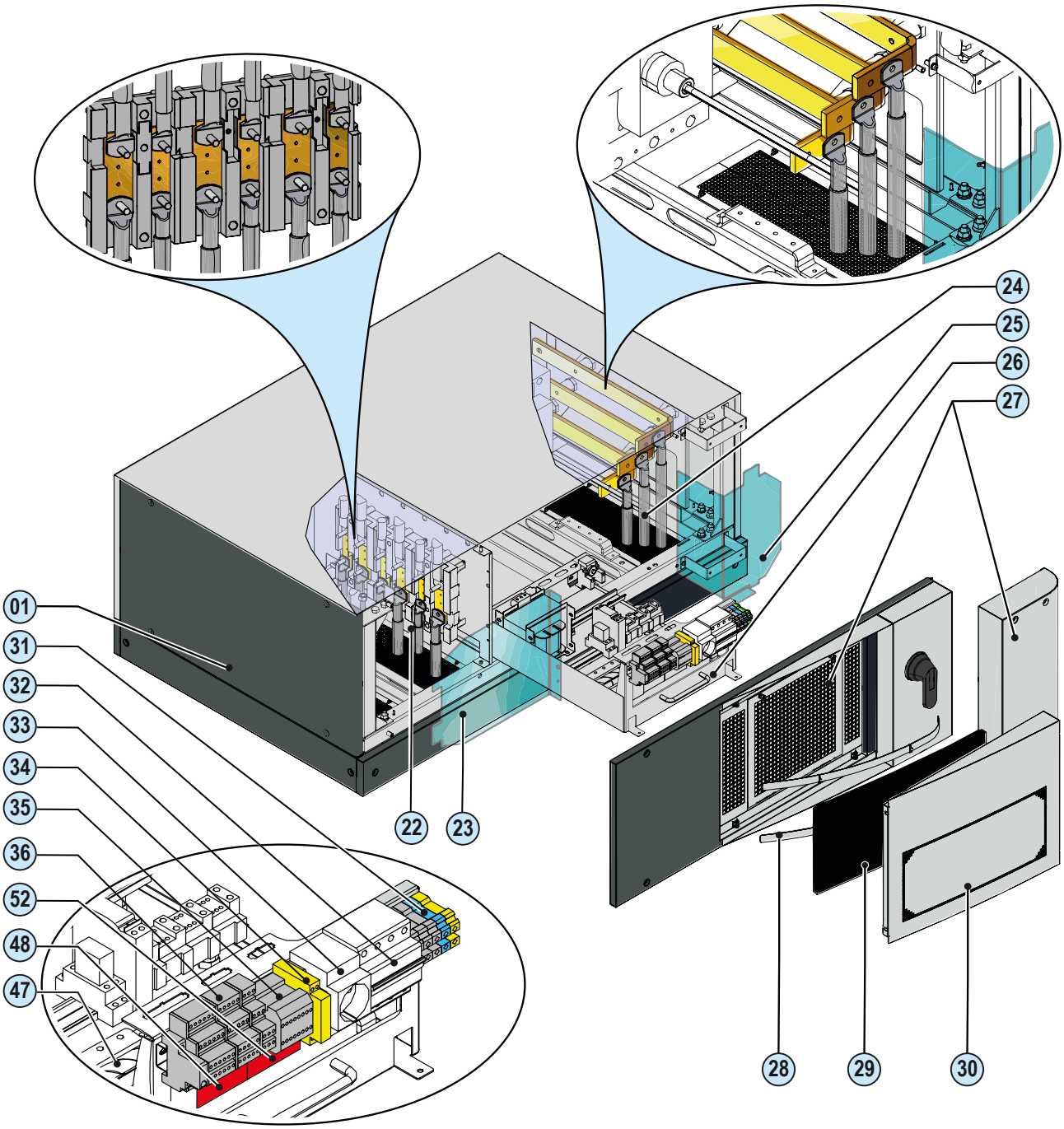
General view: PLUS-HV



General view: Framework



General view: Transformerless AC BOX



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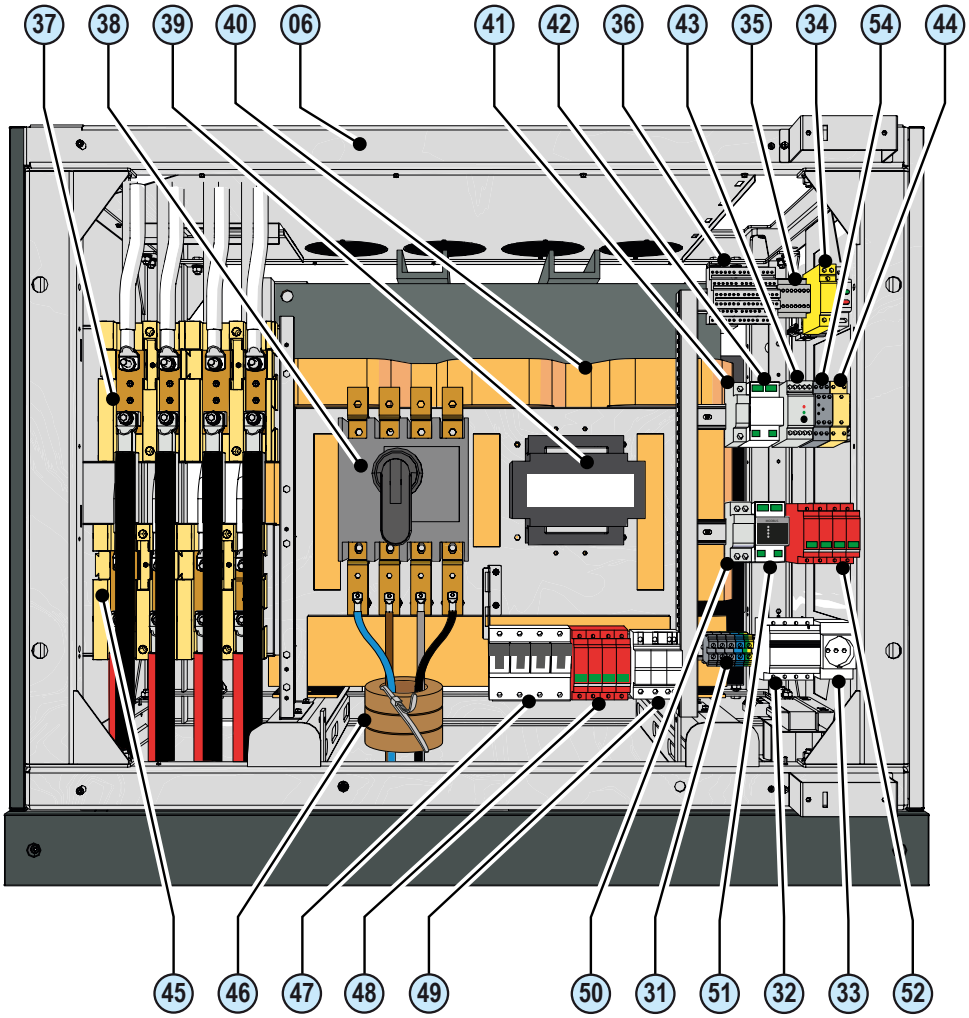
General view: AC BOX with transformer



The document and who it is for

Purpose and structure of the document

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.

If the equipment is used in a manner not specified in the installer manual, the protection provided by the equipment may be impaired.

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

List of annexes

In addition to this operating and maintenance manual, (if applicable or on request) the following enclosed documentation is supplied:
- EC declaration of conformity
- quick installation guide
- warranty

WARNING: Part of the information given in this document is taken from the original documents of the suppliers. This document contains only the information considered necessary for the use and routine maintenance of the equipment.

Staff characteristics

The customer must make sure that the operator has the necessary skill and training to do his/her job. Personnel in charge of using and maintaining the equipment must be expert, aware and skilled for the described tasks and must reliably demonstrate their capacity to correctly interpret what is described in the manual.

For safety reasons, only a qualified electrician who has received training and/or demonstrated skills and knowledge on the structure and operation of the unit may install the inverter.

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

The employment of a person who is NOT qualified, is drunk, or on narcotics, is strictly forbidden.

The customer has civil liability for the qualification and mental or physical state of the professional figures who interact with the equipment. They must always use the personal protective equipment required by the laws of the country of destination and whatever is provided by their employer.

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Symbols ad signs

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

Table: Symbols	
	This points out that it is mandatory to consult the manual or original document, which must be available for future use and must not be damaged in any way.
	Generic hazard - Important safety information. This points out operations or situations in which staff must be very careful.
	Hazardous voltage - This points out operations or situations in which staff must be very careful due to hazardous voltage.
	Hot parts - This points out a hazard due to the presence of heated areas or in any case areas that have hot parts (danger of burns).
	This points out that the examined area must not be entered or that the described operation must not be carried out.
	This points out that it is mandatory to carry out the described operations using the clothing and/or personal protective equipment provided by the employer.
	This indicates the degree of protection of the equipment according to IEC standard 70-1 (EN 60529 June 1997).
	Point of connection for grounding protection.
	This indicates the allowed temperature range
	This indicates the risk of electric shock. Time need to discharge stored energy: 5/10 minutes
	Respectively direct current and alternating current
	Isolating transformer present or not present
	Positive pole and negative pole of the input voltage (DC)
	This indicates the centre of gravity of the equipment.

Field of use, general conditions

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

You may not use the equipment for a use that does not conform to that provided for in the field of use. 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.

Intended or allowed use

This equipment is a inverter designed for:
transforming a continuous electrical current (DC)
supplied by a photovoltaic generator (FV)
in an alternating electrical current (AC)
suitable for feeding into the public distribution grid.

Limits in field of use

The inverter can be used only with photovoltaic modules which have ground isolated input poles, unless they are accessories installed that enable earthing of the inputs. In this case you must install an insulating transformer on the AC side of the system.

Only a photovoltaic generator can be connected in the input of the inverter (do not connect batteries or other sources of power supply).

The inverter can be connected to the electricity grid only in countries for which it has been certified/approved.

The inverter cannot be connected to the DC side in parallel to other inverters to convert energy from a photovoltaic generator with a power greater than the nominal power of the single inverter.

The inverter may only be used in compliance with all its technical characteristics.

Improper or prohibited use

IT IS STRICTLY FORBIDDEN TO:

- *Install the equipment in environments subject to particular conditions of flammability or in adverse or disallowed environmental conditions, (temperature and humidity).*
- *Use the equipment with safety devices which are faulty or disabled.*
- *Use the equipment or parts of the equipment by linking it to other machines or equipment, unless expressly provided for.*
- *Modify operating parameters that are not accessible to the operator and/or parts of the equipment to vary its performance or change its isolation.*
- *Clean with corrosive products that could eat into parts of the equipment or generate electrostatic charges.*
- *Use or install the appliance or parts of it without having read and understood the contents of the user and maintenance manual.*
- *Heat or dry rags and clothing on the parts in temperature. In addition to being hazardous, doing so would compromise component ventilation and cooling.*

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General conditions

A description of the characteristics of the equipment is given so as to identify its main components and specify the technical terminology used in the manual.
Technical terminology and the fast retrieval system for information, are supported by:
• Contents
• Reference number index

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

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

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

Models and range of equipment

The specific inverter models covered in this manual are divided into two groups according to the maximum output power of each individual conversion module:
FIMER PLUS models > 55.0kW conversion modules
FIMER PLUS-HV models > 67.0kW conversion modules.
Within the FIMER PLUS models, inverters with the same power rating are available in two sub-families, depending on whether or not they are equipped with an isolating transformer (low frequency).

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

Equipment models

• **PLUS** (55.0kW conversion modules)

Transformerless models "-TL"	**Models with transformer**
PVI-55.0-TL-ZZ*	**PVI-55.0-ZZ***
PVI-110.0-TL-ZZ*	**PVI-110.0-ZZ***
PVI-165.0-TL-ZZ*	**PVI-165.0-ZZ***
PVI-220.0-TL-ZZ*	**PVI-220.0-ZZ***
PVI-275.0-TL-ZZ*	**PVI-275.0-ZZ***
PVI-330.0-TL-ZZ*	**PVI-330.0-ZZ***

• **PLUS-HV** (67.0kW conversion modules)

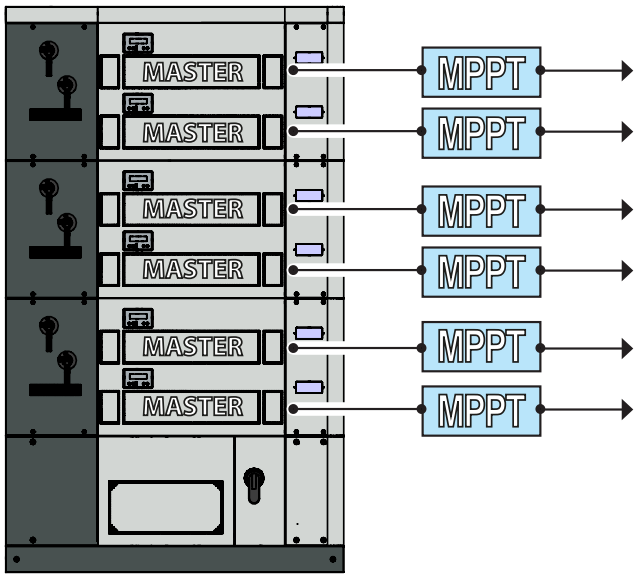
Transformerless models "-TL"
PVI-67.0 -TL-ZZ*
PVI-134.0-TL-ZZ*
PVI-200.0-TL-ZZ*
PVI-267.0-TL-ZZ*
PVI-334.0-TL -ZZ*
PVI-400.0-TL-ZZ*

** -ZZ = Country of installation*

Inverters models with same output power are available with different conversion module input configurations in order to meet the construction needs of the specific photovoltaic system. It is mandatory to specify such needs upon ordering, as they determine the hardware and software configuration to be set by FIMER before the final despatch.

The available configurations are
Multi-Master
Multi-Master/Slave
Master/Slave
and the associated descriptions are reported in the following sections.

Multi-Master configuration

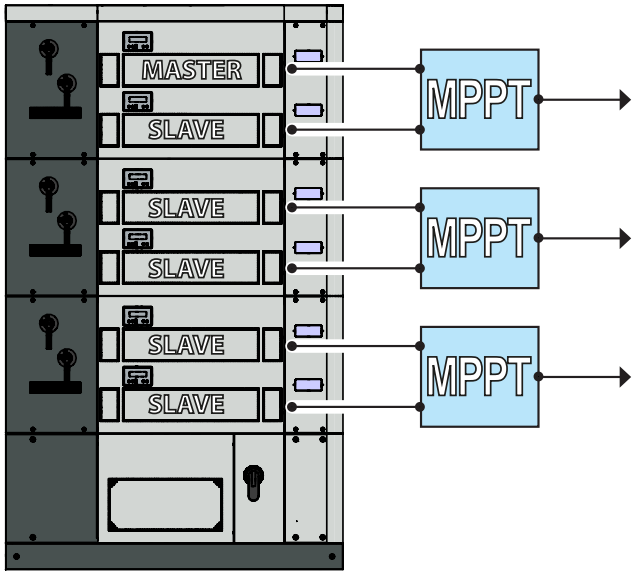


In this configuration the inverter acts as a series of separate inverters amounting to a number equal to the number of conversion modules in the equipment and with power rating equal to that of each individual conversion module.

Example:
a PLUS PVI-330.0kW-TL or PLUS-HV PVI-400.0kW-TL includes 6 conversion modules, thus 6 different MPPTs (as shown in the figure).

Each module operates with an MPPT independent of the others.

Multi-Master/Slave configuration

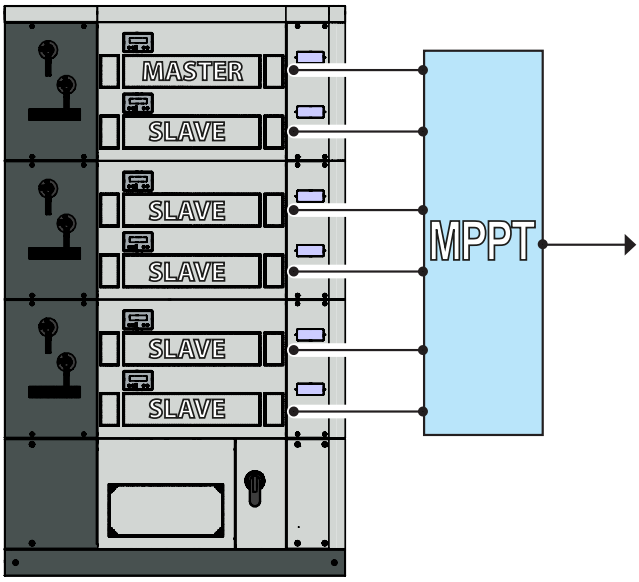


In this configuration the inverter acts as a series of separate inverters amounting to a number equal to half the number of conversion modules in the equipment and with power rating equal to that of a pair of individual conversion modules.

Example:
a PLUS PVI-330.0kW-TL or PLUS-HV PVI-400.0kW-TL includes 6 conversion modules, thus 3 different MPPTs (as shown in the figure).

Each Framework (composed of a pair of conversion module) operates separately, with a MPPT system independent of the others.

Master/Slave configuration (with a single Master)



In this configuration the inverter acts as a single inverter with power rating equal to the sum of the power of each individual conversion module in the equipment.

Example:
a PLUS PVI-330.0kW-TL or PLUS-HV PVI-400.0kW-TL includes 6 conversion modules, thus 1 single MPPT (as shown in the figure).

This configuration requires particular care while commissioning since, unlike other configurations, the inverter is equipped in this case with a pre-charge board for the capacitors of each individual module. This requires special care when operating the individual DC disconnect switches on each conversion module, following the procedure provided in the chapter covering the "Commissioning" of the inverter.

This PLUS and PLUS-HV inverter configuration is only allowed if 3 or more conversion modules are installed on the inverter (with power ratings of respectively 165.0 / 200.0kW).

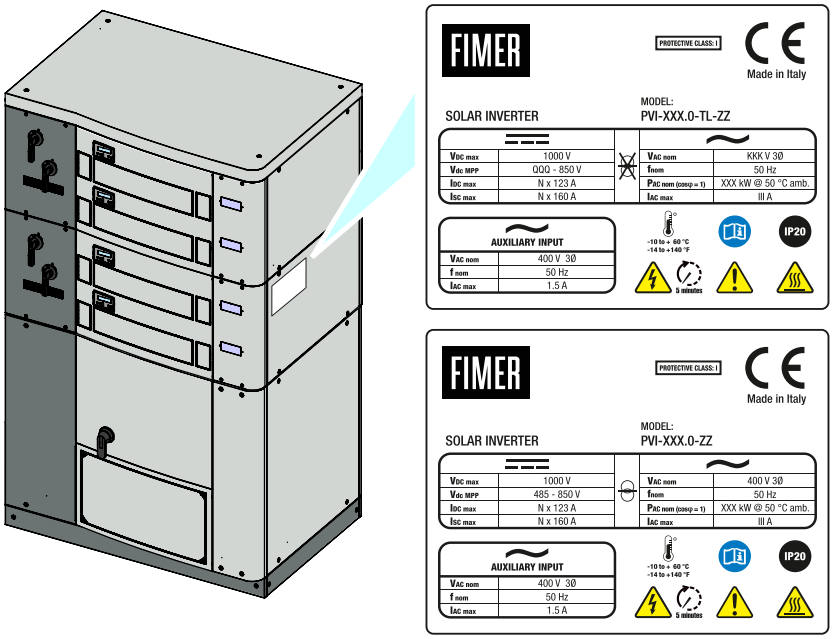
The Master position in the centralised system is not predetermined. The module with the largest serial number is always the Master.

Identification of the equipment and manufacturer

The technical data provided in this manual does not substitute the data supplied on the labels affixed to the equipment.

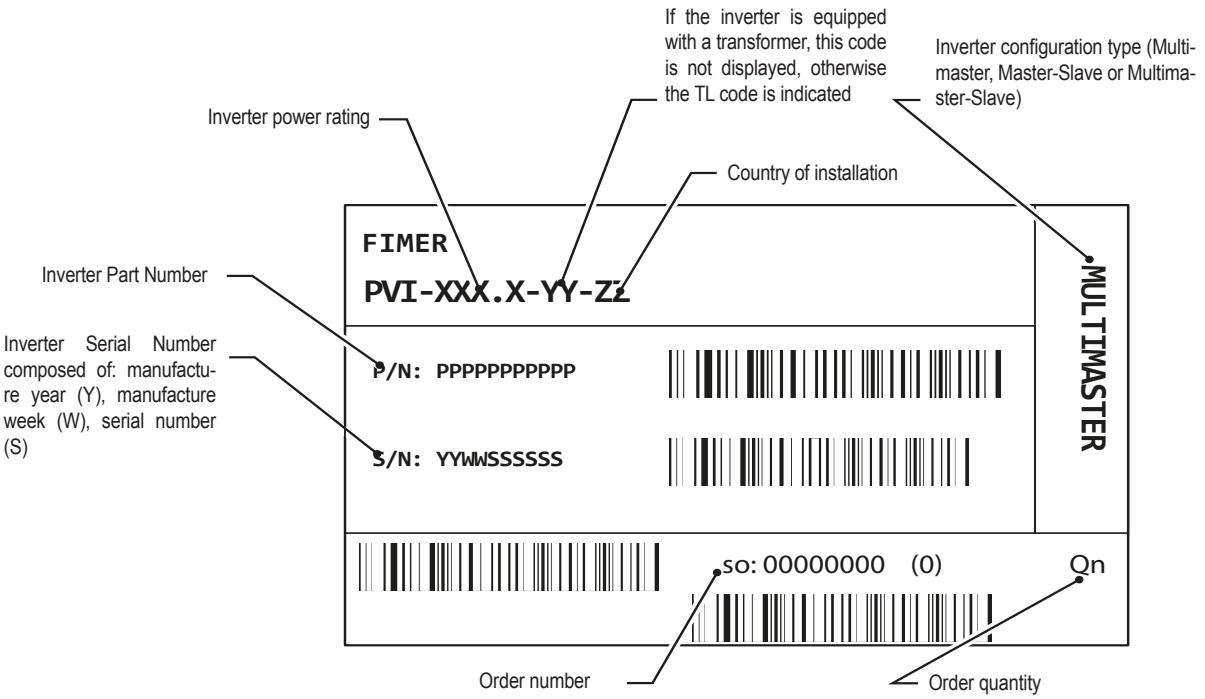
The labels affixed to the equipment must NOT be removed, damaged, stained, hidden, etc., for any reason whatsoever.

Note: The labels are NOT to be hidden by foreign objects and parts (rags, boxes, equipment, etc.); they must be regularly cleaned and always kept in sight.



Legend:
XXX= Inverter power rating
ZZ= Country of installation
III= Output current (varies depending on the inverter power)
N= Number of modules.
QQQ= Minimum VMPP
KKK= Rated Output Voltage

Besides the label with the specifications, an additional inverter identification label is also provided.
The label displays the following information:



When requesting the service password, the required data is indicated on the label in correspondence to the SN code, respectively: manufacture year (YY), manufacture week (WW) and serial number (SSSSSS).

Note: The labels are NOT to be hidden by foreign objects and parts (rags, boxes, equipment, etc.); they must be regularly cleaned and always kept in sight.

Characteristics and technical data

Table: Technical Data	PVI-55.0	PVI-55.0-TL	PVI-110.0	PVI-110.0-TL
Input				
Absolute Maximum Input Voltage (Vmax,abs)	1000 V			
MPPT DC Voltage Range (VMPPTmin ... VMPPTmax)	485...950 V Linear derating from MAX to 31.8% [800<VMPPT<950V] (6)			
MPPT DC Voltage Range (VMPPTmin... VMPPTmax)@ Pacr and Vacr	485...850 V (6)			
Number of Independent Multi-Master MPPTs	1	1	2	2
Number of Independent Multi - Master/ Slave MPPTs	Not applicable			
Number of Independent Master/Slave MPPTs	1			
Maximum Combined Input Current (Idcmaxc)	123 A		246 A	
Short Circuit Input Current (Iscmax)	160 A		320 A	
Maximum Combined Input Current for Each Module (Idcmax,m)	123 A			
Number of DC Input Connection Pairs	1		2	
DC Connection type (both poles)	2x185 mm² (M10)	2x185 mm² (M10)	2x185mm² (M10) +2x300mm² (M10)	2x185mm² (M10) +2x300mm² (M10)
Input Protection				
Reverse Polarity Protection	Yes, with standard diodes			
Input overvoltage protection - Varistors	1 for each input, Class II			
Insulation check, Floating neutral, Floating panels (IT SYSTEM)	Yes, via proprietary check (4)			
Differential protection, Grounded neutral, Floating panels (TN SYSTEM)	Not included; set the size of the output current difference with ΔI=400 mA/ module			
Fuse size for each input pair	125 A / 1000 Vdc			
Output				
Type of AC connection to the grid	Three-phase 4W+PE	Three-phase 3W+PE	Three-phase 4W+PE	Three-phase 3W+PE
Nominal AC output power (Pacr)	55 kW	55 kW	110 kW	110 kW
Rated Output Voltage (Vacr)	400 V	320 V	400 V	320 V
Output Voltage range (Vacmin...Vacmax)	320...480 V (1)	256...368 V (1)	320...480 V (1)	256...368 V (1)
Maximum Output Current (Iacmax)	88 A	108 A	176 A	216 A
Rated Output Frequency (fr)	50 / 60 Hz			
Output Frequency Range (fmin...fmax)	47..53/57..63 Hz (2)			
Nominal Power Factor (Cosphiac,r)	> 0.995 (adj.±0.90)			
Total Current Harmonic Distortion	< 3% (@ Pacr)			
AC Connection Type	1x95mm² (M12)	1x300mm² (M12)	1x95mm² (M12)	1x300mm² (M12)
Output Protection				
Anti-Islanding Protection	Complying with the local regulations			
Output overvoltage protection - Varistors	Yes, Class II			
Night Time Disconnect	Yes	No	Yes	No
AC switch (thermal-magnetic)	50 kA			
Fuse size for each phase	160 A / 690 Vac			

Table: Technical Data	PVI-55.0	PVI-55.0-TL	PVI-110.0	PVI-110.0-TL
Auxiliary AC voltage				
Auxiliary AC power supply connection	3W+N+PE			
Nominal aux AC power supply voltage	400 Vac			
Nominal aux AC power supply frequency	50/60 Hz			
Performance				
Maximum Efficiency (ηmax)	96.3% (5)	98,0% (5)	96.4% (5)	98,0% (5)
Weighted Efficiency (ηEURO/ηCEC)	95.1%/96.0%(5)	97.7%/97.5% (5)	95.1%/96.0%(5)	97.7%/97.5%(5)
Stand-by Consumption / Night-time consumption	< 17 W	< 23 W	< 24 W	< 19 W
Auxiliary AC Supply	3 x 400 V AC + N, 50/60 Hz			
Auxiliary Supply Consumption	< 0.36% of Pacr	< 0.24% of Pacr	< 0.31% of Pacr	< 0.24% of Pacr
Aux Power Supply Consumption without Cooling System	< 0.25% of Pacr	< 0.22% of Pacr	< 0.23% of Pacr	< 0.22% of Pacr
Converter Switching Frequency	18 kHz			
Communication				
Wired Local Monitoring	PVI-USB-RS232_485 (opt.)			
Remote Monitoring	PVI-AEC-EVO (opt.) / VSN700 Data Logger (opt.)			
FIMER String Combiner	PVI-STRINGCOMB (opt.)			
User Interface	Display LCD 16 characters x 2 lines for each module			
Environmental				
Room Temperature	-10...+ 60°C / +14...140°F with derating above 50°C/122°F			
Relative Humidity	0...95% w/o condensation			
Noise Emission	<62db(A)@1m	<62db(A)@1m	<65db(A)@1m	<63db(A)@1m
Maximum Operating Altitude without Derating	1000 m / 3280 ft			
Pollution Grade	2			
Physical				
Protection Rating	IP 20			
Cooling System	Forced air			
Required Air Flow	1600m³/h 944 CFM	1600m³/h 944 CFM	2800 m³/h 1652 CFM	2400 m³/h 1416 CFM
Dimension (H x W x D)	1675x1250x850mm 65.9x49.2x33.5”	1077x1250x850mm 42.4x49.2x33.5”	1675x1250x850mm 65.9x49.2x33.5”	1077x1250x850mm 42.4x49.2x33.5”
Weight	<700kg/1543lb	<350kg/771lb	<800kg/1765lb	<480kg/1058lb
Weight of the module	<60kg / 132lb			
Safety				
Transformer	Yes	No	Yes	No
Marking	CE(50 Hz only)			
Safety and EMC Standard	EN 50178, EN61000-6-2, EN61000-6-4, EN61000-3-11, EN61000-3-12			
Grid Standard	ENEL GUIDE,CEI-0-16 (3), Attached A70 Terna (3),CEI 0-21, BDEW, RD 1663			

1 - The output voltage range may vary according to the grid standard of the country of installation
2 - The output frequency range may vary according to the grid standard of the country of installation
3 - From date of applicability
4 - Disconnection if the input is not balanced with respect to ground (not enabled by default)
5 - Inverter auxiliary consumption not included
6 - Refer to section “Calculating VMPPmin as a function of the grid voltage (Vgrid)”
Note - Features not specifically mentioned in this data sheet are not included in the product.

Table: Technical Data	PVI-165.0	PVI-165.0-TL	PVI-220.0	PVI-220.0-TL
Input				
Absolute Maximum Input Voltage (Vmax,abs)	1000 V			
MPPT DC Voltage Range (VMPPTmin ... VMPPTmax)	485...950 V Linear derating from MAX to 31.8% [800<VMPPT<950V] (6)			
MPPT DC Voltage Range (VMPPTmin... VMPPTmax)@ Pacr and Vacr	485...850 V (6)			
Number of Independent Multi-Master MPPTs	3		4	
Number of Independent Multi - Master/ Slave MPPTs	2			
Number of Independent Master/Slave MPPTs	1			
Maximum Combined Input Current (Idcmaxc)	369 A		492 A	
Short Circuit Input Current (Iscmax)	480 A		640 A	
Maximum Combined Input Current for Each Module (Idcmax,m)	123 A			
Number of DC Input Connection Pairs	3		4	
DC Connection type (both poles)	4x185 mm² (M10) +2x300 mm² (M10)		4x185 mm² (M10) +4x300 mm² (M10)	
Input Protection				
Reverse Polarity Protection	Yes, with standard diodes			
Input overvoltage protection - Varistors	1 for each input, Class II			
Insulation check, Floating neutral, Floating panels (IT SYSTEM)	Yes, via proprietary check (4)			
Differential protection, Grounded neutral, Floating panels (TN SYSTEM)	Not included; set the size of the output current difference with ΔI=400 mA/ module			
Fuse size for each input pair	125 A / 1000 Vdc			
Output				
Type of AC connection to the grid	Three-phase 4W+PE	Three-phase 3W+PE	Three-phase 4W+PE	Three-phase 3W+PE
Nominal AC output power (Pacr)	165 kW		220 kW	
Rated Output Voltage (Vacr)	400 V	320 V	400 V	320 V
Output Voltage range (Vacmin...Vacmax)	320...480 V (1)	256...368 V (1)	320...480 V (1)	256...368 V (1)
Maximum Output Current (Iacmax)	264 A	324 A	352 A	432 A
Rated Output Frequency (fr)	50 / 60 Hz			
Output Frequency Range (fmin...fmax)	47..53/57..63 Hz (2)			
Nominal Power Factor (Cosphiac,r)	> 0.995 (adj.±0.90)			
Total Current Harmonic Distortion	< 3% (@ Pacr)			
AC Connection Type	1x185mm²(M12)	2x300mm²(M12)	1x185mm²(M12)	2x300mm²(M12)
Output Protection				
Anti-Islanding Protection	Complying with the local regulations			
Output overvoltage protection - Varistors	Yes, Class II			
Night Time Disconnect	Yes	No	Yes	No
AC switch (thermal-magnetic)	50 kA			
Fuse size for each phase	160A / 690Vac			
Auxiliary AC voltage				
Auxiliary AC power supply connection	3W+N+PE			

Table: Technical Data	PVI-165.0	PVI-165.0-TL	PVI-220.0	PVI-220.0-TL
Nominal aux AC power supply voltage	400 Vac			
Nominal aux AC power supply frequency	50/60 Hz			
Performance				
Maximum Efficiency (ηmax)	96.5% (5)	98,0% (5)	96.5% (5)	98,0% (5)
Weighted Efficiency (ηEURO/ηCEC)	95.3%/96.0% (5)	97.7%/97.5% (5)	95.3%/96.0% (5)	97.7%/97.5% (5)
Stand-by Consumption / Night-time consumption	< 31 W	< 26 W	< 28 W	< 33 W
Auxiliary AC Supply	3 x 400 V AC + N, 50/60 Hz			
Auxiliary Supply Consumption	<0.30% of Pacr	<0.24% of Pacr	<0.28% of Pacr	<0.24% of Pacr
Aux Power Supply Consumption without Cooling System	< 0.22% of Pacr			
Converter Switching Frequency	18 kHz			
Communication				
Wired Local Monitoring	PVI-USB-RS232_485 (opt.)			
Remote Monitoring	PVI-AEC-EVO (opt.) / VSN700 Data Logger (opt.)			
FIMER String Combiner	PVI-STRINGCOMB (opt.)			
User Interface	Display LCD 16 characters x 2 lines for each module			
Environmental				
Room Temperature	-10...+ 60°C / +14...140°F with derating above 50°C/122°F			
Relative Humidity	0...95% w/o condensation			
Noise Emission	<68db(A)@1m	<66db(A)@1m	<72db(A)@1m	<69db(A)@1m
Maximum Operating Altitude without Derating	1000 m / 3280 ft			
Pollution Grade	2			
Physical				
Protection Rating	IP 20			
Cooling System	Forced air			
Required Air Flow	4000 m³/h 2360 CFM	3200 m³/h 1888 CFM	4800 m³/h 2832 CFM	4000 m³/h 2360 CFM
Dimension (H x W x D)	2184x1250x850mm 86.0x49.2x33.5”	1675x1250x850mm 65.9x49.2x33.5”	2184x1250x850mm 86.0x49.2x33.5”	1675x1250x850mm 65.9x49.2x33.5”
Weight	<1200kg/2646lb	<680kg/1500lb	<1300kg/2867lb	<780kg/1720lb
Weight of the module	< 60 kg / 132 lb			
Safety				
Transformer	Yes	No	Yes	No
Marking	CE (50 Hz only)			
Safety and EMC Standard	EN 50178, EN61000-6-2, EN61000-6-4, EN61000-3-11, EN61000-3-12			
Grid Standard	GUIDA ENEL,CEI-0-16 (3), Allegato A70 Terna (3),CEI 0-21, BDEW, RD 1663			

1 - The output voltage range may vary according to the grid standard of the country of installation
2 - The output frequency range may vary according to the grid standard of the country of installation
3 - From date of applicability
4 - Disconnection if the input is not balanced with respect to ground (not enabled by default)
5 - Inverter auxiliary consumption not included
6 - Refer to section “Calculating VMPPmin as a function of the grid voltage (Vgrid)”
Note - Features not specifically mentioned in this data sheet are not included in the product.

Table: Technical Data	PVI-275.0	PVI-275.0-TL	PVI-330.0	PVI-330.0-TL
Input				
Absolute Maximum Input Voltage (Vmax,abs)	1000 V			
MPPT DC Voltage Range (VMPPTmin ... VMPPTmax)	485...950 V Linear derating from MAX to 31.8% [800<VMPPT<950V] (6)			
MPPT DC Voltage Range (VMPPTmin... VMPPTmax)@ Pacr and Vacr	485...850 V (6)			
Number of Independent Multi-Master MPPTs	5		6	
Number of Independent Multi - Master/ Slave MPPTs	3			
Number of Independent Master/Slave MPPTs	1			
Maximum Combined Input Current (Idcmaxc)	615 A		738 A	
Short Circuit Input Current (Iscmax)	800 A		960 A	
Maximum Combined Input Current for Each Module (Idcmax,m)	123 A			
Number of DC Input Connection Pairs	5		6	
DC Connection type (both poles)	6x185 mm² (M10) + 4x300 mm² (M10)		6x185 mm² (M10) + 6x300 mm² (M10)	
Input Protection				
Reverse Polarity Protection	Yes, with standard diodes			
Input overvoltage protection - Varistors	1 for each input, Class II			
Insulation check, Floating neutral, Floating panels (IT SYSTEM)	Yes, via proprietary check (4)			
Differential protection, Grounded neutral, Floating panels (TN SYSTEM)	Not included; set the size of the output current difference with ΔI=400 mA/ module			
Fuse size for each input pair	125 A / 1000 V DC			
Output				
Type of AC connection to the grid	Three-phase 4W+PE	Three-phase 3W+PE	Three-phase 4W+PE	Three-phase 3W+PE
Nominal AC output power (Pacr)	275 kW		330 kW	
Rated Output Voltage (Vacr)	400 V	320 V	400 V	320 V
Output Voltage range (Vacmin...Vacmax)	320...480 V (1)	256...368 V (1)	320...480 V (1)	256...368 V (1)
Maximum Output Current (Iacmax)	440 A	540 A	528 A	648 A
Rated Output Frequency (fr)	50 / 60 Hz			
Output Frequency Range (fmin...fmax)	47..53/57..63 Hz (2)			
Nominal Power Factor (Cosphiac,r)	> 0.995 (adj.±0.90)			
Total Current Harmonic Distortion	< 3% (@ Pacr)			
AC Connection Type	1x240mm²(M12)	2x300mm²(M12)	1x240mm²(M12)	2x300mm²(M12)
Output Protection				
Anti-Islanding Protection	Complying with the local regulations			
Output overvoltage protection - Varistors	Yes, Class II			
Night Time Disconnect	Yes	No	Yes	No
AC switch (thermal-magnetic)	50 kA			
Fuse size for each phase	160 A / 690 V AC			
Auxiliary AC voltage				
Auxiliary AC power supply connection	3W+N+PE			
Nominal aux AC power supply voltage	400 Vac			

Table: Technical Data	PVI-275.0	PVI-275.0-TL	PVI-330.0	PVI-330.0-TL
Nominal aux AC power supply frequency	50/60 Hz			
Performance				
Maximum Efficiency (ηmax)	96.7% (5)	98,0% (5)	96.7% (5)	98,0% (5)
Weighted Efficiency (ηEURO/ηCEC)	95.3% / 96.0% (5)	97.7% / 97.5% (5)	95.3% / 96.0% (5)	97.7% / 97.5% (5)
Stand-by Consumption / Night-time consumption	< 45 W	< 40 W	< 52 W	< 47 W
Auxiliary AC Supply	3 x 400 V AC + N, 50/60 Hz			
Auxiliary Supply Consumption	< 0.29% of Pacr	< 0.24% of Pacr	< 0.28% of Pacr	< 0.24% of Pacr
Aux Power Supply Consumption without Cooling System	< 0.22% of Pacr			
Converter Switching Frequency	18 kHz			
Communication				
Wired Local Monitoring	PVI-USB-RS232_485 (opt.)			
Remote Monitoring	PVI-AEC-EVO (opt.) / VSN700 Data Logger (opt.)			
FIMER String Combiner	PVI-STRINGCOMB (opt.)			
User Interface	Display LCD 16 characters x 2 lines for each module			
Environmental				
Room Temperature	-10...+ 60°C / +14...140°F with derating above 50°C/122°F			
Relative Humidity	0...95% w/o condensation			
Noise Emission	<75db(A)@1m	<72db(A)@1m	<78db(A)@1m	<75db(A)@1m
Maximum Operating Altitude without Derating	1000 m / 3280 ft			
Pollution Grade	2			
Physical				
Protection Rating	IP 20			
Cooling System	Forced air			
Required Air Flow	6800 m³/h 4012 CFM	4800 m³/h 2832 CFM	7600 m³/h 4484 CFM	5600 m³/h 3304 CFM
Dimension (H x W x D)	2184x1250x 850mm 86.0x49.2x33.5" 1215x250x870mm 47.8x49.2x34.3" (Transf.)	2184x1250x 850mm 86.0x49.2x33.5”	2184x1250x 850mm 86.0x49.2x33.5” 1215x250x870mm 47.8x49.2x34.3” (Transf.)	2184x1250x 850mm 86.0x49.2x33.5”
Weight	<1600kg/3527lb	<1000kg/2205lb	<1750kg/3858lb	<1150kg/2535lb
Weight of the module	< 60 kg / 132 lb			
Safety				
Transformer	Yes	No	Yes	NO
Marking	CE (50 Hz only)			
Safety and EMC Standard	EN 50178, EN61000-6-2, EN61000-6-4, EN61000-3-11, EN61000-3-12			
Grid Standard	GUIDA ENEL,CEI-0-16 (3), Allegato A70 Terna (3),CEI 0-21, BDEW, RD 1663			

1 - The output voltage range may vary according to the grid standard of the country of installation
2 - The output frequency range may vary according to the grid standard of the country of installation
3 - From date of applicability
4 - Disconnection if the input is not balanced with respect to ground (not enabled by default)
5 - Inverter auxiliary consumption not included
6 - Refer to section “Calculating VMPPmin as a function of the grid voltage (Vgrid)”
Note - Features not specifically mentioned in this data sheet are not included in the product.

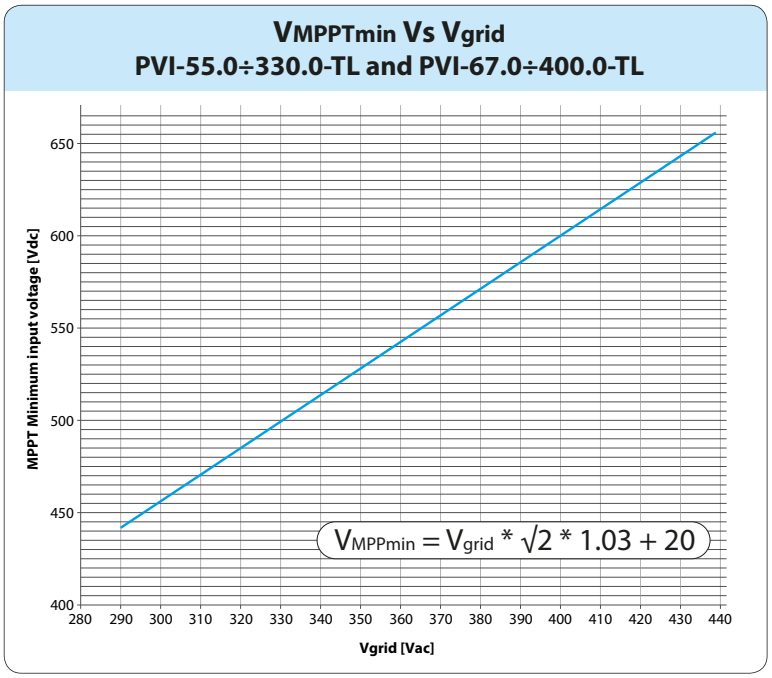
Table: Technical Data	PVI-67.0-TL	PVI-134.0-TL	PVI-200.0-TL	PVI-267.0-TL	PVI-334.0-TL	PVI-400.0-TL
Input						
Absolute Maximum Input Voltage (Vmax,abs)	1000 V					
MPPT DC Voltage Range (VMPPTmin ... VMPPTmax)	570...950 V Linear derating from MAX to 30,6% [800<VMPPT<950V] (6)					
MPPT DC Voltage Range (VMPPTmin...VMPPTmax)@ Pacr and Vacr	570...850 V (6)					
Number of Independent Multi-Master MPPTs	1	2	3	4	5	6
Number of Independent Multi - Master/Slave MPPTs	1	1	2	2	3	3
Number of Independent Master/Slave MPPTs	1	1	1	1	1	1
Maximum Combined Input Current (Idcmaxc)	123 A	246 A	369 A	492 A	615 A	738 A
Short Circuit Input Current (Iscmax)	160 A	320 A	480 A	640 A	800 A	960 A
Maximum Combined Input Current for each Module (Idcmax,m)	123 A					
Maximum Return Current (AC to DC side)	Negligible					
Number of DC Input Connection Pairs	1	2	3	4	5	6
DC Connection Type	2x185 mm^2 (M10)	2x185mm^2 (M10) + 2x300mm^2 (M10)	4x185mm^2 (M10) + 2x300 mm^2 (M10)	4x185 mm^2 (M10) + 4x300 mm^2 (M10)	6x185 mm^2 (M10) + 4x300 mm^2 (M10)	6x185 mm^2 (M10) + 6x300 mm^2 (M10)
Input Protection						
Reverse Polarity Protection	Yes, with standard diodes					
Input overvoltage protection - Varistors	1 for each input, Class II					
Insulation check, Floating neutral, floating panels	Yes, via proprietary check (4)					
Fuse size for each input pair	125 A / 1000 V DC					
Output						
Type of AC connection to the grid	Three-phase 3W+PE					
Nominal AC Output Power (Pacr)	67 kW	134 kW	200 kW	267 kW	334 kW	400 kW
Rated Output Voltage (Vacr)	380 V					
Output Voltage range (Vacmin...Vacmax)	323...437 V (1)					
Maximum Output Current (Iacmax)	108 A	216 A	324 A	432 A	540 A	648 A
Rated Output Frequency (fr)	50 / 60 Hz					
Output Frequency Range (fmin... fmax)	47..53/57..63 Hz (2)					
Nominal Power Factor (Cosphiac,r)	> 0.995 (adj.±0.90)					
Total Current Harmonic Distortion	< 3% (@ Pacr)					
AC Connection Type	2 x 300 mm^2 (M12)					
Maximum Fault Current	< 255 Arms (60 mS)					
Output Protection						
Anti-Islanding Protection	Yes, complying with the local regulations					
Output overvoltage protection - Varistors	Yes, Class II					
Night Time Disconnect	No					

Table: Technical Data	PVI-67.0-TL	PVI-134.0-TL	PVI-200.0-TL	PVI-267.0-TL	PVI-334.0-TL	PVI-400.0-TL
AC switch (thermal-magnetic)	50 kA					
Fuse size for each phase	160 A / 690 V AC					
Auxiliary AC voltage						
Auxiliary AC power supply connection	3W+N+PE					
Nominal aux AC power supply voltage	400 Vac					
Nominal aux AC power supply frequency	50/60 Hz					
Performance						
Maximum Efficiency (ηmax)	98.0% (5)					
Maximum Efficiency (ηEURO/ηCEC)	97.7% / 97.5% (5)					
Stand-by (Night-time) consumption	< 12 W	< 19 W	< 26 W	< 33 W	< 40 W	< 47 W
Auxiliary AC Supply	3 x 400 V AC + N, 50/60 Hz					
Auxiliary Supply Consumption	< 0.19% of Pacr					
Auxiliary Power Supply Consumption without Cooling System	< 0.18% of Pacr					
Converter Switching Frequency	18 kHz					
Communication						
Wired Local Monitoring	PVI-USB-RS232_485 (opt.)					
Remote Monitoring	PVI-AEC-EVO (opt.) / VSN700 Data Logger (opt.)					
FIMER String Combiner	PVI-STRINGCOMB (opt.)					
User Interface	Display LCD 16 characters x 2 lines for each module					
Environmental						
Room Temperature	-10...+ 60°C / +14...140°F with derating above 50°C/122°F					
Relative Humidity	0...95% w/o condensation					
Noise Emission	< 60 db(A) @ 1 m	< 63 db(A) @ 1 m	< 66 db(A) @ 1 m	< 69 db(A) @ 1 m	< 72 db(A) @ 1 m	< 75 db(A) @ 1 m
Maximum Operating Altitude without Derating	1000 m / 3280 ft					
Pollution Grade	2					
Physical						
Protection Rating	IP 20					
Cooling System	Forced air					
Required Air Flow	1600 m³/h 944 CFM	2400 m³/h 1416 CFM	3200 m³/h 1888 CFM	4000 m³/h 2360 CFM	4800 m³/h 2832 CFM	5600 m³/h 3304 CFM
Dimension (H x W x D)	1077x1250x850 mm 42.4x49.2x33.5”		1675x1250x850 mm 65.9x49.2x33.5”		2184x1250x850 mm 86.0x49.2x33.5”	
Weight	< 350 kg 771 lb	< 480 kg 1058 lb	< 680 kg 1500 lb	< 780 kg 1720 lb	< 1000 kg 2205 lb	< 1150 kg 2535 lb
Weight of the module	< 60 kg / 132 lb					
Safety						
Transformer	No					
Marking	CE (50 Hz only)					
Safety and EMC Standard	EN 50178, EN61000-6-2, EN61000-6-4, EN61000-3-12, EN62109-1, EN662109-2					
Grid Standard	CEI-0-16 (3), Allegato A70 Terna (3), BDEW, RD 1663, IEEE 1547-2003					

1 - The output voltage range may vary according to the grid standard of the country of installation
2 - The output frequency range may vary according to the grid standard of the country of installation
3 - From date of applicability
4 - Disconnection if the input is not balanced with respect to ground (not enabled by default)
5 - Inverter auxiliary consumption not included
6 - Refer to section “Calculating VMPPmin as a function of the grid voltage (Vgrid)”
Note - Features not specifically mentioned in this data sheet are not included in the product.

Calculating V_{MPPmin} as a function of the grid voltage (V_{grid})

By construction, the PLUS and PLUS-HV inverters vary the minimum input voltage value depending on the grid voltage. The graph below shows the trend of the variation of $V_{MPPTmin}$ and the formula used to calculate the minimum input voltage:



Tightening torques

To maintain the IP65 protection of the system and for optimal installation, the following tightening torques must be used:

Transformerless AC BOX	
Cable lugs on AC bars	80 Nm
Cable lugs on DC bars	25 Nm
Cable lugs on ground bar	8.0 Nm
Auxiliary voltage input terminals	1.8 Nm
Signal terminals	0.5 Nm

AC BOX with transformer	
Cable lugs on AC bars (PVI-55.0 and PVI-110.0kW)	6.0 Nm
Cable lugs on AC bars (PVI-165.0 and PVI-220.0kW)	28 Nm
Cable lugs on DC bars	25 Nm
Cable lugs on ground bar	8.0 Nm
Auxiliary voltage input terminals	1.8 Nm
Signal terminals	0.5 Nm

External transformer BOX	
Cable lugs on AC bars	80 Nm

Characteristics of the LV-MV/LV-LV transformer for -TL models

The centralised version of the inverter without transformer is intended for use in systems connected with medium or low voltage (compatibly with local installation regulations) through use of a transformer guaranteeing at least one simple isolation.
Because of the inverter's rated outgoing voltage, the low voltage winding must be 320/380 V AC, while the typical medium voltage winding is 20 kV, though there may be other voltage levels, depending on the country or area of installation (10, 15, 22, 25, 27, 30, 33, 35kV).
The input of the auxiliary power supply must be galvanically isolated from the power output and must comply with the following features, specified in the technical data.

Voltage	AC connection type	Overvoltage category	Frequency
400V	Three-phase + N + PE	III	50Hz

Multi-inverter installation on a single transformer

If multiple inverters must be connected to the same transformer, all the inverters may be connected on the same secondary low voltage winding. Unlike conventional inverters, centralised FIMER inverters do not require gal-vanic isolation between low voltage windings. A standard double winding transformer may be used (1 primary medium voltage winding, and 1 se-condary low voltage winding).
The limitation on this solution depends on the breaking ability of the thermal-magnetic circuit breaker on the inverter's AC output and the impedence of the transformer, which in turn determines the maximum current of the theoretical fault that might be generated in the inverter in the event of an internal short circuit.

Type of FIMER inverter	Maximum transformer power	DC voltage % (Vcc)	Secondary LV type	Secondary LV voltage	Maximum number of conversion modules connected to a single LV secondary
PLUS (version - TL)	1600kVA	6%	Triangle	320V Overvoltage category II	25 (55kW conversion modules)
PLUS-HV	2000kVA	6%	Triangle	380V Overvoltage category II	25 (67kW conversion modules)

Verification of ambient conditions for transformer installation and scaling of the inverter parallel protection breaker is the installer's responsibility.

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Overall dimensions

The overall dimensions are expressed in mm and inches

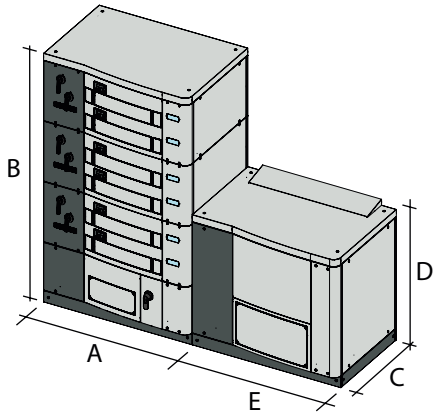


Table: Plus overall dimensions (TL models and models with Transformer)

	A	B	C	E	D
55.0	1250 mm 49.2”	1675 mm 69.5”	850 mm 33.5”	*	*
55.0-TL	1250 mm 49.2”	1077 mm 42.4”	850 mm 33.5”	*	*
110.0	1250 mm 49.2”	1675 mm 69.5”	850 mm 33.5”	*	*
110.0-TL	1250 mm 49.2”	1077 mm 42.4”	850 mm 33.5”	*	*
165.0	1250 mm 49.2”	2184 mm 86.0”	850 mm 33.5”	*	*
165.0-TL	1250 mm 49.2”	1675 mm 65.9”	850 mm 33.5”	*	*
220.0	1250 mm 49.2”	2184 mm 86.0”	850 mm 33.5”	*	*
220.0-TL	1250 mm 49.2”	1675 mm 65.9”	850 mm 33.5”	*	*
275.0	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”	1250 mm 49.2”	1215 mm 47.8”
275.0-TL	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”	*	*
330.0	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”	1250 mm 49.2”	1215 mm 47.8”
330.0-TL	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”	*	*

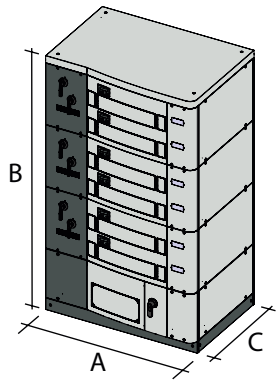


Table: Plus HV overall dimensions

	A	B	C
67.0-TL	1250 mm 49.2”	1077 mm 42.4”	850 mm 33.5”
134.0-TL	1250 mm 49.2”	1077 mm 42.4”	850 mm 33.5”
200.0-TL	1250 mm 49.2”	1675 mm 65.9”	850 mm 33.5”
267.0-TL	1250 mm 49.2”	1675 mm 65.9”	850 mm 33.5”
334.0-TL	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”
400.0-TL	1250 mm 49.2”	2184 mm 86.0	850 mm 33.5”

Efficiency curves

The equipment was designed in consideration of current energy conservation standards, to avoid waste and unnecessary leakage.

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

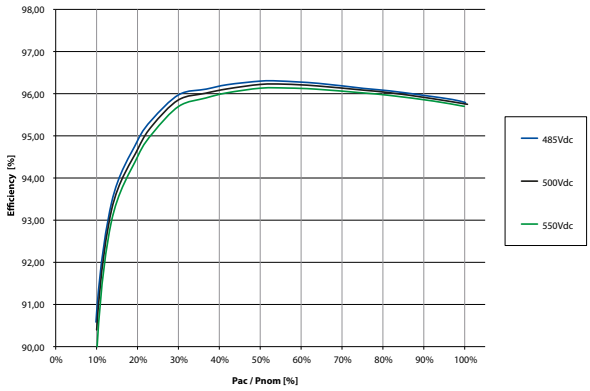
The efficiency curves are linked to technical parameters that are continually being developed and improved and should therefore be considered approximate.

PLUS

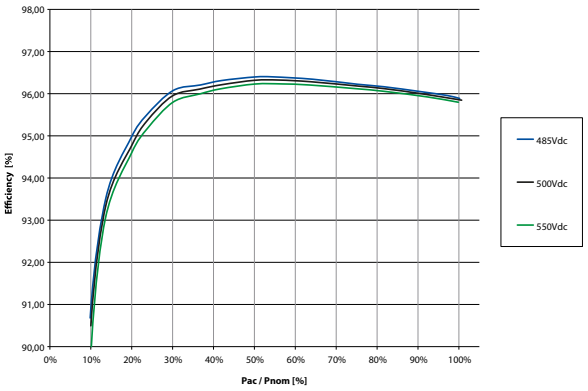
PVI-55.0÷330.0

Models with transformer

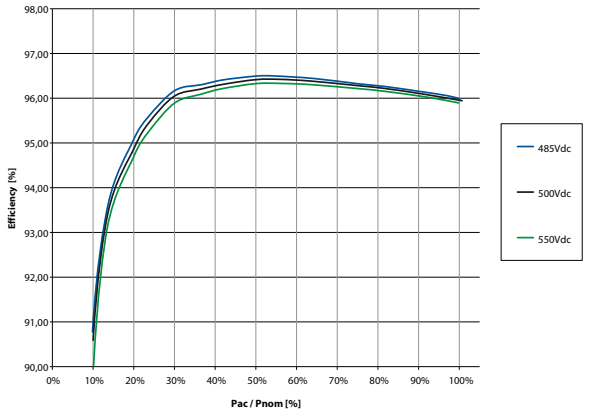
PVI-55.0



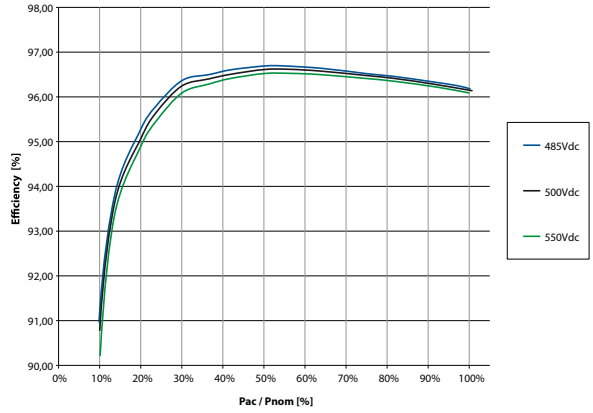
PVI-110.0



PVI-165.0/220.0

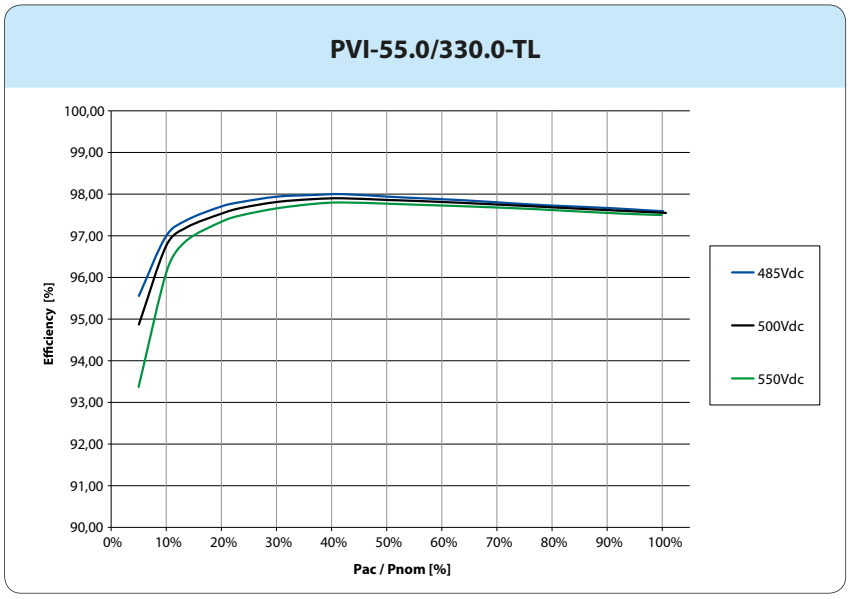


PVI-275.0/330.0



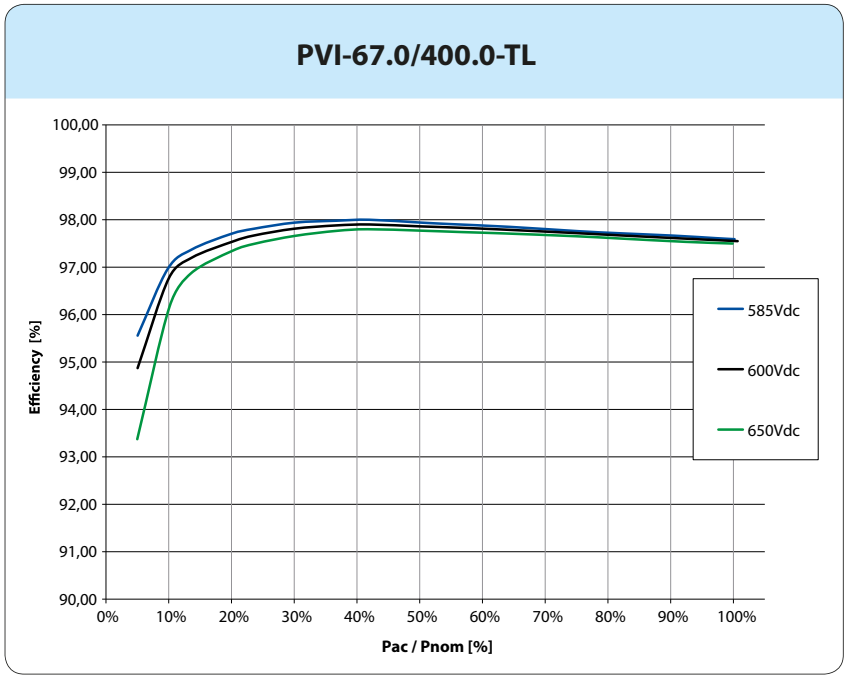
PLUS

PVI-55.0÷330.0-TL
Transformerless models



PLUS-HV

PVI-67.0÷400.0-TL
Transformerless models



Power Derating

In order 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 can take place due to adverse environmental conditions or due to unsuitable input voltage values.

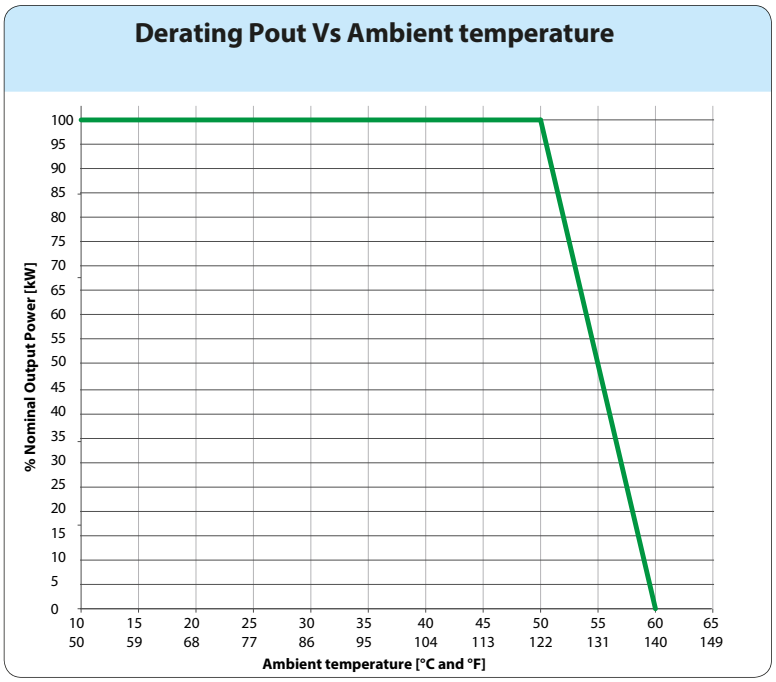
The conditions for power reduction due to environmental conditions and input voltage can also occur at the same time, but the power reduction will always relate to the lower value measured.

Power reduction 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 inverter can therefore reduce the power during certain periods of the day according to the value of these parameters.

PLUS
PVI-55.0÷330.0
Models with transformer
PVI-55.0÷330.0-TL
Transformerless models

PLUS-HV
PVI-67.0÷400.0-TL
Transformerless models

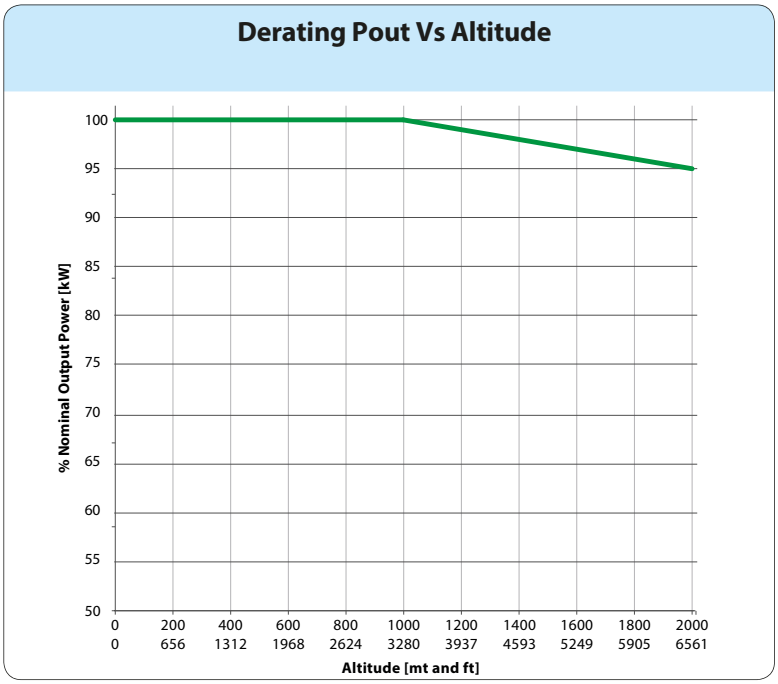


Power reduction due to the altitude of the installation

The graphs show the automatic reduction of supplied power as a function of the altitude of the installation.

PLUS
PVI-55.0÷330.0
Models with transformer
PVI-55.0÷330.0-TL
Transformerless models

PLUS-HV
PVI-67.0÷400.0-TL
Transformerless models

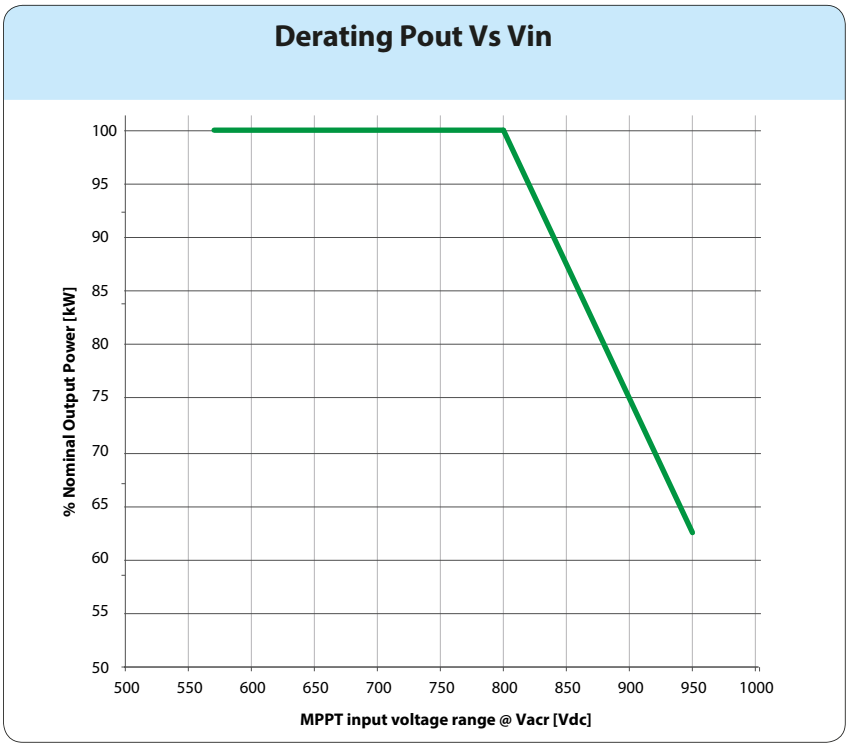


Power reduction due to the input voltage

The graphs show the automatic reduction of supplied power when input voltage values are too high or too low.

PLUS
PVI-55.0÷330.0
Models with transformer
PVI-55.0÷330.0-TL
Transformerless models

PLUS-HV
PVI-67.0÷400.0-TL
Transformerless models



Characteristics of a photovoltaic generator

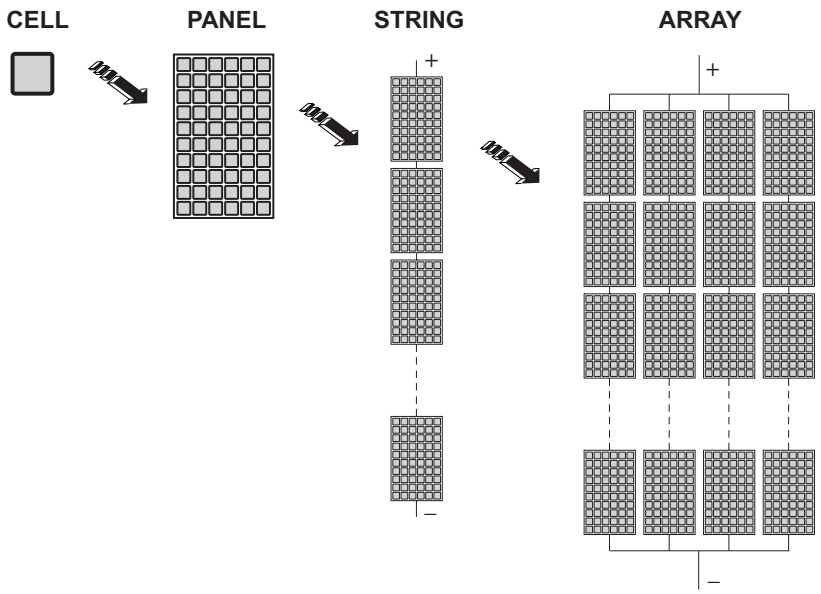
A PV generator consists of an assembly of photovoltaic panels that transform solar radiation into DC electrical energy and can be made up of:
Strings: X number of PV panels connected in series
Array: group of X strings connected in parallel

Strings and Arrays

In order to considerably reduce the cost of installing a photovoltaic system, mainly associated with the problem of wiring on the DC side of the inverter and subsequent distribution on the AC side, the string technology has been developed. 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 be made up of several arrays, connected to one or more inverters.
By maximizing the number of panels inserted into each string, it is possible to reduce the cost and complexity of the connection system of the photovoltaic system.



The current of each array must fall within the limits of the inverter.

To work, the inverter must be connected to the national electricity grid since its operation can be equated to a current generator that supplies power in parallel with the grid voltage. That is why inverters cannot support the grid voltage (islanding).

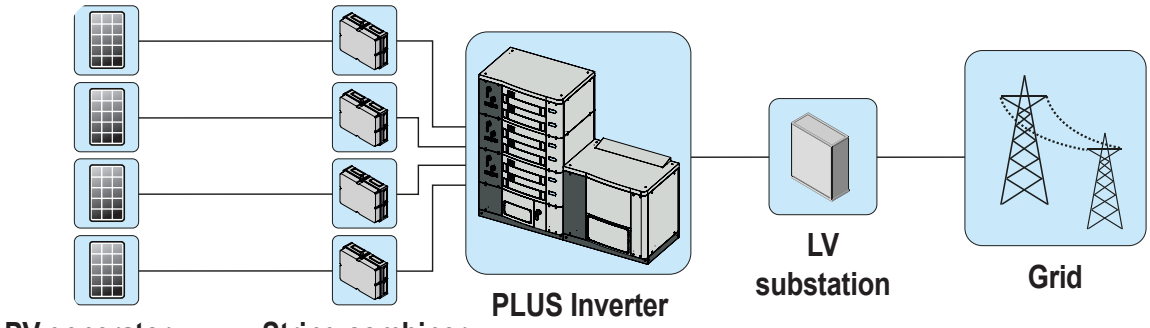
Description of the equipment

This equipment is an inverter for utilities of medium dimensions, designed exclusively for the conversion of photovoltaic energy into electrical energy compatible with the grid of the country in which it is marketed.
The photovoltaic panels convert the energy irradiated by the sun into “DC” electrical energy (via a photovoltaic system, also called PV generator); using this energy requires its conversion into “AC” alternate current.
This conversion, known as inversion from DC to AC, is done in an efficient way by the inverter FIMER, without using any rotary elements, rather only via static electronic systems.
In order to allow inverter operation in safe thermal and electrical conditions, the unit automatically reduces the value of the power fed into the grid under adverse environmental conditions or unsuitable input voltage values.
The inverter ratings are primarily suited for systems connected to the LV (Low Voltage) or MV (Medium Voltage) electricity grids, that require the use and installation (by the system installer) of a “dedicated” MV/LV transformer, in compliance with the electrical characteristics of the used inverter model.
If the inverters are connected to “PVI-STRINGCOMB” string combiners, it is possible to monitor the entire photovoltaic system with the following checks:
- Reading of string currents
- Reading of the total field voltage
- Checking that the internal safety fuses associated to each individual string are operational.

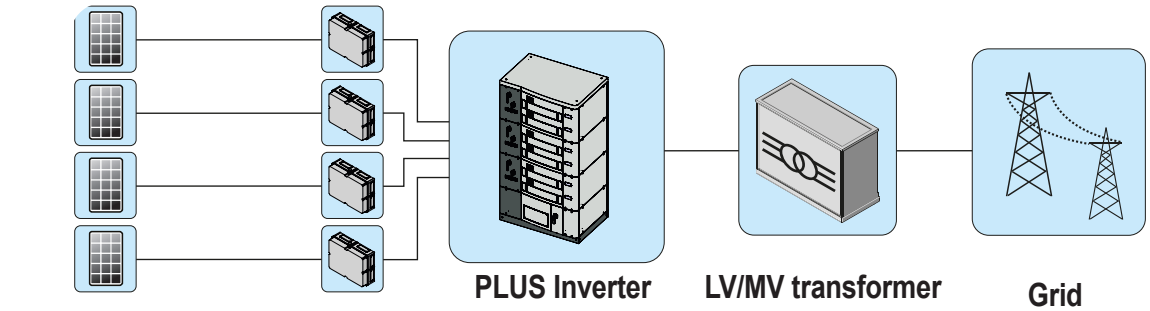
Main characteristics

- High-performance inverters with peak efficiency up to 98.7%
- Indoor enclosure (IP20 protection rating)
- Maximum input voltage up to 1000 V, allowing for high project flexibility and reducing the input distribution losses for large photovoltaic systems
- Ease of installation and maintenance. Conversion modules that can be extracted from the front.

Operating diagram with Low Voltage connection



Operating diagram with Medium Voltage connection



Connection of many inverters among themselves

For photovoltaic systems where a single inverter is not sufficient, it is possible to connect multiple inverters, each of them connected on the DC side to an appropriate section of the photovoltaic system itself, and on the AC side to the distribution grid (via a medium/low voltage transformer).
Each inverter will operate independently of the others and feed the maximum power available from its own section of PV generator to the grid.

Notes on the system sizing

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

A configuration program that can help to correctly set the size of the pho-tovoltaic system is available on the ***FIMER*** (www.fimer.com) Web site.

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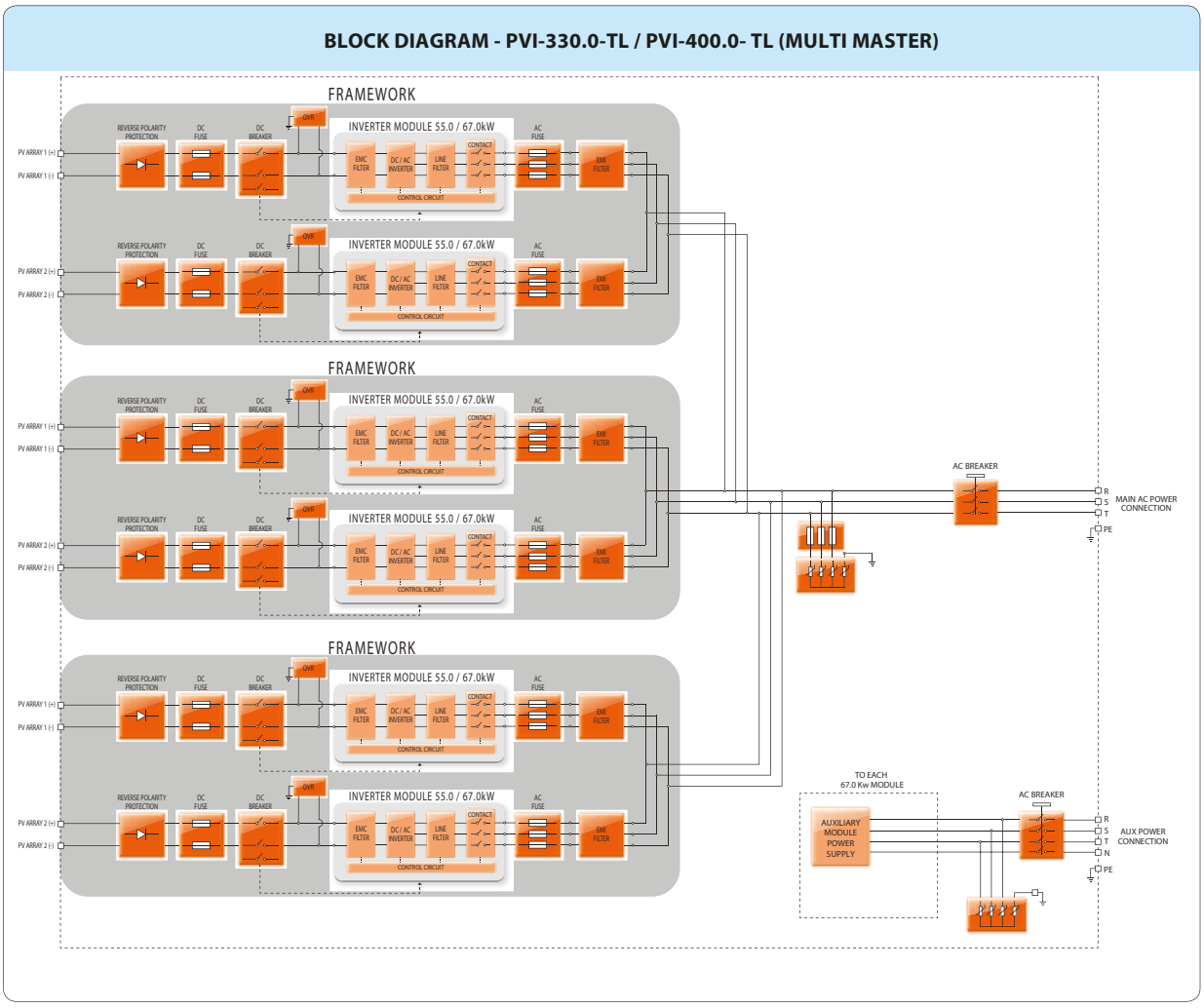
Topographic diagram for transformerless (-TL) PLUS and PLUS-HV models

The block diagram below represents an outline of the electrical diagram for the following inverter models in Multi-Master configuration:

PLUS	PLUS-HV
PVI-55.0-TL	PVI-67.0-TL
PVI-110.0-TL	PVI-134.0-TL
PVI-165.0-TL	PVI-200.0-TL
PVI-220.0-TL	PVI-267.0-TL
PVI-275.0-TL	PVI-334.0-TL
PVI-330.0-TL	PVI-400.0-TL



The diagram refers to the transformerless inverter PLUS and PLUS-HV models with the highest power rating in the available range. The lower power inverter models only differ by the number of conversion modules installed on the equipment.

The transformer is generally connected to the inverter output; it is the responsibility of the client to insert an adequate safety thermal-magnetic circuit breaker.

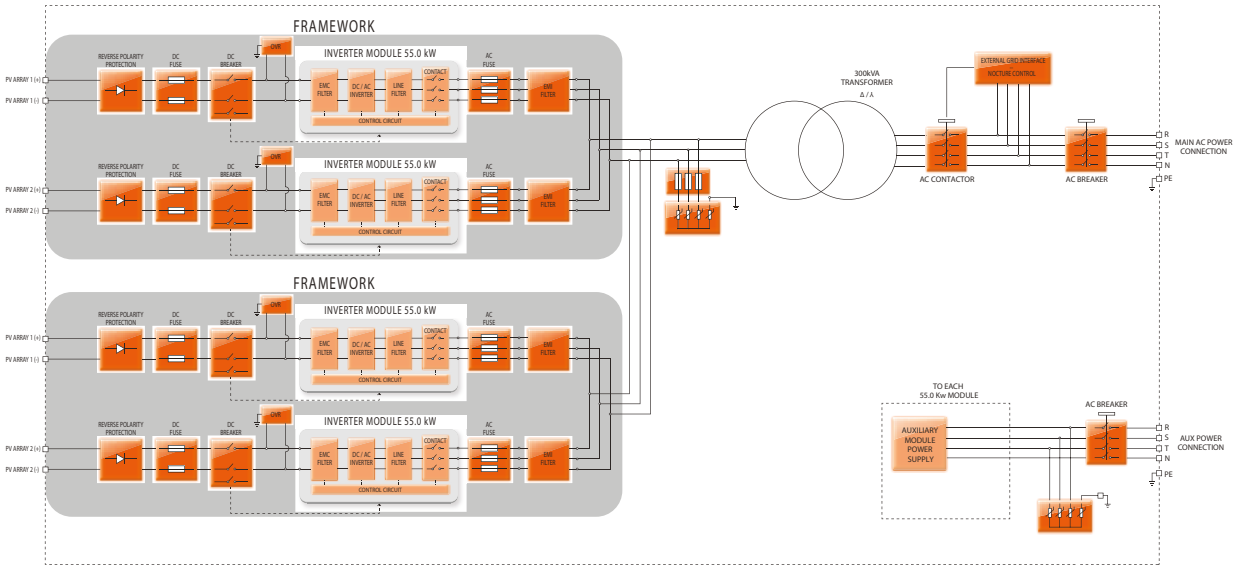
Use of circuit breakers with magnetic protection of at least 6000 A and nominal current of 480A is advised.

Topographic diagram for PLUS models with transformer

The block diagram below represents an outline of the electrical diagram for the following inverter models in Multi-Master configuration:

PLUS
PVI-55.0
PVI-110.0
PVI-165.0
PVI-220.0

BLOCK DIAGRAM - PVI-220.0 WITH TRANSFORMER (MULTI MASTER)

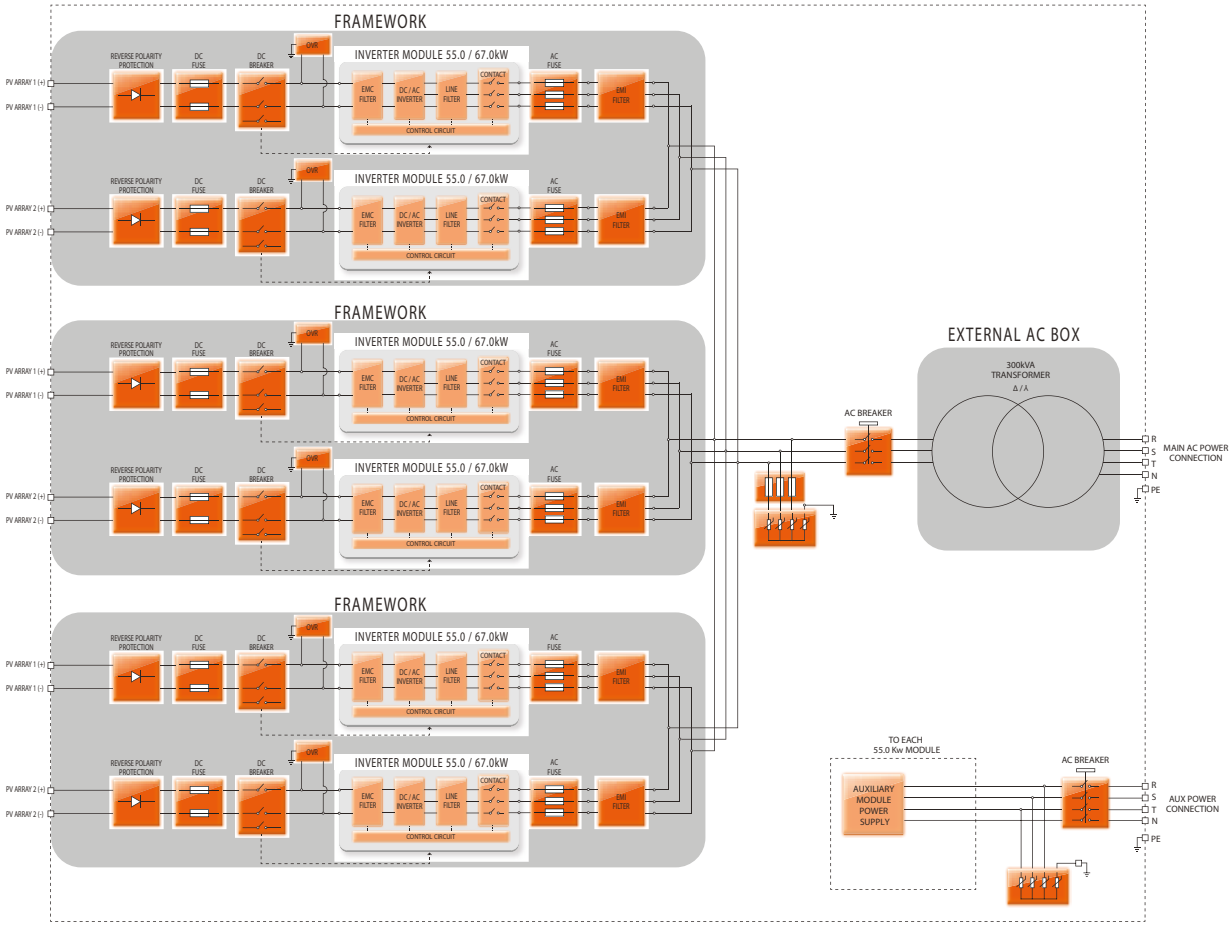


The diagram refers to the inverter PLUS and PLUS-HV models with transformer, with 220kW power rating. The lower power inverter models only differ by the number of conversion modules installed on the equipment.

The block diagram below represents an outline of the electrical diagram for the following inverter models in Multi-Master configuration:

PLUS
PVI-275.0
PVI-330.0

BLOCK DIAGRAM - PVI-330.0 WITH TRANSFORMER (MULTI MASTER)

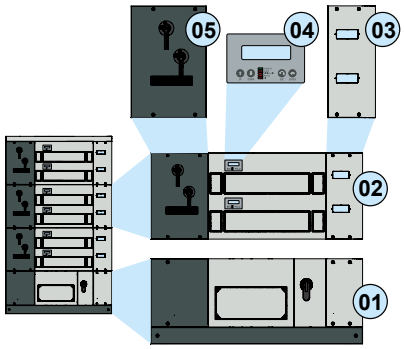


For these inverters models, the transformer is installed in an external box.

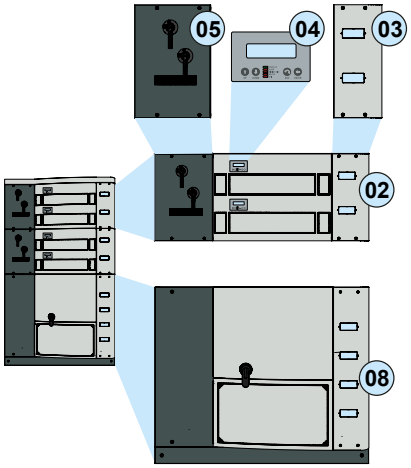
The diagram refers to the inverter models PLUS and PLUS-HV with transformer and with the highest power rating in the available range. The 275kW inverter model only differs by the number of conversion modules (5) installed on the equipment.

Main components of the equipment

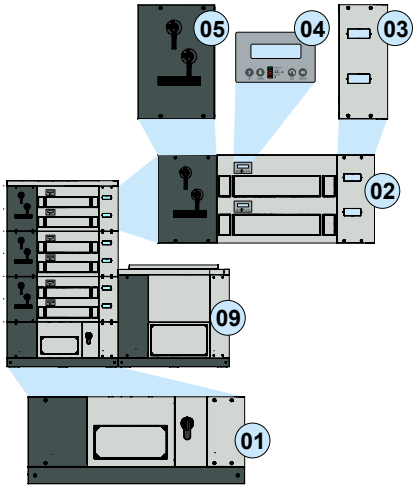
Transformerless (TL) version



Version with transformer (power up to 220kW)



Version with transformer (275 and 330kW)



The main components of PLUS and PLUS-HV inverters are:

- **AC BOX.** It is located in the lower part of the inverter, used for the connection of DC, AC, auxiliary AC, alarm and control signals, and RS485 serial communication.
Depending on the inverter model, the AC BOX may be:
Transformerless AC BOX 01 (it does NOT contain the low frequency isolating transformer)
AC BOX with transformer 08 (it contains the low frequency isolating transformer)

The table below lists the AC BOX types equipped on each inverter model:

No. of conversion modules	Transformerless AC BOX	AC BOX with transformer
1	PVI-55.0-TL / PVI-67.0-TL	PVI-55.0
2	PVI-110.0-TL / PVI-134.0-TL	PVI-110.0
3	PVI-165.0-TL / PVI-200.0-TL	PVI-165.0
4	PVI-220.0-TL / PVI-267.0-TL	PVI-220.0
5	PVI-275.0-TL/PVI-275.0/ PVI-334.0-TL*	X
6	PVI-330.0-TL / PVI-330.0 / PVI-400.0-TL*	X

* For inverters PVI-275.0 and PVI-330.0, the isolating transformer is installed in an external BOX 09 that complements the inverter.
The external BOX 09 also contains a dedicated cooling system (composed of 5 fans) controlled by a thermostat.

- One or more (up to 3) **FRAMEWORK 02** containing 1 or 2 conversion modules, depending on the inverter power rating. If the FRAMEWORK only contains 1 conversion module, it will lack all top module components, such as DC safety fuses, AC safety fuses, DC overvoltage surge arresters.

The installed conversion modules are numbered starting from the bottom (number 1). The final number depends on the inverter PLUS model (in the 400kW model, for instance, the numbering spans from 1 to 6).

The module numbering is not to be confused with the serial number of each individual module. The module numbering facilitates the DC side connections (where associated numbering labels are provided).

Transformerless AC BOX

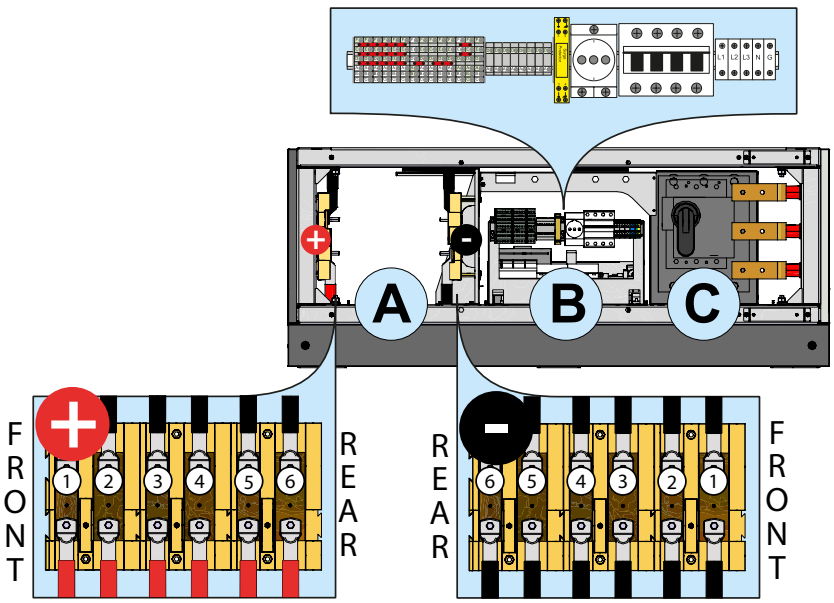
This part of the inverter is composed of three main zones:

A. DC cables connection zone for cables coming from the photovoltaic system. Located on the left of the "transformerless AC BOX", it comprises a positive and a negative connection bar. The input numbering corresponding to the conversion modules is ordered from the first farthest out (module 1) to the last closest in (module 6). The lower power versions include less conversion modules and thus require a smaller number of DC connections.

B. Auxiliary voltage and communication, control and alarm signals connection zone. Located in the middle part of the transformerless AC BOX. In addition to the connections, this zone also comprises an extractable drawer containing:
- Auxiliary voltage disconnect switch
- Auxiliary and AC output overvoltage surge arresters
- GROUND-FAULT control device (where provided).
- Thermostat controlling the internal cooling fans
- Accessory devices (e.g. ModBus converter).

C. Output connection zone. Located on the right of the "transformerless AC BOX", it comprises the 3 AC output voltage connection bars with the associated disconnect switch and the earth cables connection bar.

The figure below shows the main components of the transformerless AC BOX:



AC BOX with transformer

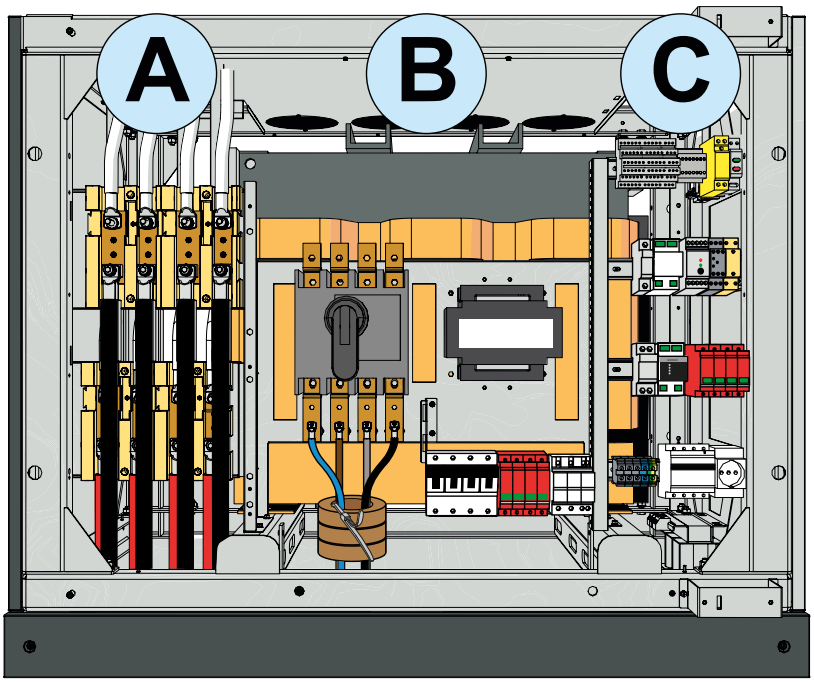
This part of the inverter is composed of three main zones:

A. DC cables connection zone for cables coming from the photovoltaic system. Located on the left of the ”AC BOX with transformer”, it comprises a positive and a negative connection bar. The input numbering corresponding to the conversion modules is ordered from the first on the right (module 1) to the last on the left (module 4). The lower power versions include less conversion modules and thus require a smaller number of DC connections.

B. Output connection zone. Located in the middle of the ”AC BOX with transformer”, it comprises the AC output voltage connection bars with the associated disconnect switch and the earth cables connection bar.

C. Auxiliary voltage and communication, control and alarm signals connection zone. Located on the left of the AC BOX with transformer. In addition to the connections, this zone also comprises:
- Auxiliary voltage overvoltage surge arresters.
- Crepuscular switch.
- GROUND-FAULT control device (where provided).
- Thermostat
- Accessory devices (e.g. ModBus converter).

The figure below shows the main components of the AC BOX with transformer:



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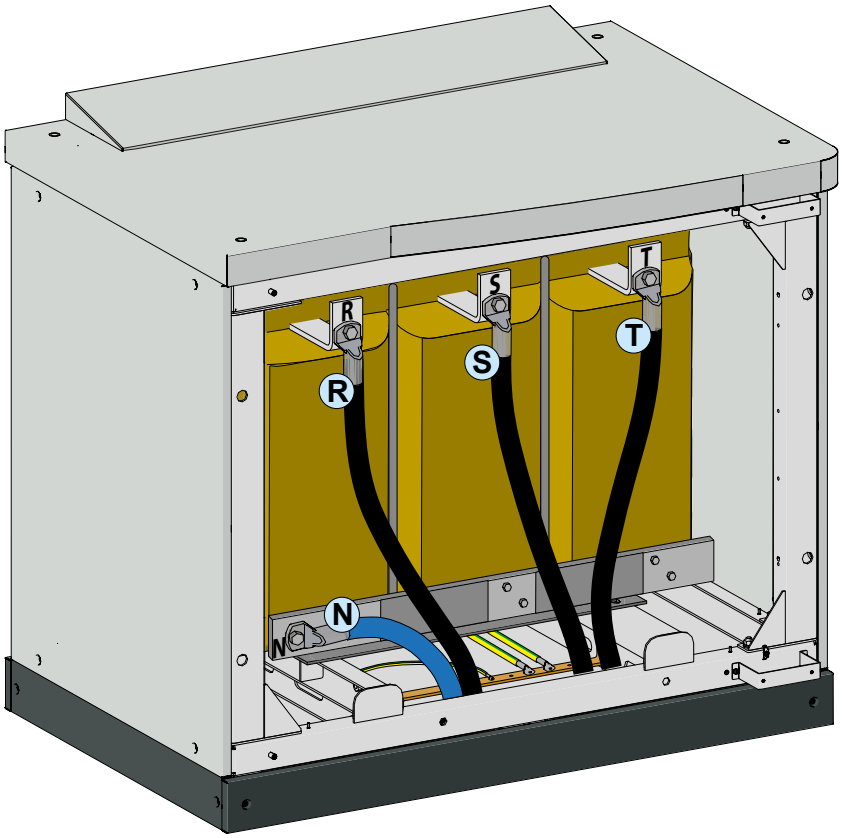
External transformer BOX

For inverter PLUS models with transformer and power rating of 275.0 and 330.0 kW, the isolating transformer is installed in an external BOX **09** that complements the inverter.

The AC output connections can be accessed by removing the front panel. The external BOX **09** contains a dedicated cooling system composed of 5 fans. The activation of the cooling system is triggered by a thermostat located inside the BOX.

The cables required for the connection to the inverter side can be accessed by removing the rear part of the BOX.



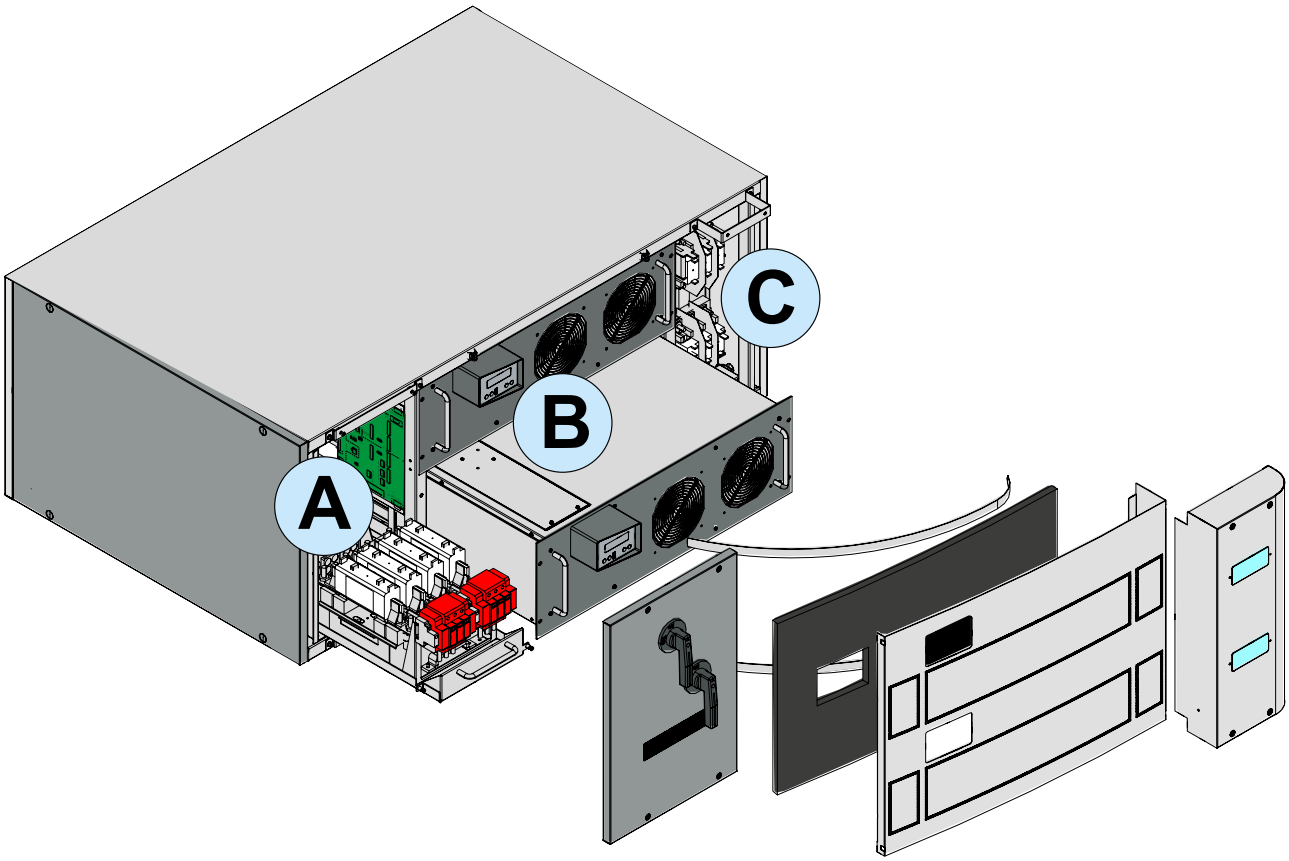
Framework

The FRAMEWORK is divided into 3 main zones:

A. DC zone - This zone is dedicated to the DC input voltage protection devices (DC fuses and DC overvoltage surge arresters) connected to each conversion module.
The disconnector switches for the DC disconnect switches are installed on the removable DC front panel.

B. Conversion modules zone - This is the main part of the inverters PLUS and PLUS-HV, where two DC/AC conversion modules are connected, capable of converting the photovoltaic energy into electrical energy suitable to be fed into the distribution grid. Each module is equipped with indicator LEDs and an interactive display.
The modules are removable and equipped with an air filter located on the FRAMEWORK front panel.

C. AC zone - This zone is dedicated to the AC output voltage protection devices (AC fuses) connected to each conversion module.
The AC front panel is removable and features two inspection windows to allow verification of the fuses status.



Protective devices

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 safely, to ensure protection of people working on the grid, all in accordance with the relevant national standards and laws. To prevent possible islanding, the inverter is equipped with an automatic protective disconnection system called “Anti-Islanding”.

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

Safety fuses

· DC side: fuses provided depending on the input configuration of each Framework.
· AC side: 3 fuses on each module, amounting to a total of 6 fuses per Framework.

Overvoltage surge arresters

As an additional protection to prevent damages caused by the discharges from lightning and electrostatic induction phenomena, the inverter is equipped with the following overvoltage surge arresters (with interchangeable cartridges):
· DC input
· AC output
· AC auxiliary
· RS485 serial line.

The sizing of the fuses must be carefully considered during installation.

Automatic measurements

· Measurement of the photovoltaic system DC voltage with independent overvoltage (OV) signalling on each module.
· Independent AC voltage measurement on each module.
· Independent AC current measurement on each module.
· Independent grid frequency measurement on each module.
· Independent thermal measurement on each module.

Further protective devices

The 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).
- Thermal-magnetic circuit breaker on the auxiliary power grid input.
- Thermal-magnetic circuit breaker on the distribution grid input.

Inverters PLUS and PLUS-HV measure the unbalance of the insulation resistances between the input terminals, therefore, if required by the local regulations, a device must be installed that is capable of performing absolute measurements of the photovoltaic generator insulation resistance.

Safety instructions and general information

The equipment has been manufactured in accordance with the strictest accident-prevention regulations and supplied with safety devices suitable for the protection of components and operators.

For obvious reasons, it is not possible to anticipate the great number of installations and environments in which the equipment will be installed; it is therefore necessary for the customer to appropriately inform the manufacturer about particular installation conditions.

FIMER accepts no liability for failure to comply with the instructions for correct installation are cannot be held responsible for the systems upstream or downstream of the equipment it has supplied.

It is essential to provide operators with correct information. They must therefore read and comply with the technical information given in the manual and in the attached documentation.

The instructions given in the manual do not replace the safety devices and technical data for installation and operation stuck on the product, and they certainly do not replace the safety regulations in force in the country of installation and common sense rules.
The manufacturer is willing to train staff, at its premises or on site, in accordance with conditions to be set out in the contract.

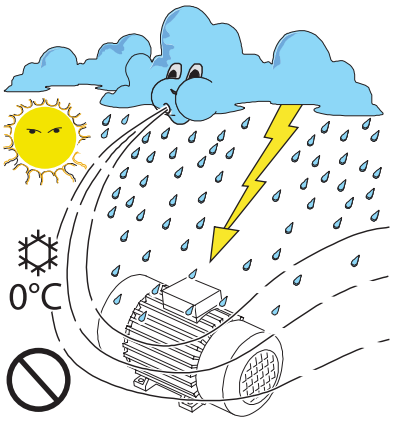
Do not use the equipment if you find any operating anomalies.

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

Liabilities arising from commercial components are delegated to the respective manufacturers.

Hazardous areas and operations

Environmental conditions and risks

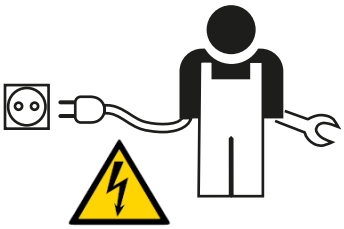


The equipment can be installed outdoors, but only in environmental conditions that do not prevent its regular operation. These conditions are reported on the thecnical data and on installation chapter.

FIMER CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.

The same precautions should be adopted for dismantling the equipment.

The equipment is not equipped to operate in environments that have particular flammability or explosive conditions.



The customer and/or installer must appropriately train operators or anyone who may come near the equipment, and highlight, if necessary with notices or other means, the hazardous areas or operations at risk if required: magnetic fields, hazardous voltages, high temperatures, possibility of discharges, generic hazard, etc.

Signs and Labels

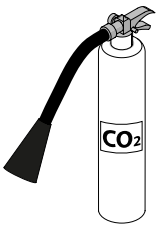
The labels attached to the equipment must absolutely NOT be removed, damaged, dirtied, hidden, etc.

The labels must be cleaned regularly and kept visible at all times, that is, they must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.)
The technical data shown in this manual do not in any case replace those shown on the labels attached to the equipment.

Thermal hazard

WARNING: removal of guards or covers is allowed only 10 minutes after the voltage has been removed; ; this is to let components cool down and allow any electrostatic charges and parasitic voltages to be discharged.

When the equipment has just been switched, it may have hot parts, as a result of overheating of the surfaces at temperature (e.g.: transformers, accumulators, coils, etc.) so be careful where you touch.



In the event of fire, use CO_2 extinguishers and use auto extraction systems to fight fire in closed environments.

Clothing and protective devices for staff

FIMER has eliminated sharp edges and corners, but in some cases it is not possible to do anything, and we therefore advise wearing the clothing and personal protective devices provided by the employer.

Staff must not wear clothes or accessories that can start fires or generate electrostatic charges or, in gener, clothing that can impede personal safety.

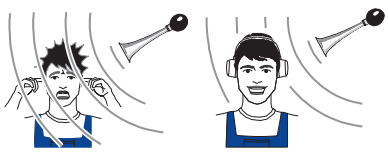
All operations on the equipment should be performed with suitably insulated clothes and instruments.
E.g.: Insulated gloves (class 0, category RC)

Maintenance operations must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.

Staff must NOT go near the equipment with bare feet or wet hands.

The maintenance technician must in any case make sure no one else can switch on or operate the equipment during the maintenance operations, and must report any anomaly or damage due to wear or ageing so that the correct safety conditions can be restored.

The installer or maintenance technician must always pay attention to the work environment, so that it is well lit and has sufficient spaces to ensure they have an escape route.



In the installation, consider or make sure the ***noise emitted based on the environment*** is not such that it exceeds thresholds allowed by law (less than 80 dBA).

Residual risks

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.

Table of residual risks

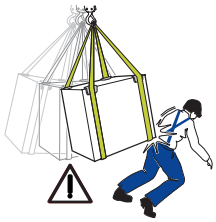
RISK ANALYSIS AND DESCRIPTION	SUGGESTED REMEDY
Noise pollution due to installation in unsuitable environments or where staff work permanently.	Reassess the environment or the place of installation.
Suitable local ventilationthat does not cause overheating of the equipment and is sufficient not to create discomfort to people in the room.	Restore suitable ambient conditions and air the room.
External weather conditions, such as water seepage, low temperatures, high humidity, etc.	Maintain ambient conditions suitable for the system.
Overheating of surfaces at temperature (transformers, accumulators, coils, etc.) can cause burns. Also be careful not to block the cooling slits or systems of the equipment.	Use suitable protective equipment or wait for the parts to cool down before switching on the equipment.
Inadequate cleaning: compromises cooling and does not allow the safety labels to be read.	Clean the equipment, labels and work environment adequately.
Accumulation of electrostatic energy can generate hazardous discharges.	Ensure the devices have discharged their energy before working on them.
Inadequate training of staff.	Ask for a supplementary course.
During installation, temporarily mounting the equipment or its components may be risky.	Be careful about and disallow access to the installation area.
Accidental disconnections of the quick-fit connectors with the equipment in operation, or wrong connections, may generate electric arcs	Be careful about and disallow access to the installation area.

4

General conditions

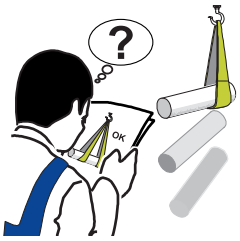
Some recommendation apply only to large size product or multiple small size packings.

Transport and handling



Transport of the equipment, especially by road, must be carried out with by suitable ways and 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 can create dangerous swinging.

Lifting



FIMER usually stores and protects individual components by suitable means to make their transport and subsequent handling easier, but as a rule it is necessary to turn to the experience of specialized staff in change of loading and unloading the components.
Where indicated and/or where there is a provision, eyebolts or handles, which can be used as anchorage points, are inserted and/or can be inserted.

The ropes and means used for lifting must be suitable for bearing the weight of the equipment.

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

Unpacking and checking

We remind you that the packaging elements (cardboard, cellophane, staples, adhesive tape, straps, etc.) may cause cuts and/or injuries if not handled with care. They should be removed by suitable means and not left in the hands of irresponsible people (e.g., children).

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

When you open the package, check that the equipment is undamaged and make sure all the components are present.
If you find any defects or damage, stop unpacking and consult the carrier, and also promptly inform the Service FIMER.

Mode of lifting

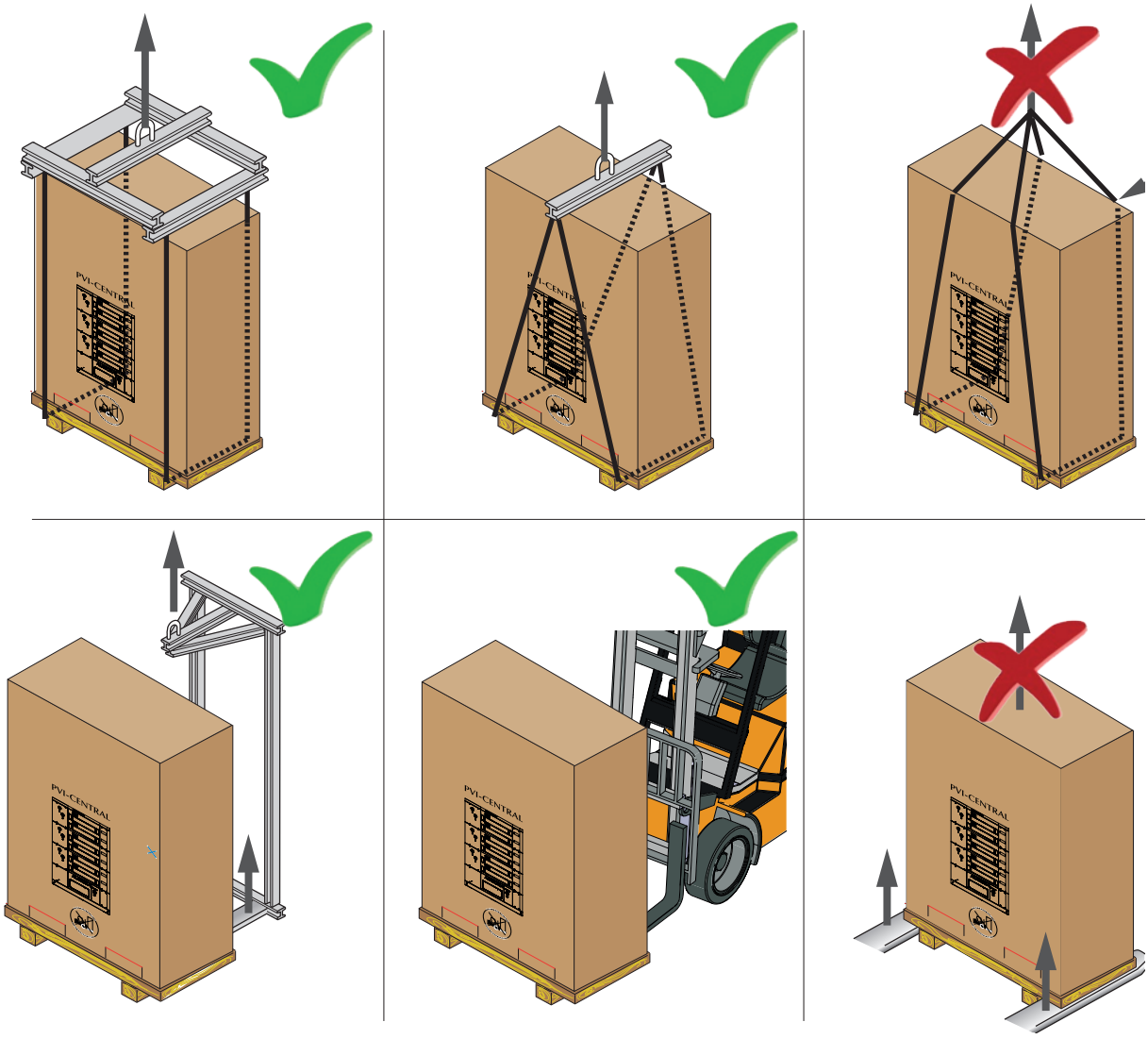
All PLUS and PLUS-HV models must not be tilted during lifting and transport.

Lifting can be done in 2 modes:
- lifting with packaging
- lifting without packaging
in both cases, it is possible to use forks and fork-lift trucks (with receptacle on the rear longitudinal side) or cables provided with suitable fork balances for pulling vertically.

During lifting and transport, take into account that the centre of gravity of the inverter is located on the top part of the equipment and that it is therefore important to space out the forks or the cables as much as possible while loading.

Lifting with packaging
The packaging is suitable for supporting the load of a single device.
The packaging walls cannot support lateral loads, and it is hence not possible to use cables or chains in contact with the top part of the packaging.

The screen-print in the packaging shows the right side for the inverter loading.



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Lifting without packaging

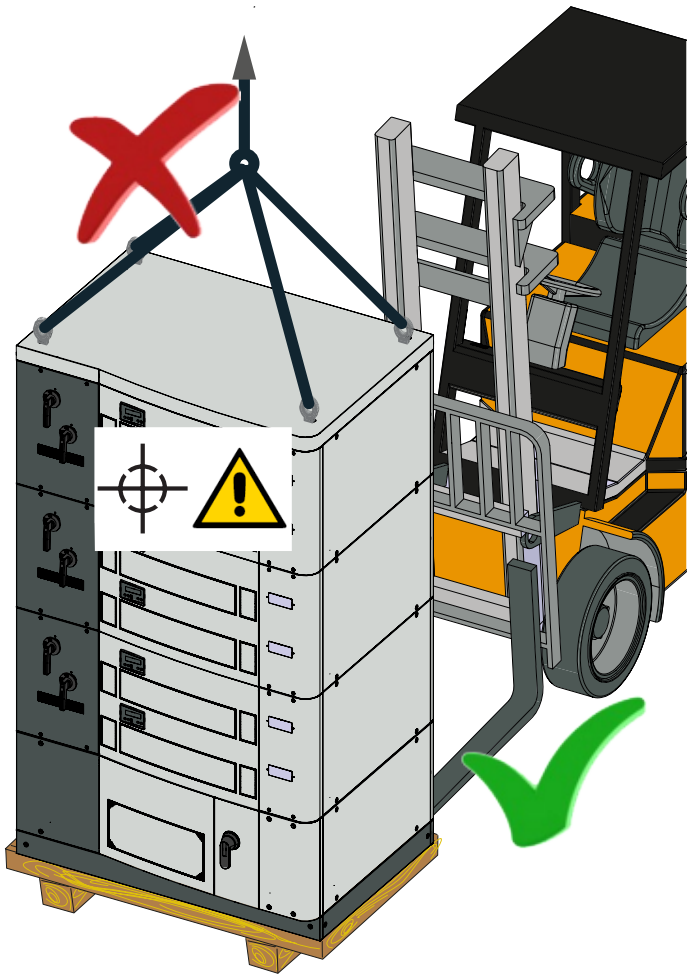
After removing the packaging side walls, it is necessary to detach the inverter from the underlying wooden pallet using the supplied wrench to remove the special bolts the secure the corners of the equipment.

For lifting the inverter without packaging, the considerations for lifting with packaging apply; in addition, it is possible to lift it while adhering to the following conditions:
In case of lifting with cables equipped with suitable fork balances for vertical pull, or with fork-lift trucks, take hold on the rear longitudinal side, inserting the forks in the dedicated lifting compartment at the base of the inverter, while spacing out the forks as much as possible.

It is absolutely FORBIDDEN to lift the inverter using eyebolts.

Model PLUS	Weight without packaging (Kg/Lb)
55.0-TL	350 / 771
110.0-TL	480 / 1058
165.0-TL	680 / 1500
220.0-TL	780 / 1720
275.0-TL	1000 / 2205
330.0-TL	1150 / 2535
55.0	700 / 1543
110.0	800 / 1765
165.0	1200 / 2646
220.0	1300 / 2867
275.0	1600 / 3527
330.0	1750 / 3858

Model PLUS-HV	Weight without packaging (Kg/Lb)
67.0-TL	350 / 771
134.0-TL	480 / 1058
200.0-TL	680 / 1500
267.0-TL	780 / 1720
334.0-TL	1000 / 2205
400.0-TL	1150 / 2535

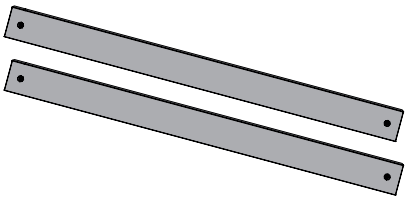
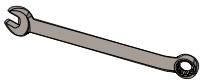


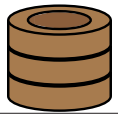
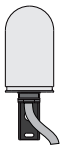
The inverters PLUS PVI-275.0 and PVI-330.0 are equipped with an external transformer box (with associated inverter connection cables), contained in a second packaging, for which the same lifting rules previously provided remain applicable.

List of components supplied

The supplied components are contained in a cardboard box placed inside the main packaging.

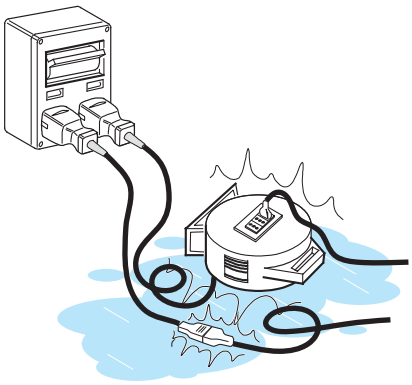
Table: Components supplied with the equipment

Components available for all models		Quantity
	Front / rear casing	2
	Casing lock screws	4
	Wrench for the removal of the fitting bolts that secure the inverter to the transport pallet	1
	Installer operation and maintenance manual	1
	CD-ROM with technical documentation	1
	Safety fuses for the auxiliary voltage overvoltage surge arresters (spare parts)	3

Components available for PLUS models: PVI-55.0 / PVI-110.0 / PVI-165.0 / PVI-220.0		Quantity
	Toroids for AC output cables **To be installed only on the ITALIAN version**	3
	CREPUSCULAR sensor	1

General conditions

Installation of the equipment is carried out based on the system and the place in which the equipment is installed; therefore, its performance depends on the correctness of the connections.



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 operation must be carried out by specialised staff; it is in any case advisable to comply with what is written in this manual and adhere to the diagrams and attached documentation.

For Safety reason only a qualified electrician, who has received training and / or has demostrated skills and knowledge in construction and in operation of this unit, can install this inverter.

The installation is done by qualified installers and/or licensed electrician according to the applicable local code regulations

The connection of an inverter energy system to an electrical installation connected to the electricity distribution network shall be approved by the appropriate electrical distributor.

The installation must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.

When the photovoltaic panels are exposed to light, these supplies a direct current voltage to the inverter.

000021EG

The installation must be carried out with the equipment disconnected from the grid (power disconnect switch open) and with the photovoltaic panels shaded or isolated.

Environmental checks

• Consult the technical data to check the environmental conditions to observe (level of protection, temperature, humidity, altitude, etc.)
• Do not install in places where flammable substances or gases may be present (the installation of a fume detector is advised).
• Place the inverter in a location that is easily accessible to operators.
• Avoid installing the inverter in locations that may be subject to rainwater accumulation.
• Avoid electromagnetic interference that can compromise the correct operation of electronic equipment, with the consequent hazards
• Arrange for passages that serve as escape routes.
• Install the inverter in a location not subject to direct sunlight, as this may cause power reductions and/or compromise its operation.
• Arrange for an adequate air intake to allow proper inverter cooling (see the technical data table).
• In case of particularly damp environments, install a heater/dehumidifier to reduce the air humidity.
• In case of environments subject to fine or metallic particulate, install adequate filtering devices on the air intakes.

The final installation of the inverter should not prevent access to any outside disconnection means.

Refer to the warranty conditions to evaluate the possible exclusions from warranty related to improper installation.

Installations above 1000 metres

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 temperatures.
• Reduction in the dielectric resistance of the air that, in the presence of high operating voltages (DC input), can create electric arcs (discharges) that can reach the point of damaging the inverter.
As the altitude increases, the failure rate of some electronic components increases exponentially because of cosmic radiation.

All installations at altitudes of over 1000 metres must be assessed case by case considering the aforesaid criticalities.

Installation position

When choosing the place of installation, observe the following conditions:
• Install the inverter on a strong base adequate to support its weight.
• Install in safe, easy to reach locations
• Install in a perfectly vertical position by using suitable verification instruments.

Installing the inverter on a base which is not sturdy and level may cause risks of fall and/or damage to the inverter.

• Maintenance/installation operations on the equipment hardware and software are mainly performed via front access.

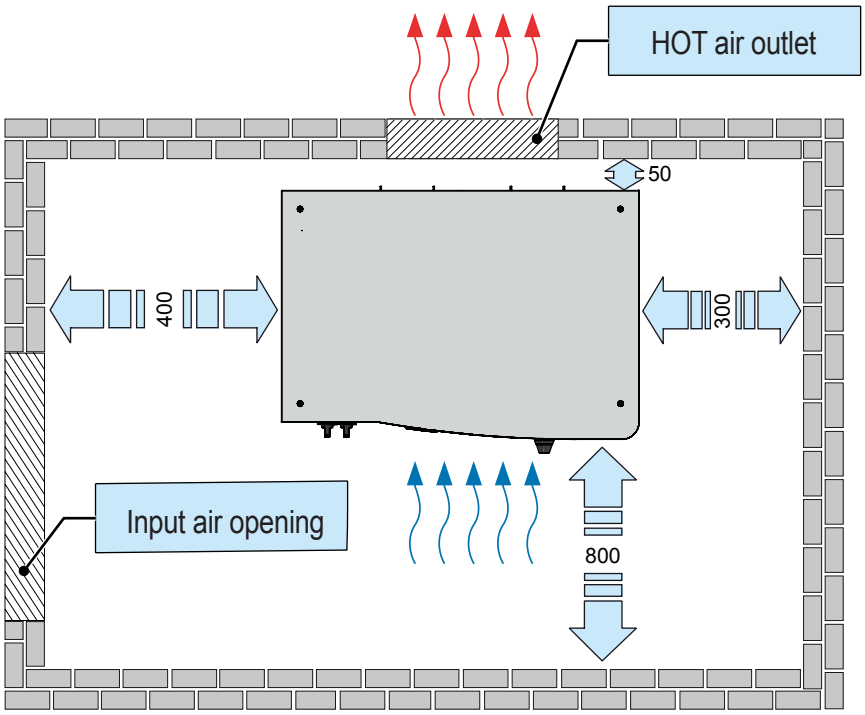
It is good practice to ensure all sides are accessible, so as to facilitate any possible maintenance operations.

• Comply with the indicated minimum distances. Distances vary depending on whether a FIMER hot air outlet hood is used.

In case of multiple inverter installations, the minimum distances must be observed for each individual unit .

1- INSTALLATION WITHOUT HOT AIR OUTLET HOOD

In case of inverter installation without hot air outlet hood, the rear side of the inverter must be placed at a 50 mm distance from the wall. The wall must, in turn, provide dedicated hot air outlets in correspondence to the inverter screens.



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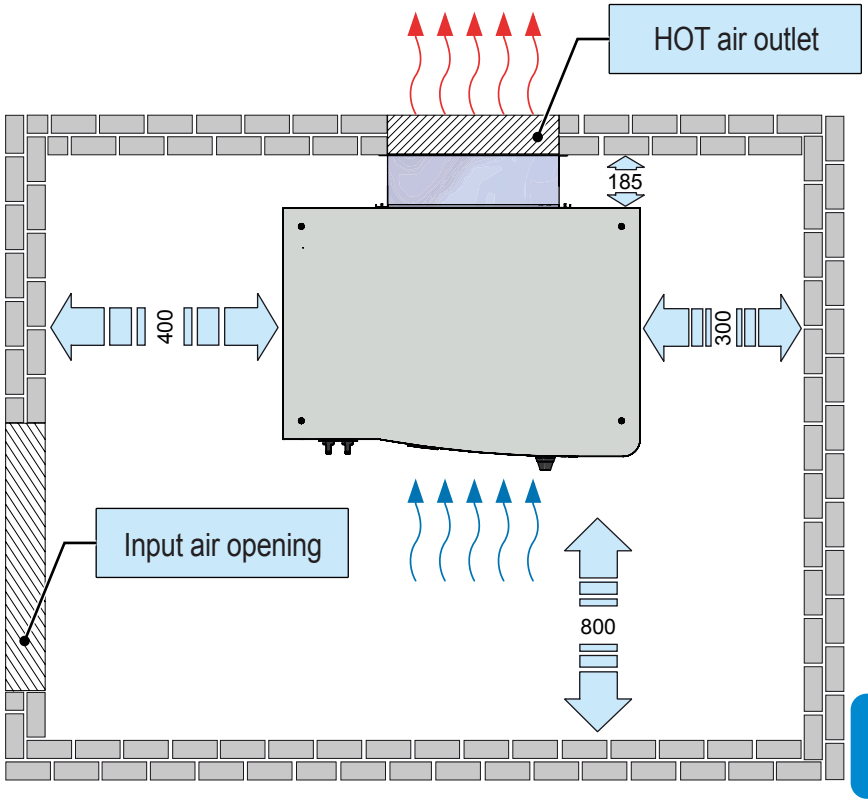
INSTALLATION WITH HOT AIR OUTLET HOOD

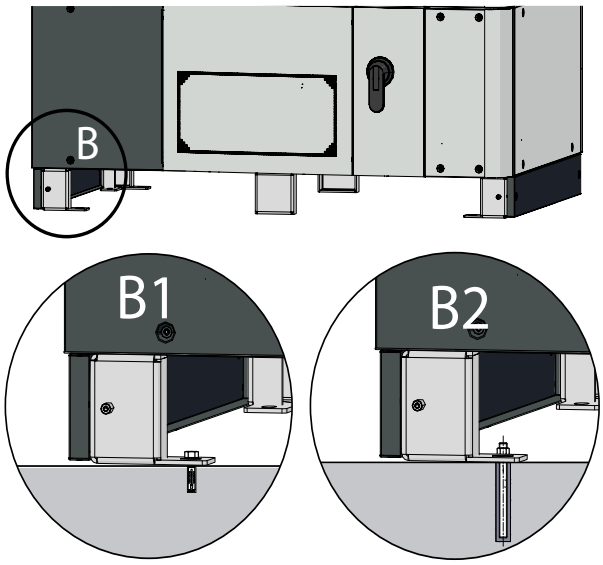
In case of inverter installation with hot air outlet hood, the rear side of the inverter must be placed at a 185 mm distance from the wall. The wall must, in turn, provide a dedicated hot air outlet slot in correspondence to the special compartment on the hood.



For installations different from those previously shown, the recommended distances may be changed by assessing the type of installation in accordance with FIMER Service.

Preparation and requirements of the base

For optimum installation, the inverter must be securely mounted to a base made of an adequate material capable of supporting the weight. The inverter is secured to ground through the dedicated supports located on the 4 corners. On each corner support there are two mounting holes (for M12 screws).



Corrugated pipes must be placed following the input areas of the conductors located on the floor of the inverter.

Suitable separate pipes must be arranged for the communication and signal cables.
Do not use corrugated pipes, which have already been used for DC or AC conductors, for communication or signal cables!

Before placing the inverter on the floor in the desired location for the installation, the supporting base must be prepared. This includes drilling through-holes to feed the AC, DC and auxiliary power cables and four holes at the corners of the base to secure the inverter to the ground.

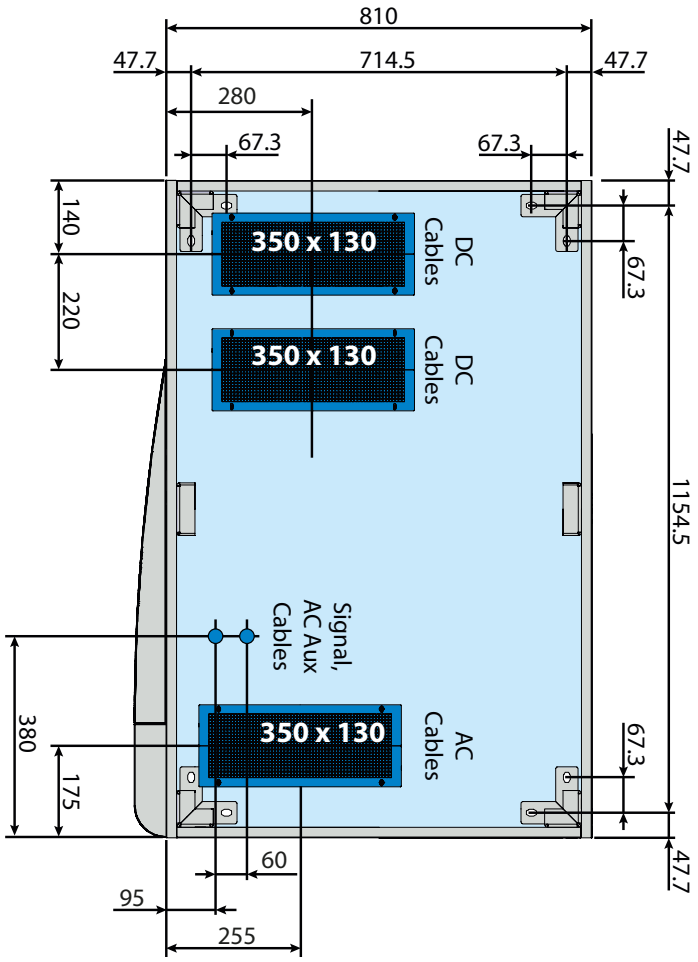
Once the electrical cables have been connected, the inverter can be secured to the ground with four M12 screws (NOT supplied).

The base dimensions (identical for all systems) and the heights for the installation of the corrugated pipes to feed the conductors into the inverter are listed below:

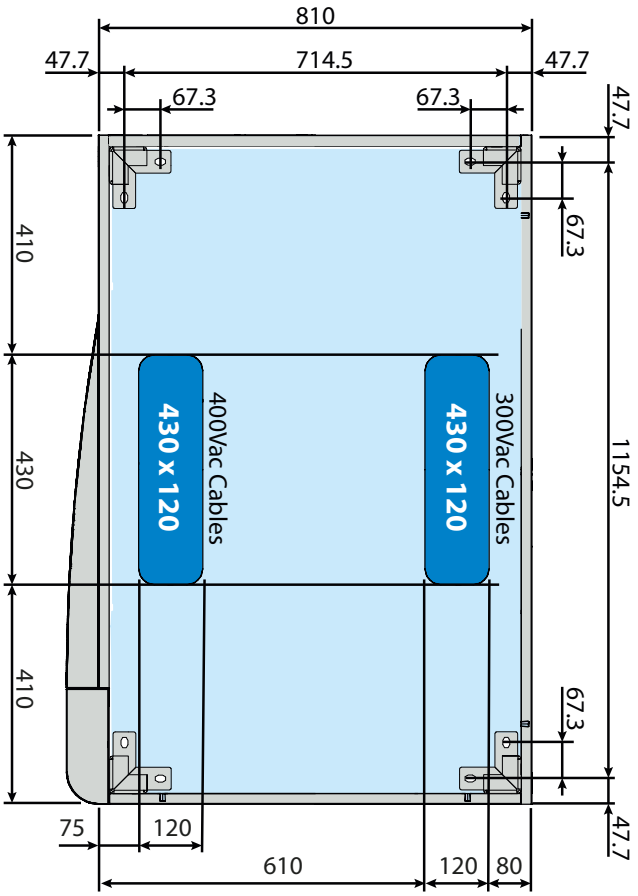
Dimensions and cable feed areas for inverter models with transformerless AC BOX:

PLUS	PLUS-HV
PVI-55.0-TL	PVI-67.0-TL
PVI-110.0-TL	PVI-134.0-TL
PVI-165.0-TL	PVI-200.0-TL
PVI-220.0-TL	PVI-267.0-TL
PVI-2750.0-TL	PVI-334.0-TL
PVI-330.0-TL	PVI-400.0-TL

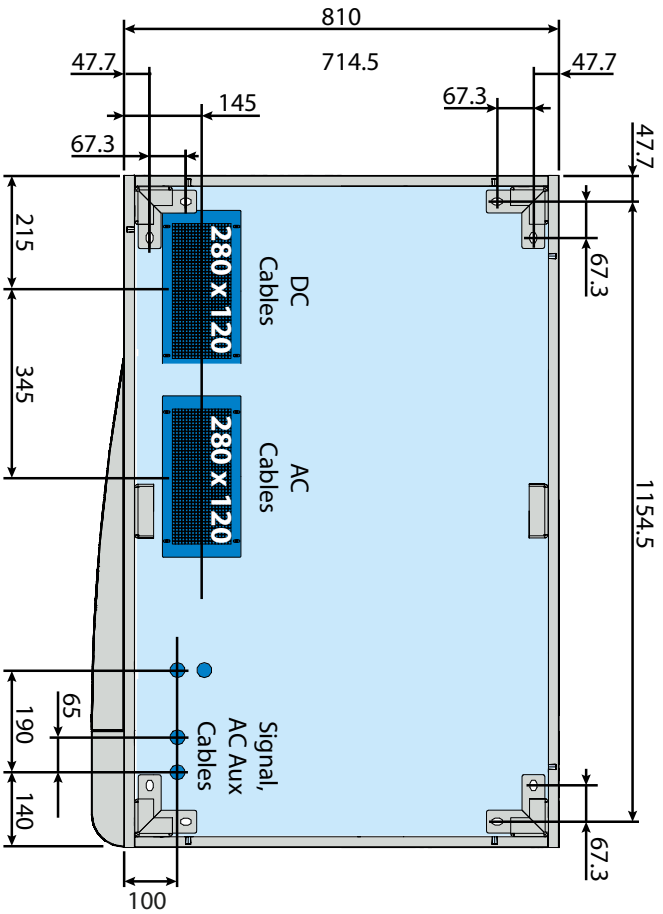
PVI-275.0
PVI-330.0



Dimensions and cable feed areas for inverter models with external transformer BOX:
PVI-275.0
PVI-330.0



PLUS models with transformer:
PVI-55.0
PVI-110.0
PVI-165.0
PVI-220.0



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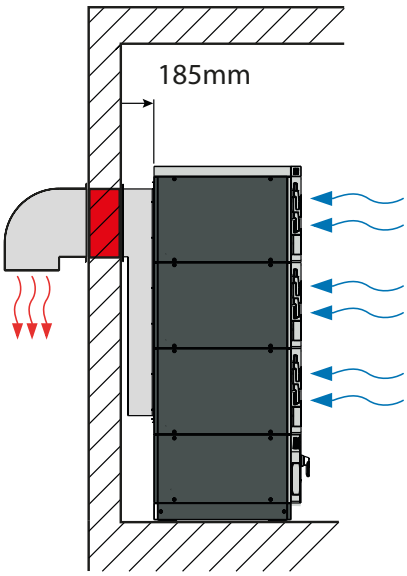
Preparation and requirements of the wall at the rear of the inverter

The wall at the rear of the inverter must be provided with openings that serve as outlets for the hot air flowing from the conversion modules.
PLUS and PLUS-HV inverters can be equipped with a manifold that collects the hot air flowing from the conversion modules and conveys it to a single opening.

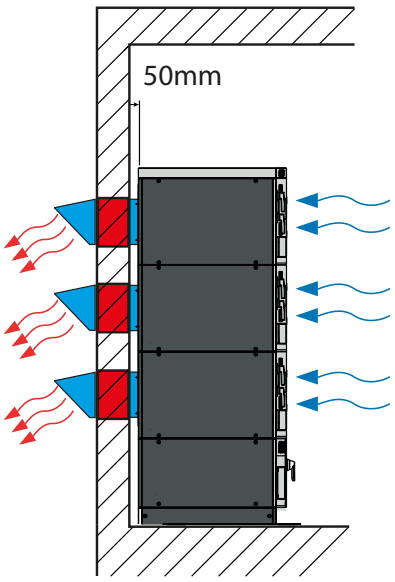
Below are two installation examples:



1. Wall preparation and inverter installation with hot air outlet manifold

The wall at the rear of the inverter must be provided with a single opening (marked in red) in correspondence to the hot air manifold outlet.

A bend must be installed on the outside of the wall to prevent rainwater seepage.



2. Wall preparation and inverter installation without hot air outlet manifold

The wall at the rear of the inverter must be provided with openings (marked in red) in correspondence to all the hot air outlets on the inverter.

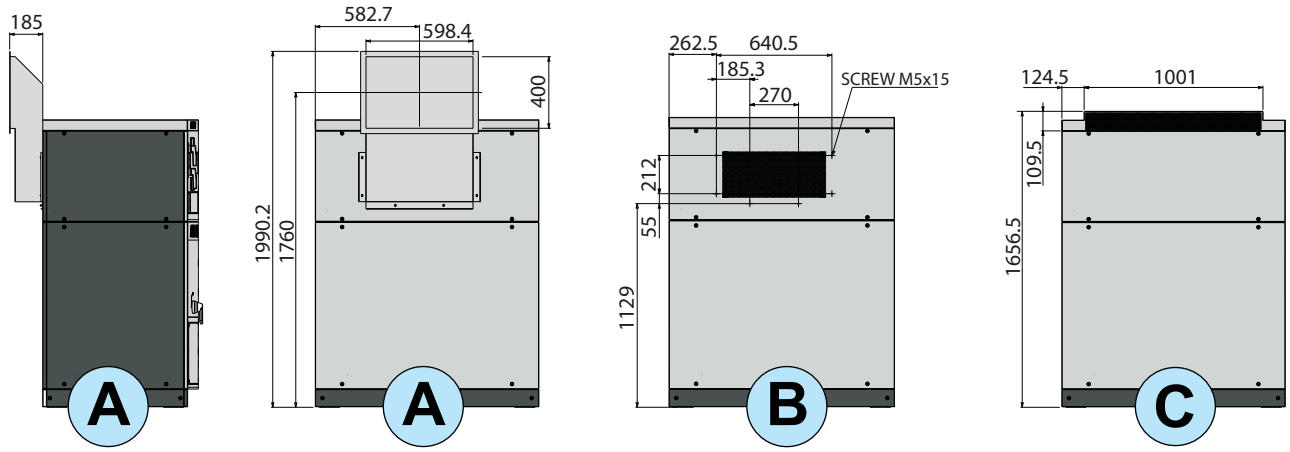
Fittings must moreover be provided (marked in blue) to “guide” the hot air outside the wall and prevent its circulation in the installation premises.

Bends or screens must be installed on the outside of the wall (marked in blue) to prevent rainwater seepage, ensuring they do not hinder the hot air flow.

Different openings must be provided in the wall at the rear of the inverter depending on the inverter model. Each model features different hot air outlet configurations (as specified upon placement of the order). The reference dimensions are shown below:

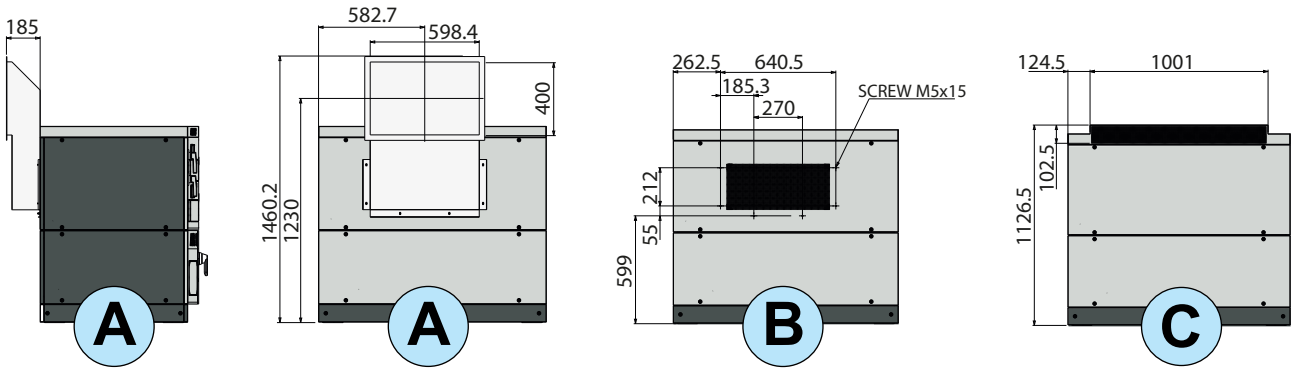
MODELS:
PVI-55.0
PVI-110.0

A. Hot air outlet manifold configuration
B. Rear hot air outlet (on the framework) configuration
C. Top hot air outlet configuration



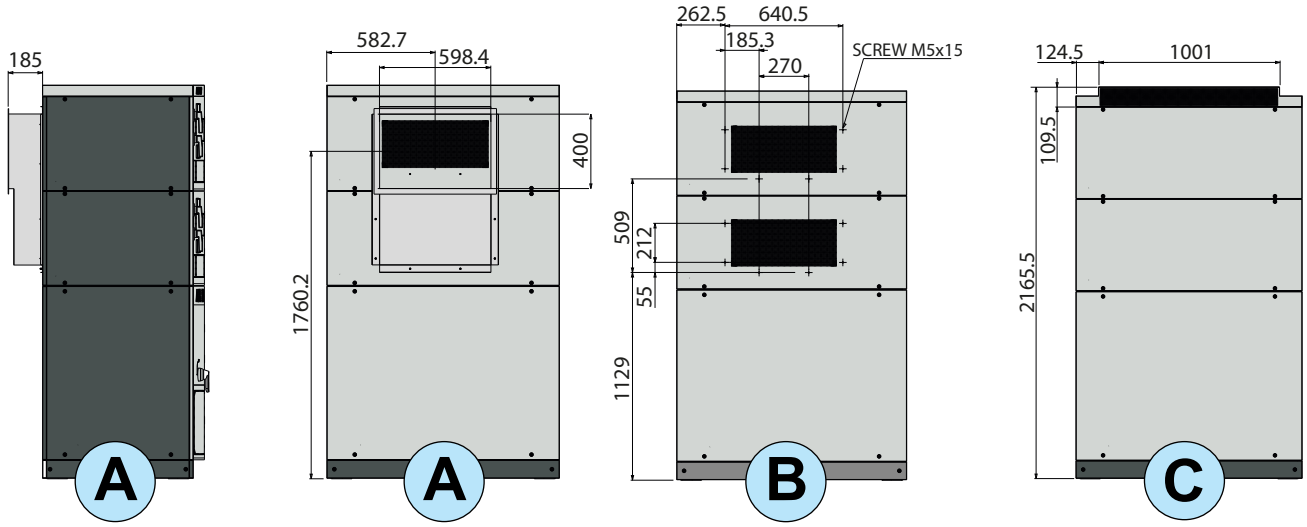
MODELS:
PVI-55.0-TL
PVI-110.0-TL
PVI-67.0-TL
PVI-134.0-TL

A. Hot air outlet manifold configuration
B. Rear hot air outlet (on the framework) configuration
C. Top hot air outlet configuration



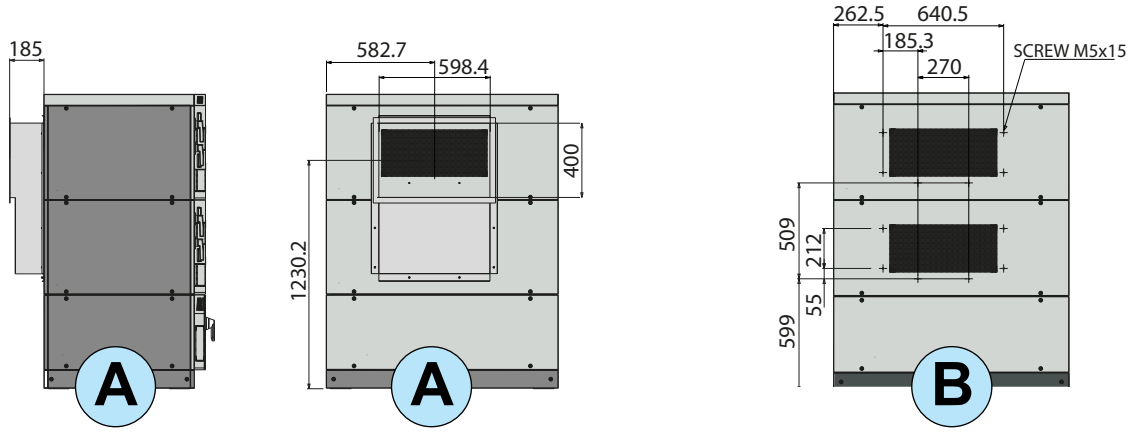
MODELS:
PVI-165.0
PVI-220.0

A. Hot air outlet manifold configuration
B. Rear hot air outlet (on the framework) configuration
C. Top hot air outlet configuration



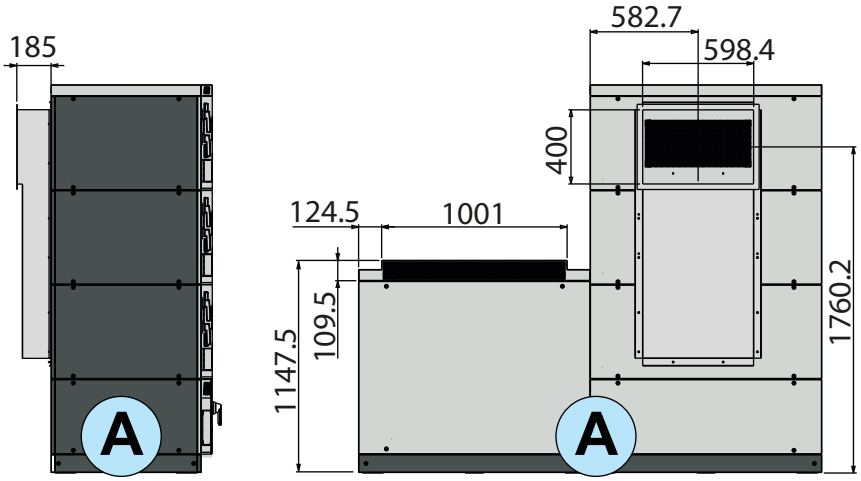
MODELS:
PVI-165.0-TL
PVI-220.0-TL
PVI-200.0-TL
PVI-267.0-TL

A. Hot air outlet manifold configuration
B. Rear hot air outlet (on the framework) configuration



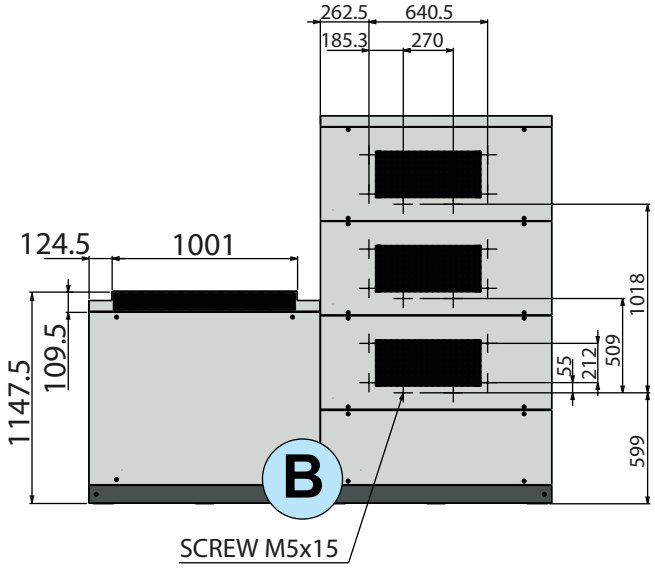
MODELS:
PVI-275.0
PVI-330.0

A. Hot air outlet manifold configuration



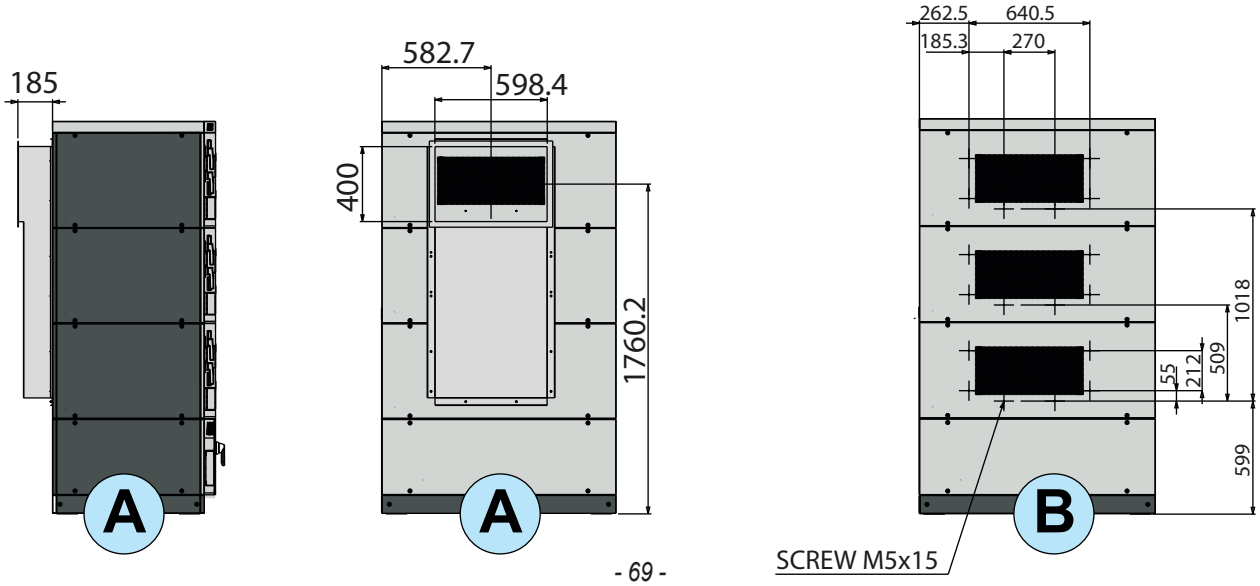
In this configuration the transformer box is not equipped with a hot air outlet manifold. An air outlet conveyor must be installed on the transformer box to prevent hot air from being released into the installation premises.

B. Rear hot air outlet configuration



MODELS:
PVI-275.0-TL
PVI-330.0-TL

A. Models with hot air outlet manifold
B. Models with rear hot air outlet (on the framework)



Operations preparatory to PV generator connection

Checking the correct polarity of the strings

Using a voltmeter, check that the voltage of each string observes the correct polarity and falls within the input voltage limits accepted by the inverter (see technical data).

Inversion polarity can cause serious damage

If the voltage without load of the string is near the maximum value accepted by the inverter, it must be borne in mind that with low ambient temperatures the string voltage tends to increase (in a different way 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).

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 insulation 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 found because the inverter might not connect to the grid.

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DC connections

Preliminary operations

Any operation performed not in accordance with what reported below may give rise to dangerous conditions for the operator/installer and damage to the equipment.

It is absolutely important and advisable, before the connection to the inverter, to isolate the photovoltaic system using upstream DC switches, as there may be possible high voltages posing serious risks.

While designing the system, always observe the nominal voltage and current characteristics. For the photovoltaic system in particular, bear in mind the following:
· Maximum array DC voltage ever to reach the input of each of the MPPT circuits.
· Maximum array DC current ever to reach the input of each of the MPPT circuits..

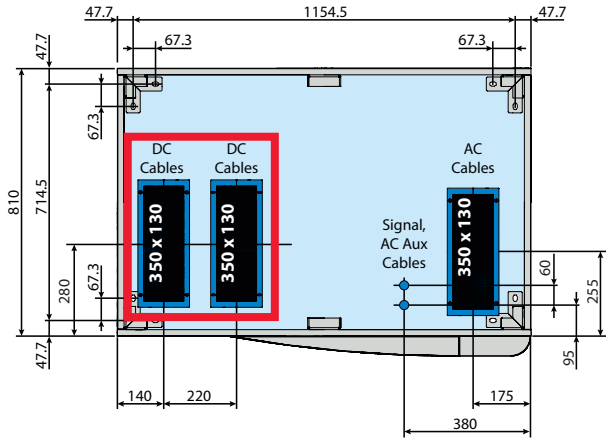
Connection of the DC cables coming from the photovoltaic system

The inverter configuration (Multi Master, Multi Master/Slave and Master/Slave) is factory set before the delivery, so that only the DC cables need to be connected.

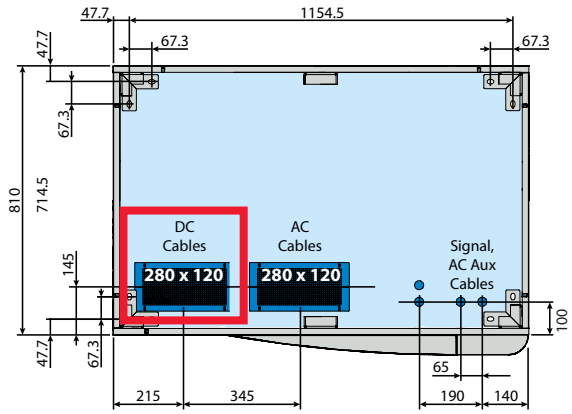
1. Identify the DC cables coming from the photovoltaic system

2. Feed the DC cables inside the inverter through the cable entries at the back. The screens on each opening must be cut to allow the cables through.

Transformerless AC BOX



AC BOX with transformer



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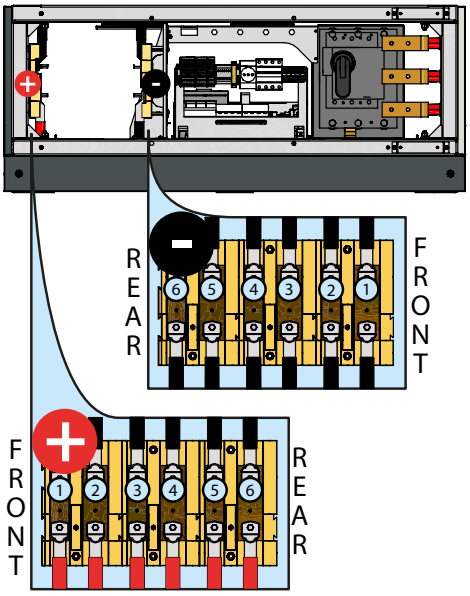
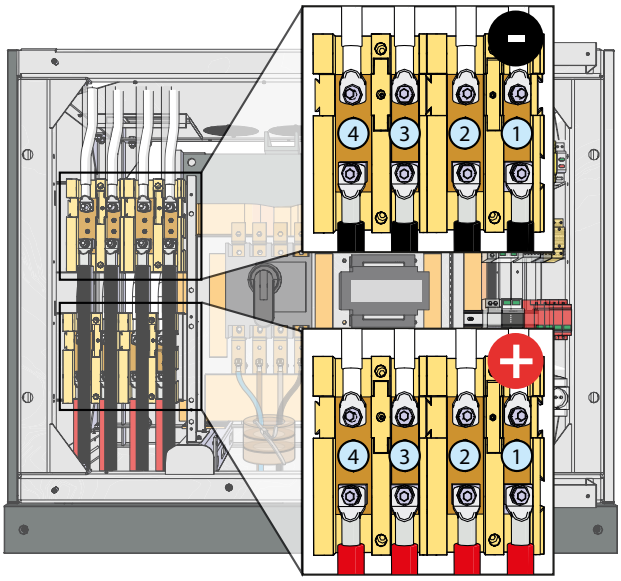
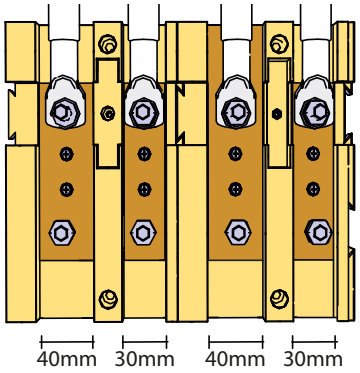
3. Connect the cables to the input terminal block observing the correct polarity. The AC BOX may be different depending on the type of the inverter PLUS. The two possible solutions are shown below.

Transformerless AC BOX



AC BOX with transformer

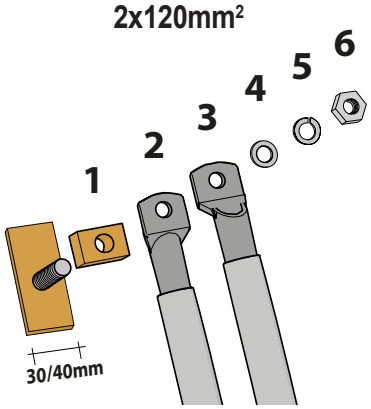




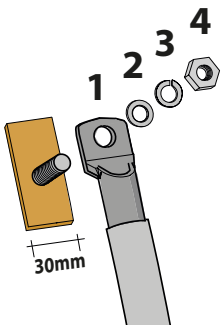
Each input terminal block is composed of connection bars of different dimensions (30 or 40 mm), arranged in alternate sequence.
40 mm bars can be used for the connection of cables of up to 300 mm2 cross-section, whereas 30 mm bars are suitable for cables of up to 185 mm2 cross-section.

Below are the installation sequences based on the used DC cables:

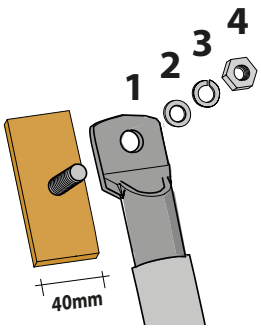
2x120mm²



1x185mm²



1x300mm²



Refer to section "Characteristics and technical data" for information on the dimensions and the tightening torques for the cables.

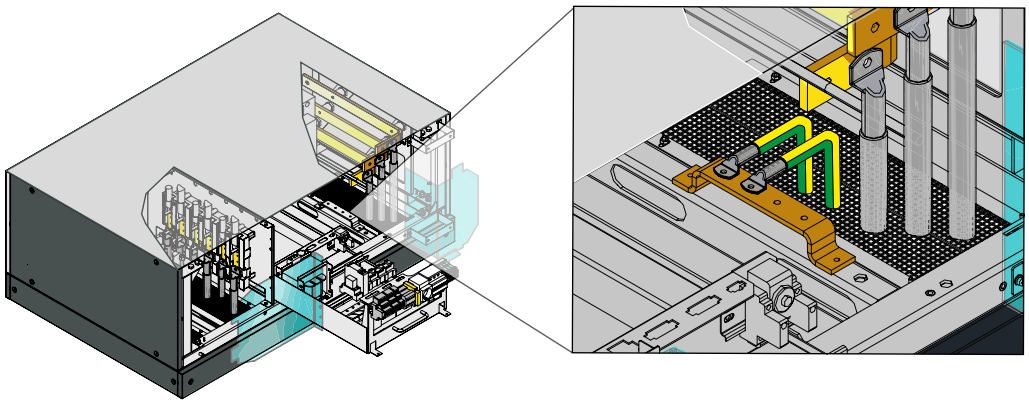
Once the cables have been passed through it is important to properly seal the leftover holes in the screens, for instance using expanded foam. This ensures that no animals or dust can penetrate the inverter

Connection of the protective earthing (PE) cable

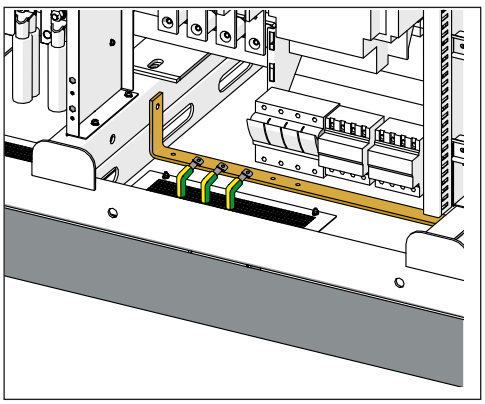
The grounding resistance of the system is crucial to the system's safety. Its value must be established before the first start-up of the system (the Table shows the minimum recommended cross section).

Model	Cross section	Cable lug
PVI-55.0(-TL) / PVI-67.0(-TL)	1x50 sq mm	M12
PVI-110.0(-TL)	1x70 sq mm	M12
PVI-134.0(-TL) / PVI-165.0(-TL)	1x95 sq mm	M12
PVI-200.0(-TL) / PVI-220.0(-TL)	1x120 sq mm	M12
PVI-267.0(-TL) / PVI-275.0(-TL)	1x150 sq mm	M12
PVI-334.0(-TL) / PVI-330.0(-TL) / PVI-400.0(-TL)	1x185 sq mm	M12

1. Connection of the protective earthing cables for transformerless AC BOX.



2. Connection of the protective earthing cables for AC BOX with transformer.



For 275kW and 330kW models, connect the earthing cable supplied in the external transformer BOX directly to the ground bar of the inverter's AC BOX.

Refer to section "Characteristics and technical data" for information on the tightening torques for cables.

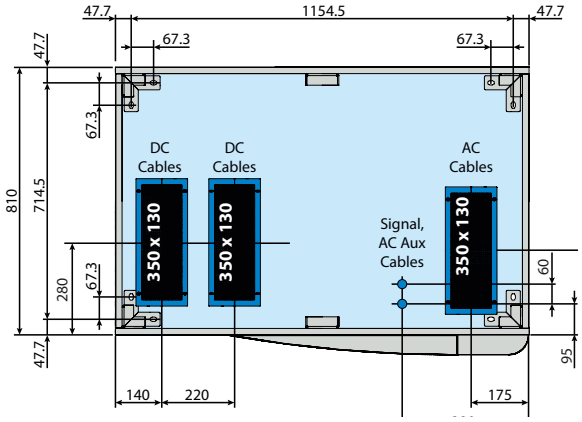
Connection of the AC output cables

For the connection to the distribution grid, it is necessary to connect the cables at the inverter AC BOX zone. Depending on the inverter PLUS model, 3 different connection configurations are possible.

Transformerless AC BOX - AC output connection

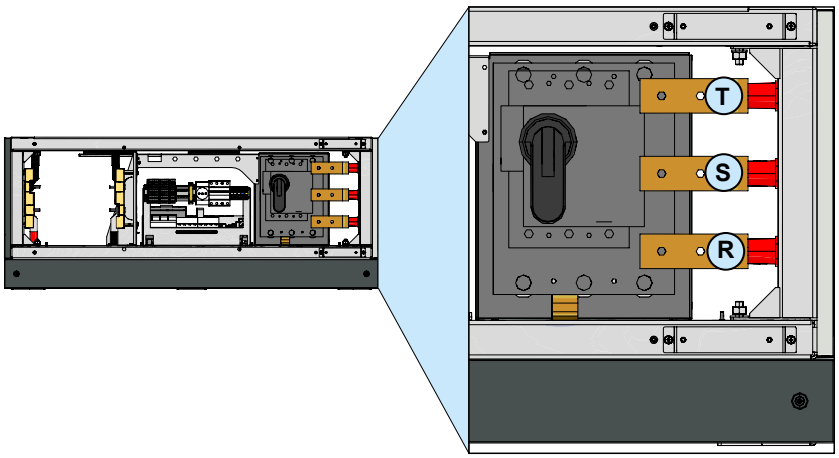
1. Remove the AC BOX front panel, then remove the AC zone plexiglas protection

2. Pass the AC cables through the cable entries at the back inside the inverter. The screens on each opening must be cut to allow the cables through.



3. Connect the cables to the bars on the right side of the AC BOX carefully observing the phase order shown in the figure below.

Transformerless PLUS
PVI-55.0-TL / PVI-110.0-TL
PVI-165.0-TL / PVI-220.0-TL
PVI-275.0-TL / PVI-330.0-TL
PLUS with transformer
PVI-275.0
PVI-330.0
PLUS-HV versions
PVI-67.0-TL / PVI-134.0-TL
PVI-200.0-TL / PVI-267.0-TL
PVI-334.0-TL / PVI-400.0-TL



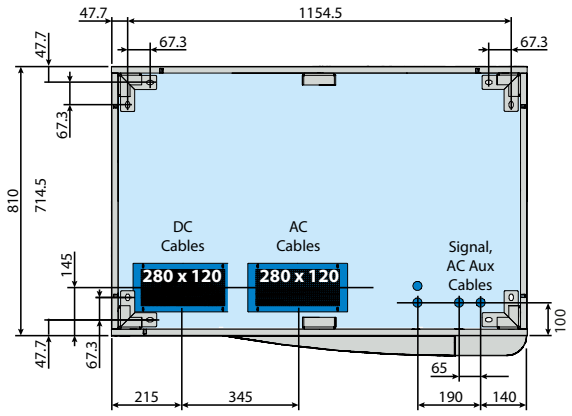
Refer to section "Characteristics and technical data" for information on the dimensions and the tightening torques for the cables.

Once the cables have been passed through it is important to properly seal the leftover holes in the screens, for instance using expanded foam. This ensures that no animals or dust can penetrate the box.

AC BOX with transformer - AC output connection

1. Remove the AC BOX front panel

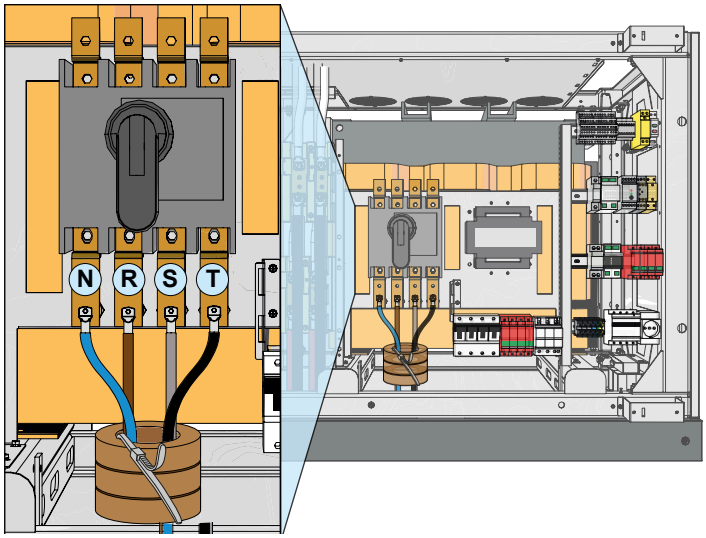
2. Pass the AC cables through the cable entries at the back inside the inverter. The screens on each opening must be cut to allow the cables through.



3. Connect the cables to the bars below the AC disconnect switch, carefully observing the phase and neutral order shown in the figure below.

For the 55 kW-110 kW-165 kW and 220 kW versions with transformer, pass the AC cables through the three supplied toroids before connecting them to the disconnect switch terminals

PLUS with transformer
PVI-55.0 / PVI-110.0
PVI-165.0 / PVI-220.0



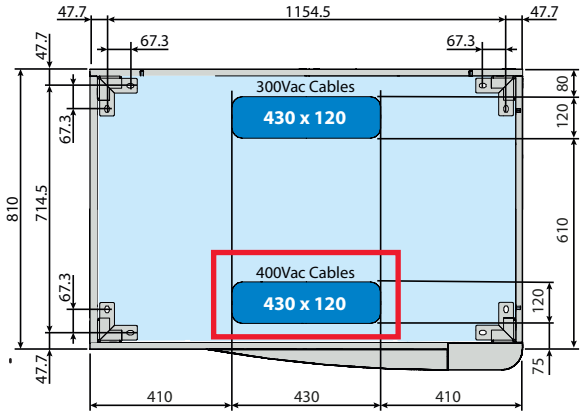
Refer to section "Characteristics and technical data" for information on the dimensions and the tightening torques for the cables.

Once the cables have been passed through it is important to properly seal the leftover holes in the screens, for instance using expanded foam. This ensures that no animals or dust can penetrate the box

External transformer BOX - AC output connection

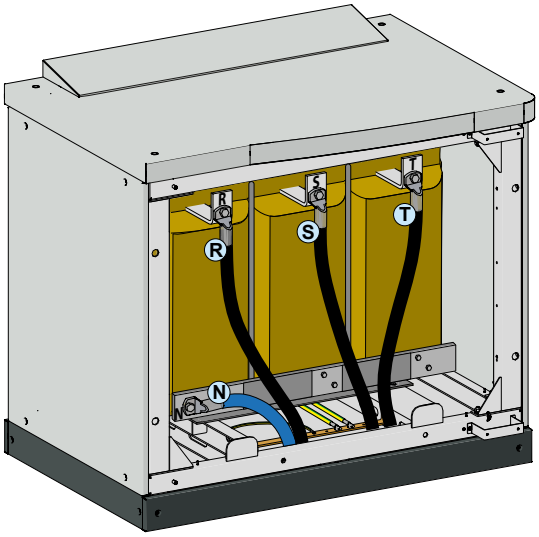
1. Remove the external transformer BOX front panel

2. Pass the AC cables inside the BOX through the cable entries at the back. The screens on each opening must be cut to allow the cables through.



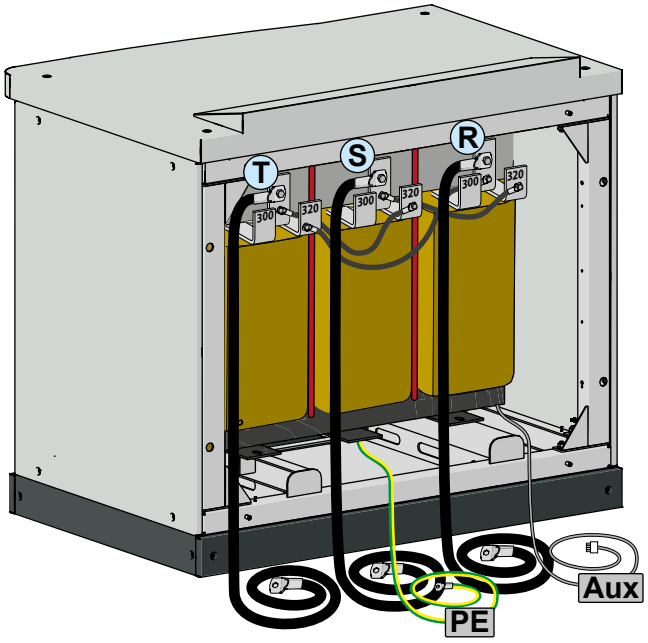
3. Connect the output cables to the bars on the isolating transformer, carefully observing the phase and neutral order shown in the figure below.

PLUS with transformer
PVI-275.0 / PVI-330.0

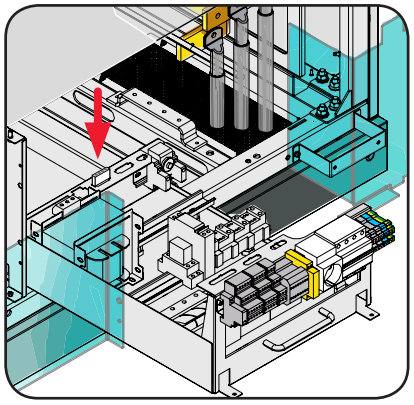


Refer to section "Characteristics and technical data" for information on the dimensions and the tightening torques for the cables.

These inverter PLUS versions require earthing, output and auxiliary power connections between the external transformer BOX and the inverter part AC BOX, using the cables contained in the latter (accessible by removing the BOX rear panel).
The connection cables are factory pre-wired on the external transformer BOX side.

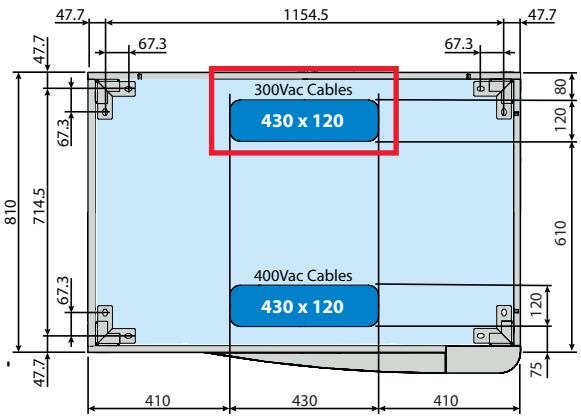


To connect the inverter part AC BOX, follow the instructions provided in the previous sections on the “Connection of the protective earthing (PE) cable” and “Connection of the AC output cables”, both valid for the transformerless AC BOX model.



The auxiliary (Aux) voltage connection cable must instead be connected to the dedicated connector on the extractable AC drawer inside the inverter part AC BOX:

All connection cables must be passed through the cable entries at the back of the inverter and of the external transformer BOX.

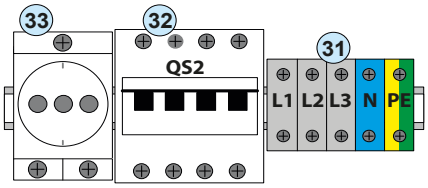


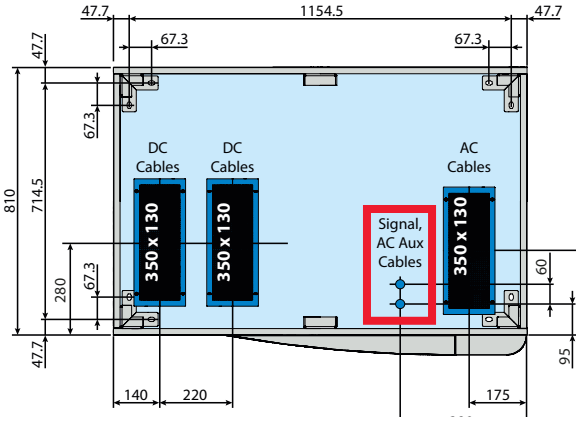
Once the cables have been passed through it is important to properly seal the leftover holes in the screens, for instance using expanded foam. This ensures that no animals or dust can penetrate the box

Connection of the auxiliary power supply

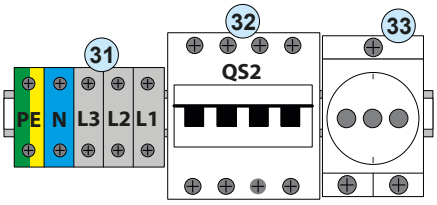
1. Connect the five-way cable (3P+N+PE) to the auxiliary voltage input terminals. The connection configuration varies depending on the type of AC BOX mounted on the inverter PLUS:

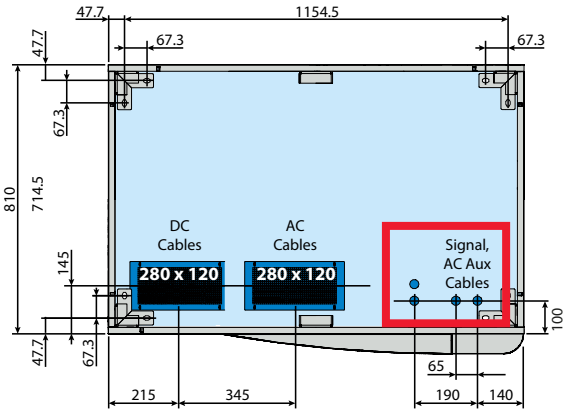
1a. Connection of the auxiliary voltage on transformerless AC BOX





1b. Connection of the auxiliary voltage on AC BOX with transformer





Exercise all due caution when connecting the neutral conductor (N).
Missing the neutral connection (blue terminal) or swapping it with one of the three phase connections may cause damage to the inverter.

2. Leave the QS2 switch in the OFF position (down)
The QS2 switch has two functions:
- Isolate the auxiliary voltage
- Isolate the system if the AC overvoltage surge arresters are being replaced.

3. For PLUS 275kW and 330kW versions with the transformer housed in an external BOX, ensure to connect the four-way cable (3P+N) contained in the external transformer BOX to the appropriate counterpart located in the extractable AC drawer inside the inverter part AC BOX.

It is important to leave approximately 30 cm of spare cable length inside the AC BOX to allow the extraction of the AC drawer.

Connection of the communication/alarm/control signals

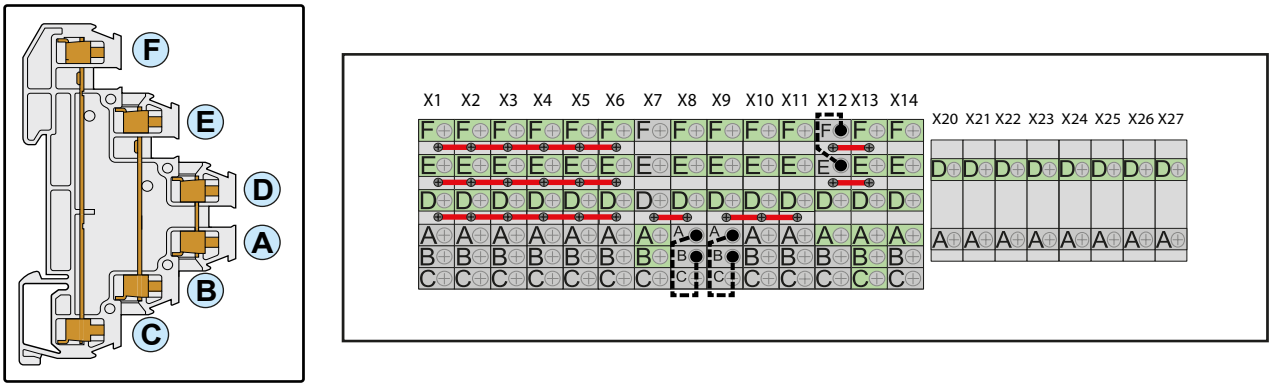
All inverter PLUS and PLUS-HV versions include a dedicated terminal block for the connection of the following signals:

• RS485 serial communication (X20 to X27 terminals)

• Modules status (X1 to X6 terminals)

• Remote on/off switching triggered by external command (X9, X10 and X11 terminals).

The figure below shows the pin configuration of the terminal block and a detail of the connection on an individual 6-pole terminal (X1 to X14).



The green contacts shown in the figure are not used for internal connections and can be used by the installer

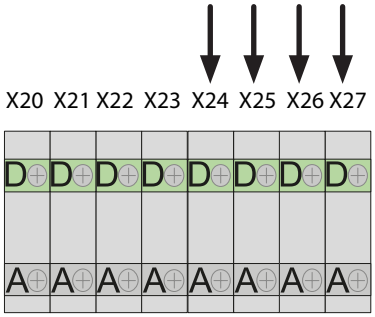
A flathead screwdriver (approximately 3.5 mm blade) is required to make the connections. To make the connections, loosen the screw, insert the wire(s) and finally tighten the screw to the appropriate torque value indicated in the “Characteristics and technical data” section.

Check that all connections are secure by pulling the wires.

Connection of RS485 serial communication

The inverter is equipped with two RS485 communication lines:
USR2 - RS485 serial line for the connection of the inverter to the parallel panels of FIMER string combiners (PVI-STRINGCOMB)
USR - RS485 serial line for the connection of a monitoring device

• Connection of the USR2 serial line (Stringcomb)
This line is dedicated to the connection of PVI-STRINGCOMB units (FIMER string parallel panel). Each PLUS and PLUS-HV inverter can manage up to 12 FIMER PVI-STRINGCOMB units that may be connected in "daisy-chain" ("in-out") configuration.
The connection terminals for the USR2 serial line are terminals X25 and X26:



X20		X21		X22		X23	
D	GRD_5V_ISO	D	+485_USR	D	-485_USR	D	GRD
A	GRD_5V_ISO	A	+485_USR	A	-485_USR	A	GRD

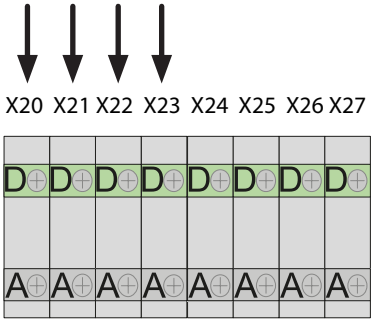
X24		X25		X26		X27	
D	GRD7	D	+485_USR_2	D	-485_USR_2	D	GRD
A	GRD7	A	+485_USR_2	A	-485_USR_2	A	GRD

Terminals X20 to X27 are fully extractable to facilitate the connection.

1. Connect the +485_USR_2 signal to the X25D terminal.
2. Connect the -485_USR_2 signal to the X26D terminal.
3. Connect the return (RTN or earth) to the X24D terminal.
4. Connect the cable shield to the X27D terminal.

Check that all connections are secure by pulling the wires

• Connection of the USR serial line (User)
This serial line is used for the connection of the inverter to monitoring devices or for "daisy-chain" ("in-out") connections of multiple inverters (max 32 conversion modules).
The connection terminals for the USR serial line are terminals X21 and X22:



X20		X21		X22		X23	
D	GRD_5V_ISO	D	+485_USR	D	-485_USR	D	GRD
A	GRD_5V_ISO	A	+485_USR	A	-485_USR	A	GRD

X24		X25		X26		X27	
D	GRD7	D	+485_USR_2	D	-485_USR_2	D	GRD
A	GRD7	A	+485_USR_2	A	-485_USR_2	A	GRD

Terminals X20 to X27 are fully extractable to facilitate the connection.

000222BG

1. Connect the +485_USR signal(s) to the X21D terminal.
2. Connect the -485_USR signal(s) to the X22D terminal.
3. Connect the return (RTN or earth) to the X20D terminal.
4. Connect the cable shield to the X23D terminal.

Check that all connections are secure by pulling the wires.

If the inverter is connected to a “daisy-chain” (“in-out”) of multiple inverters and it is not the last unit in the chain, ensure that the 120 ohm termination is deactivated (OFF). Then set the unique RS485 serial communication addresses on each conversion module, following the instructions provided in the next sections.

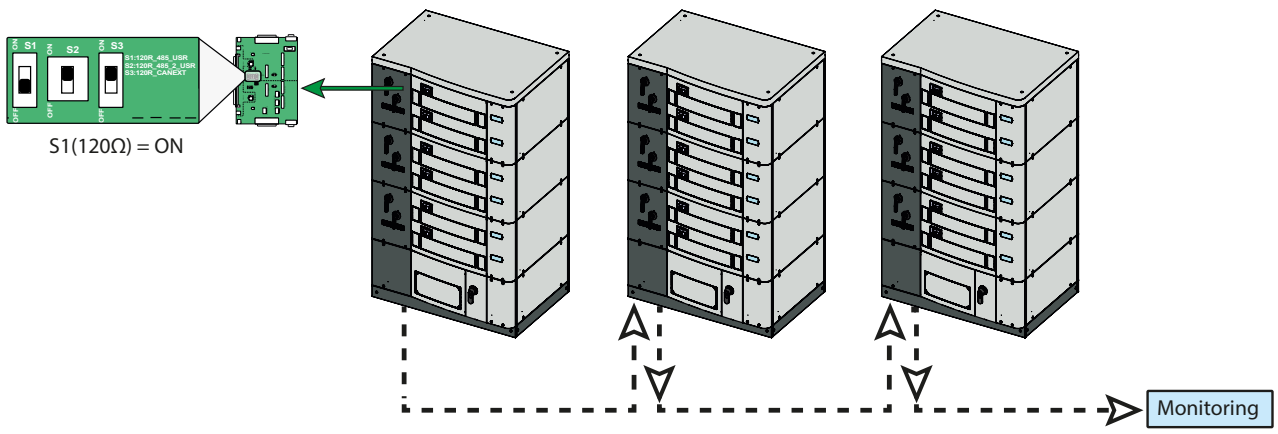
It is important to leave approximately 30 cm of spare cable length inside the AC BOX to allow the extraction of the AC drawer.

Serial monitoring systems (USR)

The RS485 line can be connected to various monitoring devices that can be in local or remote mode:
• Local monitoring from PC with PVI-USB-RS485_232 adaptor and Aurora Communicator software
• Remote monitoring with monitoring system (E.g.: PVI-AEC-EVO and Portal P1)
For local monitoring, FIMER recommends connecting its PVI-USB-RS485_232 adaptor between the first unit of the daisy-chain and the computer.

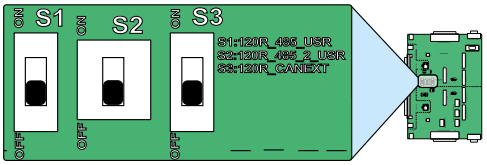
Equivalent devices found on the market can also be used for the same purpose, but, bearing in mind that they have never been specifically tested, FIMER cannot guarantee correct opera-tion of the connection.

Please note that these devices may also require an external termination impedance, whereas this is not necessary with the PVI-USB-RS485_232.



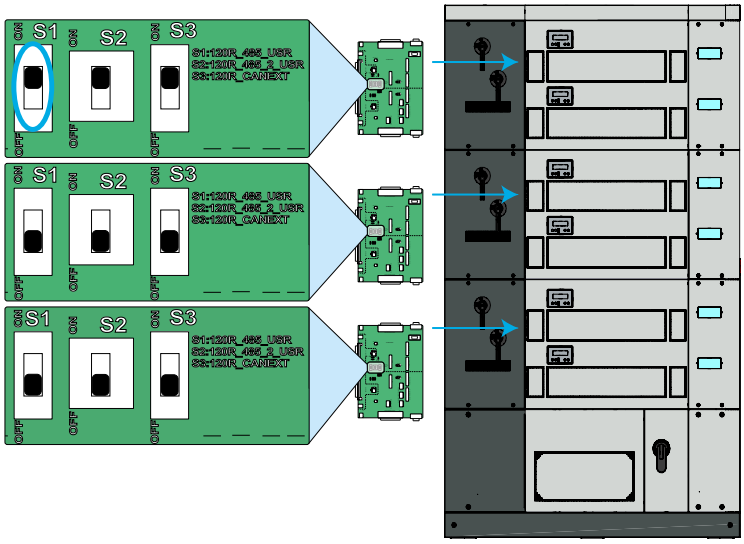
Setting the RS485 120 ohm termination

The activation of the termination resistance is necessary if the inverter is the last unit of a “daisy-chain” (“in-out”) of multiple inverters.



The resistance is activated by operating the S1 switch on the configuration board in the DC compartment of the top framework.

The figure below shows the location of configuration boards inside each framework. As clearly visible, the resistance is activated (ON) only on the top framework of the inverter.



The inverter PLUS are factory supplied with the RS485 communication line 120 ohm termination resistance deactivated (OFF).

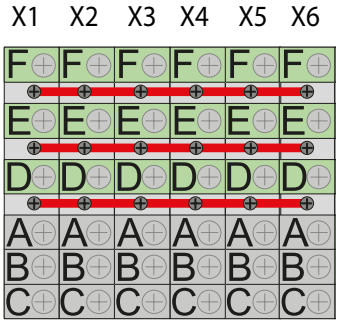
In case of daisy-chain connection, it is important that the termination is deactivated (OFF) on all frameworks, except for the last module of the last framework in the chain.

Setting the communication addresses

In case of “daisy-chain” (“in-out”) connection of multiple inverters, it is necessary that each conversion module installed on the inverters PLUS be assigned to a unique RS485 communication address.
The addresses are set on the display, by accessing the SETTINGS>addr. Rs485 ext menu.

Ensure no conversion modules share the same RS485 address in order to avoid serial communication conflicts and malfunctions.

Connection to conversion modules status relay

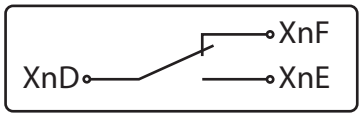


The inverter is equipped with an internal relay with configurable switching. It can be connected with normally open contact (being connected between the NO terminal and the common contact C) and with normally closed contact (being connected between the NC terminal and the common contact C).
This contact can be used in 2 different operating configurations that can be set in the dedicated menu.

X1		X2		X3		X4		X5		X6	
F	AUX_NC1	**F**	AUX_NC2	**F**	AUX_NC3	**F**	AUX_NC4	**F**	AUX_NC5	**F**	AUX_NC6
E	AUX_NO1	**E**	AUX_NO2	**E**	AUX_NO3	**E**	AUX_NO4	**E**	AUX_NO5	**E**	AUX_NO6
D	AUX_C1	**D**	AUX_C2	**D**	AUX_C3	**D**	AUX_C4	**D**	AUX_C5	**D**	AUX_C6
A	AUX_C1	**A**	AUX_C2	**A**	AUX_C3	**A**	AUX_C4	**A**	AUX_C5	**A**	AUX_C6
B	AUX_NO1	**B**	AUX_NO2	**B**	AUX_NO3	**B**	AUX_NO4	**B**	AUX_NO5	**B**	AUX_NO6
C	AUX_NC1	**C**	AUX_NC2	**C**	AUX_NC3	**C**	AUX_NC4	**C**	AUX_NC5	**C**	AUX_NC6

AUX_C = Common contact
AUX_NO = Normally open
AUX_ NC = Normally closed
The numbers beside the nomenclatures above indicate the numbers of the modules installed on the inverter.

When in rest condition, this contact is connected internally as shown in the figure below, where “n” refers to the number of the conversion module.



Example of connection of the contact for module 1:
X1D terminal (contact D) = Common contact
X1E terminal (contact E) = Normally open
X1F terminal (contact F) = Normally closed

This contact can be used in two operation modes:

Crepuscular mode: the relay usually switches when the voltage from the photovoltaic generator exceeds/falls below the threshold set for grid connection.
If the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter has an input voltage higher than the one selected for grid connection. The contact remains switched from its rest condition for as long as the inverter is switched on (even if not connected to the grid). This mode is useful for disconnecting large output transformers that could have unnecessary consumption during the night.

Grid mode: The relay switches whenever a connection to (and therefore a disconnection from) the grid occurs.
If then the NO (or NC) contact is chosen, the contact will stay open (or closed) until the inverter is connected to the grid; once the inverter connects to the grid and starts to export power, the relay switches state and therefore closes (or opens).

When the inverter disconnects from the grid, the relay contact returns to its position of rest, namely open (or closed).

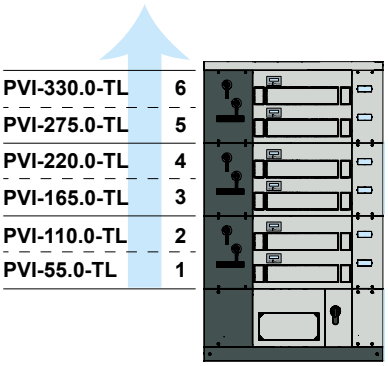
The selection of the operation mode is possible by accessing the SETTINGS → Service menu (the Service menu access password can be obtained by registering on the https://registration.solar.fimer.com/index.php website and providing the inverter Model, Serial Number and Week of manufacture).

Different types of devices (light, sound, etc.) can be connected to the relay, provided they comply with the following requirements:
Direct current
Maximum Voltage: 30 V DC Maximum Current: 0.8 A

The contact is factory supplied in Grid mode operation

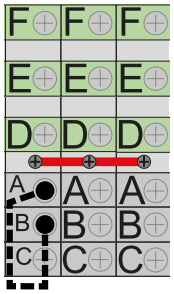
It is important to leave approximately 30 cm of spare cable length inside the AC BOX to allow the extraction of the AC drawer.

Remote control connection



Connection to and disconnection from the grid of individual conversion modules can be triggered with REMOTE n signals (where n is the conversion module number).
By default all REMOTE signals are connected to ground (X9) through jumpers on the terminal block. If manual connection is desired, these must be removed for instance by a free contact of a relay.

Closed contact between GRD and REMOTE = Inverter connected to the grid
Open contact between GRD and REMOTE = Inverter disconnected from the grid



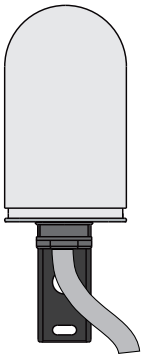
X9		X10		X11	
F	GRD7	F	REMOTE 3	F	REMOTE 4
E	GRD7	E	REMOTE 5	E	REMOTE 6
D	GRD7	D	REMOTE 1	D	REMOTE 2
A	GRD7	A	REMOTE 1	A	REMOTE 2
B	GRD7	B	REMOTE 5	B	REMOTE 6
C	GRD7	C	REMOTE 3	C	REMOTE 4

DO NOT connect live signals to the REMOTE terminals, as this will irreversibly damage the internal circuits of the conversion modules.

It is important to leave approximately 30 cm of spare cable length inside the AC BOX to allow the extraction of the AC drawer.

Connection of the Crepuscular Sensor

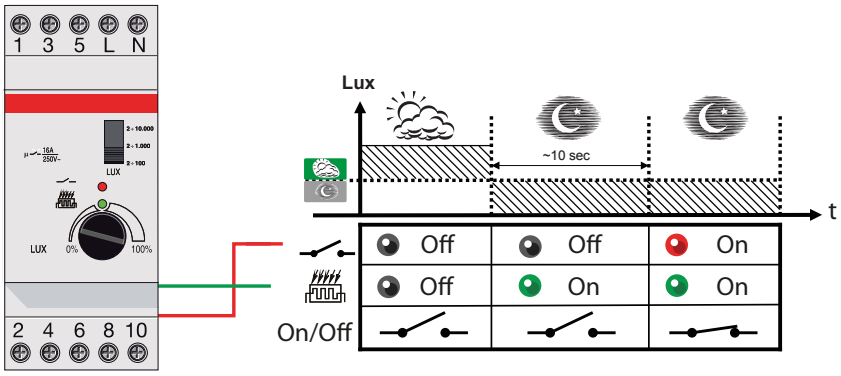
PLUS models with transformer
PVI-55.0
PVI-110.0
PVI-165.0
PVI-220.0
are equipped with a Crepuscular Sensor that allows to physically disconnect (by means of an AC contactor) the inverter from the grid during night time hours.



Each inverter PLUS equipped with a Crepuscular Relay is provided with a light sensor that must be installed for correct operation.
If the sensor is not installed and configured, the inverter will not be able to connect to the AC grid as the AC contactor will stay open.

Connect the crepuscular sensor to terminals 2 and 4 and place it vertically in a location free from shading.

Set the switch on the desired scale and adjust the sensitivity knob so that the relay switching is triggered with the desired the lighting conditions.



Below is a list of the LED aspect combinations:

Green LED	Red LED	Crepuscular state
Off	Off	Brightness exceeding the set threshold and open internal contact
On	Off	Brightness lower than the set threshold and open internal contact
On	On	Brightness lower than the set threshold and closed internal contact

6

General conditions

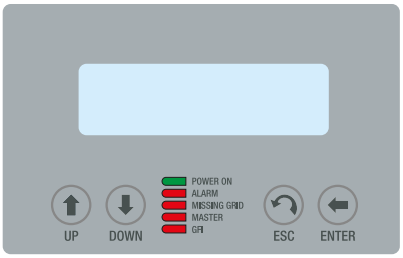
One of the first rules for preventing damage to the equipment and to the operator is to have a thorough knowledge of the INSTRUMENTS. We therefore advise you to read this manual carefully. If you are not sure about anything or there is discrepancy in information, please ask for more detailed information.

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.

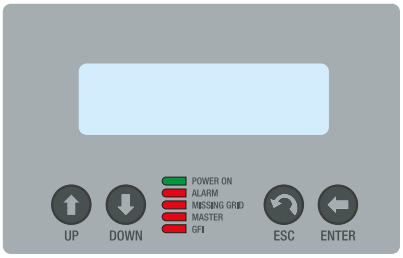
FIMER cannot be held responsible for damage to the equipment or the operator if it is the result of incompetence, insufficient qualifications or lack of training.

Display and keyboard

55kW modules display



67kW modules display



The LCD display (with two rows of 16 characters each) is located on the front panel of each conversion module and shows the following information:

- Operating status of the inverter and statistics.
- Service messages for the operator.
- Alarm messages.
- Settings, Info and Statistics menus.

During normal operation the data cycles on the display. The screen changes every 5 seconds, or upon manual operation of the UP and DOWN buttons.

The activation of cyclic scrolling is indicated by the 2 arrows in the top left corner of the display.

Scrolling of the information can be locked by pressing the ENTER button and will be indicated by the displayed padlock symbol.

The menus can be accessed by pressing the ESC button.
To cycle through the entries or access the submenus, use the side UP and DOWN buttons.
The selected option is marked by an arrow on the left side of the display.
Once the desired entry has been selected, press ENTER to access the corresponding submenu.

General conditions

Before checking the operation of the equipment, it is necessary to have a thorough knowledge of the INSTRUMENTS chapter and the functions that have been enabled in the installation.
The equipment operates automatically without the aid of an operator; operating state is controlled through the instruments.

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

The incoming voltage must not exceed the maximum values shown in the technical data in order to avoid damaging the equipment.
Consult the technical data for further details.

Even during operation, check that the environmental and logistic conditions are correct (see installation chapter).
Make sure that the said conditions have not changed over time and that the equipment is not exposed to adverse weather conditions and has not been isolated with foreign bodies.

Monitoring and data transmission

As a rule, the inverter operates automatically and does not require special checks. When there is not enough solar radiation to supply power for export to the grid (e.g. during the night), it disconnects automatically and goes into stand-by mode.
The operating cycle is automatically restored when there is sufficient solar radiation. At this point, the luminous LEDs on the LED panel will indicate this state.

User interface mode

The inverter is able to provide information about its operation through the following instruments:
• Warning lights (luminous LEDs)
• LCD display for displaying operating data
• Data transmission on the dedicated RS-485 serial line. Data may be collected by a PC (using signal converter PVI-USB-RS485_232) or a data logger with an RS-485 port (PVI-DESKTOP / PVI-AEC-EVO). Contact the FIMER support service with any queries about device compatibility.

Types of data available

The inverter provides two types of data, which can be retrieved through the special interface software and/or the display.

Real-time operating data
Real-time operating data can be transmitted on request through the communication lines and are not recorded in the inverter.

Internally stored data
The inverter internally stores a set of data that are necessary for processing statistical data and an error log with time marking.

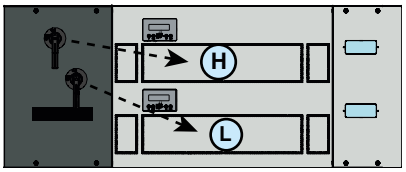
Measurement tolerance

The data supplied by the inverter may differ from measurements taken by certified measuring instruments (e.g. output meters, multimeters 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

Preliminary operations before commissioning

• Ensure that all conductors and protective grounding points are connected.
• Check the position of all DC, AC, Auxiliary and communication and control signals connection cables and that all connections are tight.
• Ensure that all electrical safeguards and front panels have been correctly installed.
• Check that every DC disconnect switch is open.
• Check that the AC and auxiliary voltage disconnect switches are open.

Function of the DC disconnect switches in each framework



The disconnector switches on the DC panel operate the DC disconnect switches of the conversion modules.
The bottom switch operates the DC disconnect switch of the lower module (L-low), whereas the top switch operates the upper module (H-High).

Each framework can contain a maximum of two conversion modules. Based on the inverter PLUS power rating, it is possible that only the lower conversion module and the associated protection devices are installed in a FRAMEWORK.

• Function of the DC disconnect switches with Multi Master configuration
In this configuration there is no physical connection between the photovoltaic systems of each module. Each DC disconnect switch is independent of the others.

• Function of the DC disconnect switches with Multi Master/Slave configuration
In this configuration the two (Master-Slave) modules of the Framework share the same photovoltaic field. The DC disconnect switches within a single framework are interconnected.

• Function of the DC disconnect switches with Master/Slave configuration
In this configuration all the modules share the same photovoltaic field. Each DC disconnect switch is connected to all the other DC disconnect switches of the inverter.

In this case it is particularly important to understand the operation of the DC disconnect switches and the commissioning procedure. The incorrect operation sequence for the DC disconnect switches may cause damage to the inverter, especially in the Master/Slave configuration.

Commissioning (Multi Master and Multi Master/Slave configurations)

1. Ensure the AC disconnect switch is open (position 0).

2. Ensure the DC disconnect switches are open (position 0)

3. Close the general auxiliary voltage switch by placing it on the ON position. The system control logic is activated and the displays on the front of the conversion modules turned on.
a. In a Multi-Master configuration, the Master LED is turned on for each module.
a. In a Multi Master/Slave configuration, the Master LED is turned on only for the Master module of each Framework.
In both cases the displays will show an alarm for open AC and DC disconnect switches.
In this condition, the LEDs have the following aspect:
POWER ON LED > flashing
ALARM LED > on
MISSING GRID LED > on

4. Close the DC disconnect switches (position 1), one at a time.

5. Close the output AC disconnect switch (position 1):

In the case of inverter PLUS models with transformer PVI-55.0, PVI-110.0, PVI-165.0 or PVI-220.0, it is necessary to set the crepuscular sensor

a. No alarms will be shown on the display of the modules.
In this condition, the LEDs have the following aspect:
POWER ON LED > flashing
ALARM LED > off (if no anomalies are detected)
MISSING GRID LED > off (if no grid voltage parameters are out of range)
b. The fans are activated if the DC voltage is sufficient to exit the energy saving mode
c. If the DC voltage is not sufficient for the connection to the grid, the display shows a “WAITING SUN” message.
d. If the primary conditions (DC and AC voltages present) are met, the system automatically connects to the AC grid.
In this condition, the LEDs have the following aspect:
POWER ON LED > on

With each connection, the system performs a complete scan of the field to identify the point of maximum power. During this stage a sudden increase of power is observed, followed by a decrease and a final increase. This stage has a duration of less than 5 seconds.

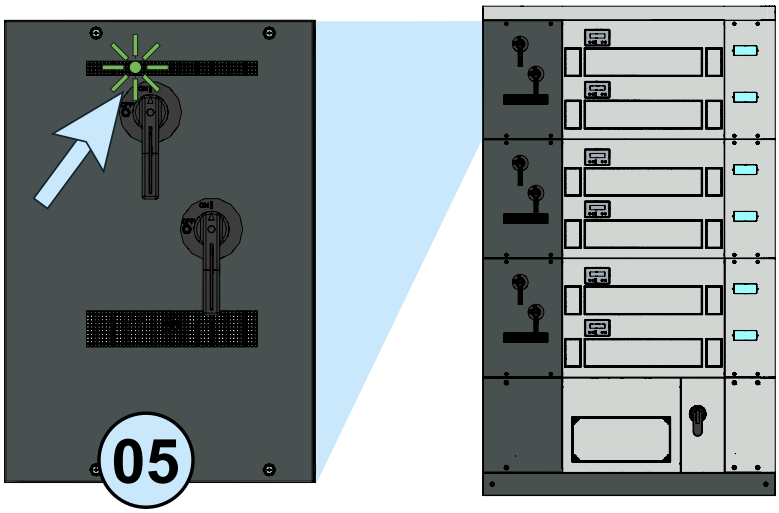
e. At this point the Master or the Masters will display the power fed into the grid, together with other parameters.

Commissioning (Master/Slave configuration)

1. Ensure the AC disconnect switch is open (position 0).

2. Ensure that the external DC disconnect switch (upstream) and the inverter DC disconnect switches are open (position 0)

If the inverter is provided with a pre-charge board, it is not necessary to open (install) the external DC disconnect switch (upstream). The presence of a pre-charge board is indicated by a lit LED on the DC front panel of the top framework.



4. Close the general auxiliary voltage switch by placing it on the ON position. The system control logic is activated and the displays on the front of the conversion modules turned on.
The Master LED must be lit only on one conversion module. If more than one Master LED are lit, this indicates an inverter fault.
The displays will show an alarm for open AC and DC disconnect switches.
In this condition, the LEDs have the following aspect:
POWER ON LED > flashing
ALARM LED > on
MISSING GRID LED > on

5. Close the DC disconnect switches (position 1), one at a time.

If the inverter is provided with a pre-charge board, when the first disconnect switch is closed the pre-charging stage is indicated by an acoustic signal. When the acoustic signal ceases, a second LED is lit on the Framework (next to the previously described LED), indicating that it is safe to close all the other DC disconnect switches.

6. After closing all the inverter DC disconnect switches, close the external DC disconnect switch (position 1).

This step is not necessary if the inverter is provided with a pre-charge board, as the installation of an external DC disconnect switch is not required.

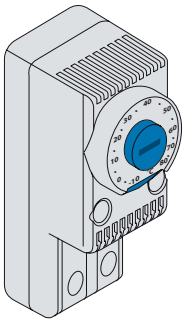
In both cases the displays will show an alarm for open AC disconnect switch.
In this condition, the LEDs have the following aspect:
POWER ON LED > flashing
ALARM LED > on
MISSING GRID LED > on

7. Close the output AC disconnect switch (position 1):
a. No alarms will be shown on the display of the modules.
In this condition, the LEDs have the following aspect:
POWER ON LED > flashing
ALARM LED > off (if no anomalies are detected)
MISSING GRID LED > off (if no grid voltage parameters are out of range)
b. The fans are activated if the DC voltage is sufficient to exit the energy saving mode
c. If the DC voltage is not sufficient for the connection to the grid, the display shows a “WAITING SUN” message.
d. If the primary conditions (DC and AC voltages present) are met, the system automatically connects to the AC grid.
In this condition only the POWER ON LED is lit.

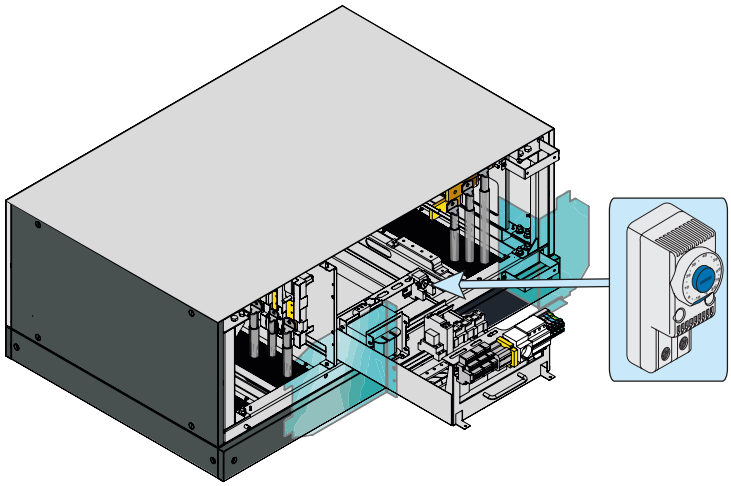
With each connection, the system performs a complete scan of the field to identify the point of maximum power. During this stage a sudden increase of power is observed, followed by a decrease and a final increase. This stage has a duration of less than 5 seconds.

e. At this point the Master or the Masters will display the power fed into the grid, together with other parameters.

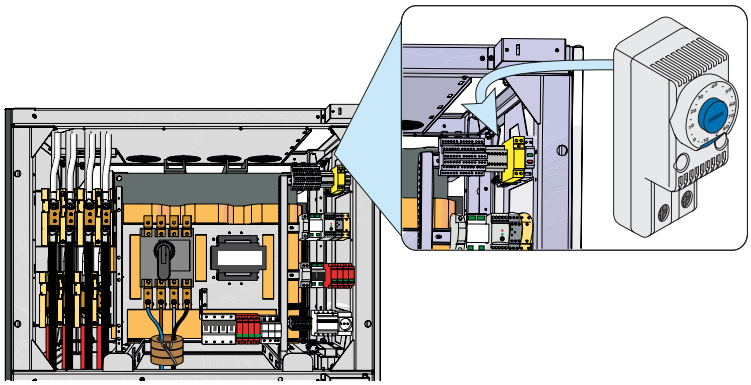
Setting the cooling system activation



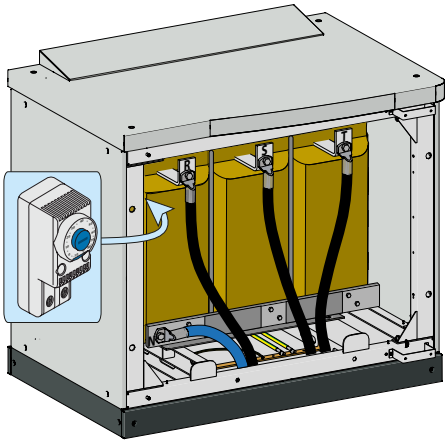
The inverter contains an internal cooling system that uses fans to direct hot air towards the openings on the rear.
The activation temperature of the cooling system (50°C by default) can be set on a dedicated thermostat that allows adjustment over the range from -10 to 80°C. Depending on the inverter model, the thermostat is placed as follows:



- Transformerless AC BOX
In this AC BOX version the thermostat is placed on the rear part of the extractable AC drawer



- AC BOX with transformer
In this AC BOX version the thermostat is placed behind the connection terminals for the alarm and control signals and for the RS485 serial line



- External transformer BOX
The thermostat is placed on the left internal wall of the BOX

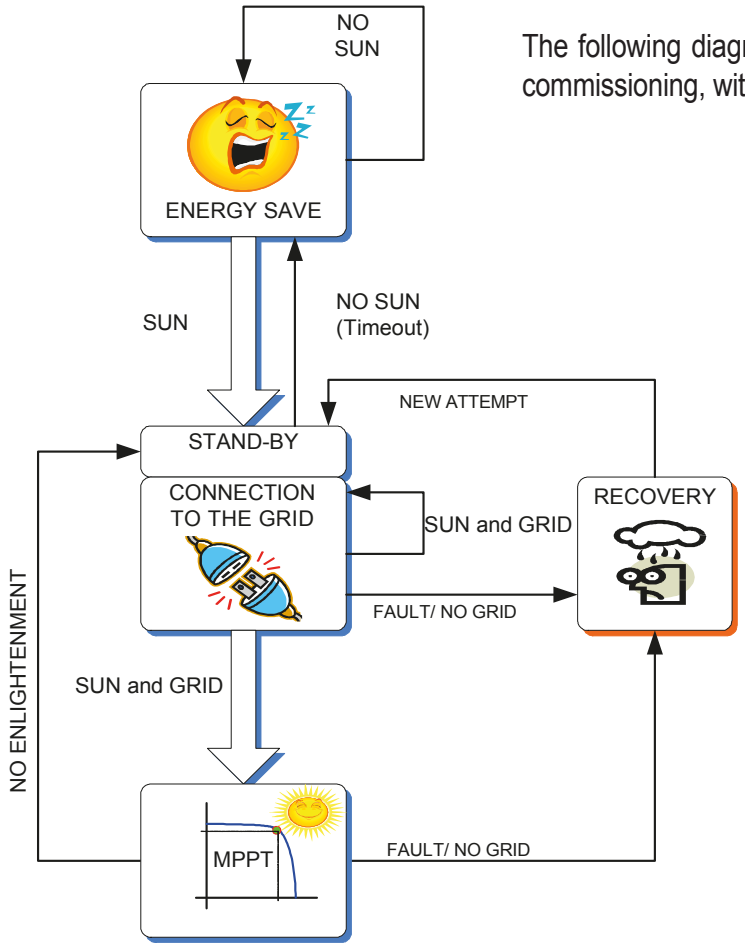
Advanced configuration - Aurora CVI Central software

Once the inverter has been commissioned, it is possible/necessary to configure it. The configuration can be accessed in the “settings menu” directly on the display or through the Aurora CVI Central (User) advanced configuration software available on the www.fimer.com website, together with the user manual. The main software features are:

- Viewing the inverter identification information
- Real time monitoring of the inverter/system
- Viewing the inverter/system statistics
- Monitoring and configuring the main settings on Stringcomb
- Setting the DC input parameters
- Setting the AC output parameters
- Adjusting the active/reactive power fed into the grid

Some of the above features are only available for Installer role.
Access with this role is pro-tected by a password that may be obtained by registering on the https://registration.solar.fimer.com/index.php

Operating diagram



The following diagram illustrates the inverter operation after the commissioning, with the different operative stages highlighted.

LED behaviour

The following table shows the main activation combinations for the conversion module LEDs, in relation to the operating state of the inverter.

Legend:
▭ = LED Off
▬ = LED on
◥ = LED Flashing

Table: LED behaviour

LED Status	Description
	• Module not powered
	• Module connected to the grid • Module set as Master • No active alarms
	• Module connected to the grid • Module set as Slave • No active alarms
	• Module not connected to the grid • Module set as Slave • Module detected an error or alarm
	• Module not connected to the grid • Module set as Master • AC grid absent or out of range

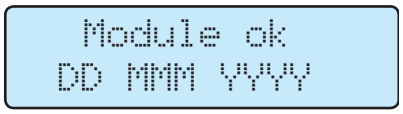
Display operating diagram

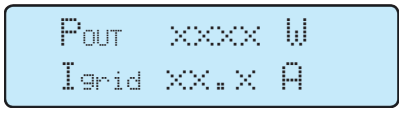
During normal operation the data cycles on the display. The screen changes every 5 seconds, or upon manual operation of the UP and DOWN buttons.

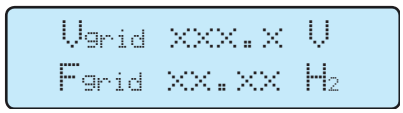
The activation of cyclic scrolling is indicated by the 2 arrows in the top left corner of the display.

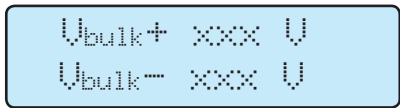
Scrolling of the information can be locked by pressing the ENTER button and will be indicated by the displayed padlock symbol.

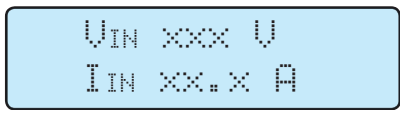
Below are the cyclic screens shown on the display:

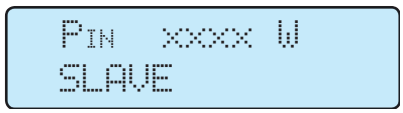




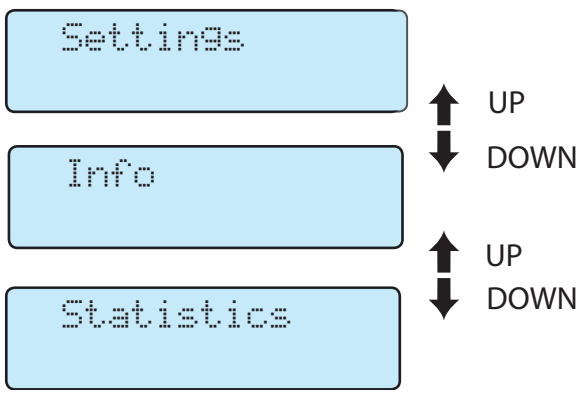








It is possible, by pressing ESC while in the cyclic screen menu and scrolling with the UP and DOWN buttons, to view the three main menus:



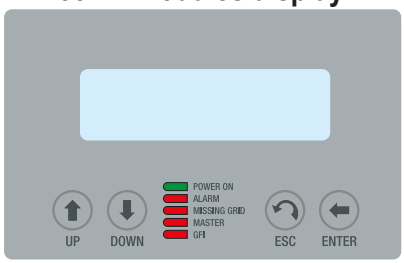
Description of the menus

The display consists of 2 lines of 16 characters each and allows, using the buttons, to navigate the menus to:

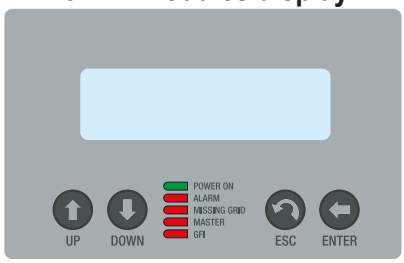
- View the operating status of the inverter and the statistical data;
- View service messages for the operator;
- View the alarm and fault messages;
- Change the inverter settings.

Using the panel buttons

55kW modules display



67kW modules display



- The UP and DOWN buttons are used to move around a menu or to increase/decrease the settable values.

- The ESC button allows access to the three main submenus, STATISTICS, SETTINGS and INFO.
It also allows to return to the previous submenu while moving through the menus.

- The ENTER button allows access to the required submenu while moving though the menus and allows the main menu scroll mode to be changed:
CYCLIC: Cyclic display of the main parameters of the inverter.
LOCKED: Display locked on the screen to be constantly monitored.

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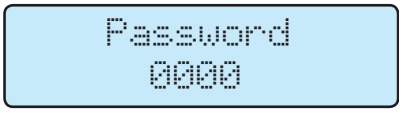
Settings Menu

The SETTINGS menu allows to change the inverter settings listed in the following table:

SETTINGS	
Password 0000	
1.	addr. Rs485 ext
2.	485s Baud rate
3.	display set
4.	Service
5.	New password
6.	Cash
7.	time
8.	language
(*)	Software ON/OFF
9.	trafo type
10.	Ext. 485 Delay



To access the SETTINGS menu, it is necessary to enter the default password (0000).

1. addr. Rs485 ext
This section of the menu allows to set the address for the serial communication of single conversion modules connected to the RS485 line

2. RS485 Baud rate
This section of the menu allows to choose the speed of transmission of the information via the RS485 serial communication line.
The selection may refer to the internal USR2 (Stringcomb) line or to the external USR line for the connection to a monitoring device

3. display set
This section of the menu allows to set the display properties:
• Light: setting of the mode and adjustment of the brightness of the display
Backlight mode > Enable = Backlighting always on
Backlight mode > Disable = Backlighting always off
Backlight mode > AUTO = Automatic backlight control. The light is switched on whenever a button is pressed and stays on for 30 sec, after which it gradually dims out.
• Contrast: adjustment of display contrast (scale from 1 to 9)

4. Service
This section of the menu is reserved for installers. To access this, it is necessary to have a dedicated password which may be obtained from the website https://registration.solar.fimer.com/index.php.
Before connecting to the site, make sure you have all the information required to calculate your password:
- Inverter model
- Serial Number and Week of Production

Once a password is obtained, it is possible to set the parameters in the menu following the directives provided by FIMER Service.

5. New Password
This section of the menu allows to change the access password for the settings menu (default 0000).

We advise you to be very careful in memorizing the new password. If the Password is misplaced, it will not be possible to access the inverter, since there is no Reset function for security reasons

6. Cash
This section of the menu allows to set the name of the currency and the value given to 1 kWh of energy produced. The correct setting of these parameters allows you to display the actual earnings/savings achieved by the system.
€-Val: sets the desired currency (default is Euro)
Val/KWh: indicates the cost/incentive for 1 kWh expressed in the chosen currency (default is 0.50).

7. Time
Allows you to set the current date and time (daylight saving time not included)

8. Language
Allows to set the desired menu language

9. Software ON/OFF
This section of the menu allows to perform a software switch-off of the conversion module (ON/OFF Active). If this function is deactivated, the module will restore normal operation (ON/OFF Not Active)

10. Trafo
This section of the menu allows to set the transformer type associated to a new module after a replacement.

11. Ext. 485 delay
Allows to set the inverter response time when polled by an external device.

Info menu

The INFO menu allows to show on the display the inverter information listed in the following table:

INFO	
1.	Module p/n
2.	Module s/n
3.	Part. No. Sys.
4.	Serial no. Sys.
5.	trafo type
6.	Firmware
7.	Junction Box

1. Module p/n
This option shows the conversion module Part Number.

2. Module s/n
This option shows two pieces of information:
s/n mod.: Module serial number
wk/yr: Module Week (wk) and Year (yr) of manufacture

3. Part. No. Sys.
This option shows the inverter Part Number (4 digits)

4. Serial no. Sys.
This option shows the inverter serial number

5. Trafo type
This option shows two pieces of information:
Trafo yes/no: Inverter with or without transformer
mod trafo: Number of conversion modules

6. Firmware
This option shows the release of conversion module internal software (in the form x.x.x.x)

7. Junction Box
This option allows to check the status of the Junction Boxes included in the system.
The “Junction Box” option shows the following information:
Nn is the Stringcomb identification number (set by the installer)
Tn is the number of the module to which the Stringcombs refer
Rn is the number of detected Stringcombs
Jn is the Stringcomb Field number (1 to 12)
Px indicates the presence (Y/N) of PVI Stringcomb

Pressing ENTER on the selected (Stringcomb) line will show on the display the Monitor JBOX x entry, where x is the Stringcomb number to be displayed.
Once the Stringcomb number has been selected, three submenus will be shown: states, fuses, currents.

states shows the status of all the Stringcomb parameters (OK/NOT OK):
Fuses: it is possible to check the status of the individual fuses, from 1 to 20
JBOX Temperature
Voltage
Balance
Currents: it is possible to check the status of the individual string currents
Power
Comm.
Calib.

Statistics Menu

The STATISTICS menu allows to show on the display all the inverter statistics

STATISTICS	
1.	Lifetime
2.	Num. grid
3.	E-tot
4.	Partial
5.	E-day
6.	E-week
7.	E-month
8.	E-year
9.	Last N days
10.	Peak Power

1. Lifetime
This option shows the following information:
life: Total operation hours
grid: Total hours of grid connection

2. Num. Grid
This option shows the number of connections to the grid

3. E-tot
This option shows two pieces of information:
E: Total energy produced
Val: Earnings based on the set incentive tariff

4. Partial
This option shows the following information:
PT: Total operation time since the last counting reset
E: Total energy produced since the last counting reset
Val: Earnings since the last counting reset
Reset Partial: Allows to zero the parameters of this submenu

5. E-day
This option shows two pieces of information:
E: Energy produced during the current day
Val: Daily earnings based on the set incentive tariff

6. E-week
This option shows two pieces of information:
E: Total energy produced during the current week
Val: Weekly earnings based on the set incentive tariff

7. E-month
This option shows two pieces of information:
E: Total energy produced during the current month
Val: Monthly earnings based on the set incentive tariff

8. E-year
This option shows two pieces of information:
E: Energy produced during the current year.
Val: Yearly earnings based on the set incentive tariff

9. Last N days
This option shows two pieces of information:
E: Total energy produced over the last N days
Val: Earnings associated to the N selected days, based on the set incentive tariff

10. Peak Power
This option shows two pieces of information:
PPA: Peak power value since the first inverter start-up
PPT: Peak power value for the current day

Turning off the inverter

Some inverter parts may be subject to voltages that could be hazardous for the operator. Before performing any work on the inverter, follow the procedure for turning off the inverter.

If work has to be carried out on exposed parts (not protected by panels), opening the AC and DC disconnect switches (position 0) is not enough as a safety measure as the input cables are always live. It is furthermore necessary to switch off and open (upstream) the inverter.

Isolating the AC grid

1. It is advisable to set all the Master modules of the rack to the REMOTE OFF position via the display.
2. Turn the AC switch anticlockwise, to the 0 position:
a. The inverter disconnects from the AC grid, thus not supplying any power.
b. All the displays in the rack will signal an open AC switch alarm.
The POWER ON LED flashes.
The ALARM LED is lit.
The MISSING GRID LED is lit.

In this stage the modules may display a different error during the first minute, as opening the switch causes a grid interruption, with possible detection of a Grid Fault error or similar. After the recovery time (e.g. 60 sec), all modules will display the same warning.

Isolating the photovoltaic system

1. Ensure the AC switch is open (position 0).
2. Open the DC disconnect switches (position 0), one at a time
a. In a Multi-Master/Slave configuration, it is necessary to turn both switches in the Framework to physically disconnect the modules from the system.
b. In a Multi-Master configuration, each individual switch disconnects the corresponding module from the photovoltaic system.
c. In the case of Master/Slave configuration, it is necessary to turn all the switches in the rack to physically disconnect the modules from the system. Isolation is also possible by operating the external DC switch.

Before proceeding with the next step, wait for 30 minutes to allow the system fans to correctly dissipate the heat.

Isolating the auxiliary line

For this operation it is necessary to open the global switch connected upstream the inverter (to be performed by the installer) or the inverter internal auxiliary voltage disconnect switch:

1. Follow the instructions provided for the AC and DC isolation.
2. Remove the AC BOX front panel and open the QS2 auxiliary power disconnect switch (OFF position)

Isolating the inverter (upstream)

Should it be required to move/remove or dismiss the inverter PLUS, or in any case to isolate it from the rest of the system, it is absolutely mandatory to isolate the device on the AC and DC sides, that is from the photovoltaic generator and from the distribution grid.
To do so it is necessary to isolate:
- DC input voltage
- Output distribution line connected to the AC terminals
- Auxiliary power supply.

This operation can only be performed by operating the disconnect switches on the photovoltaic system and on the distribution line, and not via the disconnect switches on board of the inverter.

It is now possible to physically disconnect the DC and AC cables from the inverter by removing all necessary panels.

General conditions

Checking and maintenance operations must be carried out by specialized staff assigned to carry out this work.

Maintenance operations must be performed with the apparatus disconnected from the grid (power switch open) and the photovoltaic panels obscured or isolated, unless otherwise indicated.

For cleaning, DO NOT use rags made of filamentary material or corrosive products that may corrode parts of the equipment or generate electrostatic charges.
Avoid temporary repairs. All repairs should be carried out using only genuine spare parts.
The maintenance technician is under an obligation to promptly report any anomalies.

DO NOT allow the equipment to be used if problems of any kind are found, and restore the normal conditions correctly or otherwise make sure that this is done.

Always use the personal protective equipment provided by the employer and comply with the safety conditions of the Accident prevention chapter.

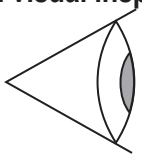
Routine maintenance

Routine maintenance can be performed either by an authorised FIMER technician under a servicing contract, or a qualified technician. In the latter case, the technician must be trained by FIMER. If not performed by FIMER, routine maintenance must be self certified by the client. The relevant documentation can be requested from FIMER at any time. FIMER further reserves the right to inspect the client system to verify its maintenance conditions and provide the client with the appro-priate documentation.

The periodicity of the maintenance operations may vary in accordance with local environmental conditions and the installation

Perform maintenance operations in compliance with all safety regulations

Table: routine maintenance

Annual visual inspection 	• Check that the inverter is operating correctly, with no alarm indications • Ensure the ventilation system is operating efficiently; check the openings are not obstructed or narrowed. • Check that the metal parts that do not carry any current are correctly connected to ground (panel frames, metal boxes, etc.) • Ensure all labels and safety symbols are visible • Visually check that all DC and AC overvoltage protection devices are in an adequate working state • Visually check that all module fans are in an adequate working state.
Annual operations 	• Check that all power cables and bus connections are tightened to the recommended torque value; if a thermographic camera is available, it is recommended to perform thermal scans on all connection points that carry maximum power. The points to be checked are: DC/AC bars AUX drawer AC fuses DC fuses and diodes (if accessible) Rear AC bars and DC/AC connectors drawer (if accessible) AC switch (if accessible) Transformer and contactor (if present) • Visually check that all DC and AC safety fuses are in an adequate working state. • Ensure the voltage at the DC side is balanced. • If no monitoring system is present, check the alarm and error logs with the Aurora CVI Central software.
Annual cleaning 	• Remove dirt and debris accumulated in front of and around the inverter • Remove and clean the air filters (contact FIMER if replacement parts are nee-ded)

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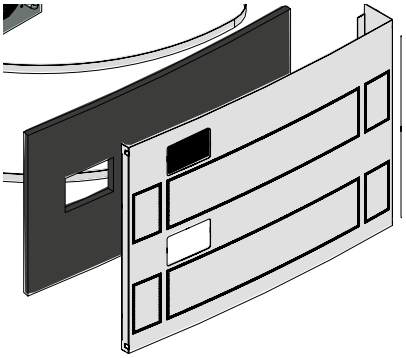
Cleaning the air filters

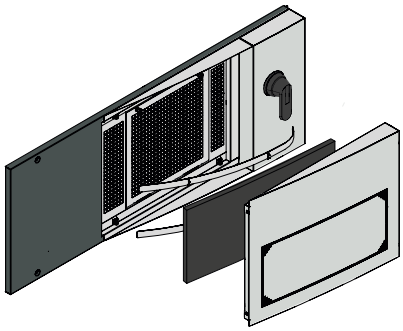


To access the air filters it is necessary to remove some of the inverter PLUS front panels. The air filters are made of a plastic material that can be washed with water and industrial soap.

Modules zone filter: To clean the modules zone, the protective front panel of the conversion modules must be removed. The filter is removed by pulling the panel outwards.

Once the panel is removed, the filter mounted on the inner side can be extracted and washed. If necessary, also clean the panel screens.

Although removing the front panel with the inverter switched on is permitted, switching the device off beforehand is desirable.
Ensure the filter is perfectly dry before putting it back. Replace the panel if no other subsequent checks are needed.



AC BOX zone filter: To clean this zone, remove the AC BOX front panel. Once the panel is removed, the filter mounted on the inner side can be extracted and washed.
If necessary, also clean the panel screens.

Although removing the front panel with the inverter switched on is permitted, switching the device off beforehand is desirable.
Ensure the filter is perfectly dry before putting it back. Replace the panel if no other subsequent checks are needed.

Torque checks and visual inspections

To perform a torque check it is necessary to open the inverter. Before doing this, it is absolutely essential to switch off and isolate (upstream) the inverter (DC side and AC side).

If work has to be carried out on exposed parts (not protected by panels), turning the AC and DC disconnect switches on the 0 position (off) is not enough as a safety measure as the input cables are always live.

Once the system is isolated and the inverter panels have been removed, check that all power cables and bus connections are tightened to the recommended torque value.
The points to be checked are:
DC/AC bars
AUX drawer
AC fuses
DC fuses and diodes (if accessible)
Rear AC bars and DC/AC connectors drawer (if accessible)
AC switch (if accessible)
Transformer and contactor (if present)

To remove the panels you may need to disconnect the earth lug. Remember to reconnect it before closing each panel.

Any internal check on the modules must only be performed by specialised and adequately trained personnel.

Visual inspection includes checking any point that shows variations in colour with respect to other similar points. It is important to verify that the colour of anchor, tightening and insulation points does not change over time. Any anomalous non-uniform discoloration may be a symptom of thermal stress and thus of possible operational problems.

If a thermographic camera is available, you are recommended to perform thermal scans on all connection points that carry maximum power.

Checking the AC and DC protection devices

To perform a torque check it is necessary to open the inverter. Before doing this, it is absolutely essential to switch off and isolate (upstream) the inverter (DC side and AC side).

AC BOX checks

AC overvoltage surge arresters (AC BOX with transformer):
Remove the AC BOX front panels and verify that the inspection windows on each surge arrester are green (see the visual representation of the references to locate the components).
If the windows are red, they are damaged and must be replaced. In this event, you are recommended to replace the faulty cartridges with ones of the same type.

AC overvoltage surge arresters (transformerless AC BOX):
Remove the AC BOX front panels, extract the AC drawer and verify that the inspection windows on each surge arrester are green (see the visual representation of the references to locate the components).
If the windows are red, they are damaged and must be replaced. In this event, you are recommended to replace the faulty cartridges with ones of the same type.

FRAMEWORK checks

Checking the DC overvoltage surge arresters:
The damage check on the DC OVR (overvoltage surge arrester) device is automatically performed: the display will signal this with an appropriate indication. In this case the faulty cartridge must be replaced.
The DC overvoltage surge arresters are located to the left of each module. Within the DC zone, the left surge arrester operates on the upper module, whereas the right one operates on the lower module.

The Master-slave version includes a single DC overvoltage surge arrester. In this case, all fault warnings are displayed on both displays of the relevant Framework.

Checking the AC fuses: This check does not require opening the AC front panel and switching the inverter off, as the status of the fuses can be verified through the inspection windows on the AC panel.
The fuse status is signalled through an inspection window on the body of each fuse; if the fuse is undamaged the colour shown through the window is red.

Checking the DC fuses: In case of a faulty fuse, the display might show the “Waiting sun” message.
To perform this check, it is necessary to switch the inverter off and open the DC front panel. Each DC fuse is equipped on the top side with a status indicator; if the fuse is undamaged the indicator is horizontal and

attached to the fuse case, whereas if the fuse has blown the indicator will be vertical.

A continuity measurement by means of a multimeter is however recommended to check the status of the fuses.

Troubleshooting

To understand and deal with the warnings (Wxxx) or errors (Exxx) shown on the inverter display, refer to the table shown in the next section.

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

Alarm Messages

The equipment signals the following errors/warnings on the display.

Alarm message	Alarm	Code displayed	Possible cause	Possible solution
	Display Off	/	a) if the problem is found on all rack modules: No auxiliary voltage b)if the problem is found on some but not all of the rack modules: Logic board display connection	a) Verify the status and the voltage at the Aux disconnect switch terminals inside the AC BOX. Check the auxiliary voltage distribution wiring, starting at the bottom. b) Lay the auxiliary voltage distribution wirings again, bottom-up. Remove the module upper panel and check that the flat connector is properly connected to the display. If no solution is found, contact FIMER Service.
Energy Save	/	/	a) DC voltage too low	a) • Open the front panel and verify that the supplied DC voltage is sufficient (at least 350 V). • Check the status of the DC fuses. • Check the status of the field panel disconnect switch. • Check the polarity of the strings. • Using Aurora CVI Central (DC side, Vpanel), check that DC voltage is supplied (at least 350 V): - If the DC voltage is within the threshold: Try swapping the module with another one from the same rack while checking that the connection between the module blades and the tape-red rack pins is correct. If the error persists, contact FIMER Service. - If the DC voltage is above the threshold: • Check Vpanel using the Aurora CVI Central software: if the threshold is not 350 V, try decreasing the value of the variable 112 in the Setup submenu (DC side). • Contact FIMER Service for module replacement.
Waiting sun/ grid	/	/	a) **(if the problem is found on all modules):** No AC side voltage b) **(if the problem is found on some but not all of the modules):** Internal module fault	a) Verify the voltage at the AC switch terminals. • Check the status of the three AC fuses connected to the module and verify that the voltage supplied to them is 320 V AC. • Remove the right front panel and check the voltage at the terminals of the AC filters. • Check the status of the AC contactor by verifying the connections to the crepuscular relay and to the interface protection device (BT version only). • Check the voltage at the ends of the integrated transformer (BT version only). • Check the connectors on the rack connection plug. Using a tester, measure the AC voltage at the connectors. If the blades are out of position, the corresponding part of the module will not make contact. • Check that the AC disconnect switch on the AC BOX is not in the TRIPPED position. This would indicate that the Imax and Tmax trimmers have not been calibrated in the MAX position by the manufacturer. b) Check that the module is operational. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.

Alarm message	Alarm	Code displayed	Possible cause	Possible solution
Input OC	Input current exceeding the maximum threshold	E001	a) PV generator wrongly sized. Error during system implementation. b) Internal module fault	a) : Check that the composition of the PV generator gives an output which falls within the DC limits of the inverter. If it does not, the DC-AC current transformation may be stopped by the tripping of the DC fuses. Adapt the system to the inverter limits. b) Check that the module is operational. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Bulk OV	Input voltage exceeding the maximum threshold	E004	a) PV generator wrongly sized. Error during system implementation. b) Internal module fault	a) Check the inverter DC input voltage. • Open the field disconnect switch and check that the composition of the PV generator falls within the DC limits of the inverter. • Adapt the system to the inverter limits. • Check the status of the inverter DC input connections. b) Check that the module is operational. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Comm. Error	DSP communication error	E005	a) Internal module fault	a) Perform a complete inverter restart cycle. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service. If repeated, this error may cause the module to give the E043 Autoexclusion error
Output OC	Output current exceeding the maximum threshold	E006	a) Short circuit on the inverter AC side. AC grid voltage fault. b) Internal module fault	a) Fully isolate the module: • Open the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. • Check the AC side voltage and connections. • Check the status of the three AC fuses connected to the module and verify that the voltage supplied to them is 320 V AC. • Check the voltage at the ends of the integrated transformer (BT version only). b) Check that the module is operational. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
OCH	IGBT SAT	E007	a) Disturbance / grid interruption / poor irradiation (morning, evening) b) IGBT fault inside module.	If the error is occasional or observed on different modules: • Download the fault log with the Aurora CVI Central software and check the generating conditions and the number of occurrences. If repeated, this error may lead the module into the E043 Autoexclusion error. If the error is not repeatedly observed, this is not a real problem. b) If the error is permanently observed on a module, try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Over Temp.	Over-temperature	E014	a) Faulty temperature probes, ambient temperature over 60°, obstructed filters.	a) Use the Aurora CVI Central software to check: • Heat sink temperature (H Sink degrees centigrade). If higher than 95°C, contact FIMER Service • Check the installation premises and the ambient temperature, check the status of the filters. • Try swapping the module with another one from a different framework. If the error persists on the same module, contact FIMER Service. If the error persists on the same framework, check the status of the temperature probe on the dipswitch board on the side. If no solution is found, contact FIMER Service.

Alarm message	Alarm	Code displayed	Possible cause	Possible solution
Cap. fault	Voltage difference across DC capacitors exceeding the maximum threshold	E015	a) Loss of insulation on the PV generator b) Module fault	a) Fully isolate the module: • Open the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. • Check for DC voltage unbalance with respect to ground: Use a tester to compare the voltage drop between the PV generator positive bar and ground with the voltage drop between the negative bar and ground. If the measured values are unbalanced, it is necessary to verify the PV generator insulation, repeating the check on each individual string to identify on which of them the problem is observed (A megohmmeter might come in handy for this task). b) If the two voltage values measured on the PV generator are balanced, try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Under Temp.	Temperature below minimum threshold	E033	a) Ambient temperature below -10° b) Faulty temperature probes	a) In the Aurora CVI Central software, access the INVERTER MONITORING menu to check if the default value for the thresholds MCU°C, P. Feed °C, H Sink°C, AUX2 °C and AUX3 °C is -10°C. If the value is lower, access the SETUP->SPECIAL FUNCTION menu and edit the variables 101/103/105/109. If the error is observed on AUX2, edit the variable 107. Although this change allows to keep the inverter productive, it is necessary to contact FIMER Service in any case. b) Check the installation premises and the ambient temperature. Try swapping the module with another one from a different framework. If the error persists on the same module, contact FIMER Service. If the error persists on the same framework, check the status of the temperature probe on the dipswitch board on the side. If no solution is found, contact FIMER Service.
Remote OFF	Remote off	E035	a) Remote off by software command b) Intentional/accidental switch-off via contacts X9-X10-X11 of the terminal block.	a) Use the Aurora CVI Central software to reset Remote ON in the MODULE-> COMMANDS->SOFTWARE COMMANDS-> REMOTE ON/OFF SETTINGS menu. b) Check the X9-X10-X11 terminals inside the AC BOX for: • Short circuits via terminal strip • Correct tightening • Correct connection of the cables between the terminal block and the Molex CN3 connector of the AC drawer • Correct connection between the lateral boards on connectors J18 and J9. • Check the S7 dipswitch on the lateral board: -Lower frame -> Switch 1 and 2 ON / Switch 3, 4, 5 and 6 OFF -Middle frame -> Switch 3 and 4 ON / Switch 1, 2, 5 and 6 OFF -Top frame -> Switch 5 and 6 ON / Switch 1, 2, 3 and 4 OFF NOTE: If all the S7 switches in the lower frame are OFF, the REMOTE command is disabled for the whole system.
Input UC	Negative input current exceeding the maximum threshold	E037	a) Negative DC input current	a) Download the fault log with the Aurora CVI Central software and check the error occurrence. If the error is permanently observed, try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Fan Stuck	Stuck fans	E038	a) Foreign bodies b) Faulty fan	a) Check the status of the filters and inspect the front panel area corresponding to the central fan. If the error is permanently observed, contact FIMER Service. b) Use Aurora CVI Central to check which fan is stuck (FAN 1/2/3) and contact FIMER Service. If repeated, this error may cause the module to give the E043 Autoexclusion error.

Alarm message	Alarm	Code displayed	Possible cause	Possible solution
DC Open	Open DC disconnect switch	E039	a) Open DC disconnect switch b) Faulty auxiliary status contact	a) Remove the left front panel and check the status of the DC discon-nect switch. b) Check the status of the auxiliary contact (J14/J11 on the lateral board) by operating the DC contactor (ON/OFF) and using a tester to verify the state change in the connection cables. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
TRAS open	Open AC disconnect switch	E040	a) Open AC switch / faulty auxiliary contact, faulty dipswitch board b) Faulty dipswitch board	a) If the error is observed on all the modules in the same rack, check the status of the switch and of the auxiliary contact inside the AC disconnect switch. For TL inverters, follow the instructions below to verify the auxiliary contact continuity between the AC drawer and the terminal block in the AC BOX compartment: • AC disconnect switch ON: Continuity between X7D and X7F • AC disconnect switch OFF: Continuity between X7D and X7E Verify the cable connections between the terminal block and the Molex CN2 connector of the AC drawer. In case of TL system, the cables connected to the Molex CN2 must be connected to the thermostat side Molex 6-pole connector of the AC BOX drawer. b) If the error is observed on some but not all the modules of the same rack, check the connections on the dipswitch board. Try swapping the module with another one from a different framework. If the error persists on the same module, contact FIMER Service.
AC switch	The internal AC contactor failed to switch	E041	a) Faulty contactor inside module.	Perform a complete inverter restart cycle. Try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Bulk UV	Capacitor voltage below minimum threshold	E042	a) DC side voltage below minimum threshold	a) Download the fault log with the Aurora CVI Central software and check the error occurrence. If the error is permanently observed, try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Auto Ex.	Module autoexclusion due to repeated faults	E043	a) The module detected a large number of errors of the same type	a) The module switched to the state of autoexclusion from the system to prevent further damage. The errors that may lead the module to this state are: E005, E007, E015, E038. It is necessary to use the Aurora CVI Central software to unlock the module and download the fault log in order to identify the root cause of the autoexclusion. If error E038 occurs, the module switches to the autoexclusion state after 900 seconds from the detection of the first fault.
A.I. Warn	/	/	a) No anti-islanding pulse on jbox serial	a) This state does not hinder in any way the inverter productivity. It signals that no module has been set as stringcomb manager in the Aurora CVI Central software. If no FIMER stringcomb are used, it is possible to set a module as stringcomb manager by zero as the number of strings specified (PLANT CONFIGURATION -> STRINGCOMB MANAGER -> SET).
Grid OV	Grid overvoltage	W004	a) AC voltage too high, high grid impedance, wrong AC cables cross section, wrong AC cables wiring.	a) Fully isolate the module by opening the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. Use a tester to identify the fault root cause.
Grid UV	Grid undervoltage	W005	a) AC voltage too low, wrong AC cables wiring	a) Fully isolate the module by opening the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. Use a tester to identify the fault root cause.

Alarm message	Alarm	Code displayed	Possible cause	Possible solution
Grid OF	Grid OF	W006	a) Grid frequency exceeding the maximum threshold, grid transients, AC switch or inverter contactor tripping.	a) Fully isolate the module by opening the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. Identify the fault root cause.
Grid UF	Grid UF	W007	a) Grid frequency below the minimum threshold, grid transients, AC switch or inverter contactor tripping	a) Fully isolate the module by opening the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. Identify the fault root cause.
Zero power	Zero power fed	W014	a) Zero power fed	a) Download the fault log with the Aurora CVI Central software and check the error occurrence. If the error is permanently observed, try swapping the module with another one from the same rack. If the error persists on the same module, contact FIMER Service.
Grid df/dt	Grid df/dt	W015	a) Transient operating conditions off-grid	a) Fully isolate the module by opening the AC switch installed on the inverter, the DC disconnect switch and the Auxiliary power supply. Identify the fault root cause.
	Surge Protector Device	W016	a) DC side cartridge varistor tripping, faulty auxiliary status contact	a) Remove the left front panel and check that: • The auxiliary contact signal cables are inserted under the varistor cartridge • The varistor is in good condition (the varistor status indicator must be green; if red, replacement is needed)
Jbox alarm	One or more StringCombs communicated a problem	W017	a) Generic stringcomb error	a) Use the Aurora CVI Central software to check the occurrence of the STRINGCOMB MONITORING warning. It is possible in the stringcombmanager module to check the stringcombs affected by the problem and the type of the signalled warning. In case of permanent warning, check the RS485 line between the inverter and the stringcombs.
Quartz fail	Lost synchronisation between the two clocks managed by MCU	/	a) Quartz crystal short circuit	a) The inverter does not show operation faults, but there may be problems in the statistics logging. Contact FIMER Service. When replacing the module, check that date and time are synchronised with the other modules in the rack
Battery low	Lost synchronisation between the two clocks managed by MCU	/	a) Battery under voltage	a) The inverter does not show operation faults, but there may be problems in the statistics logging. Contact FIMER Service.

Removal and insertion of a conversion module

Some special maintenance operations may require the removal of a conversion module from the Framework (for instance if the module itself is faulty).

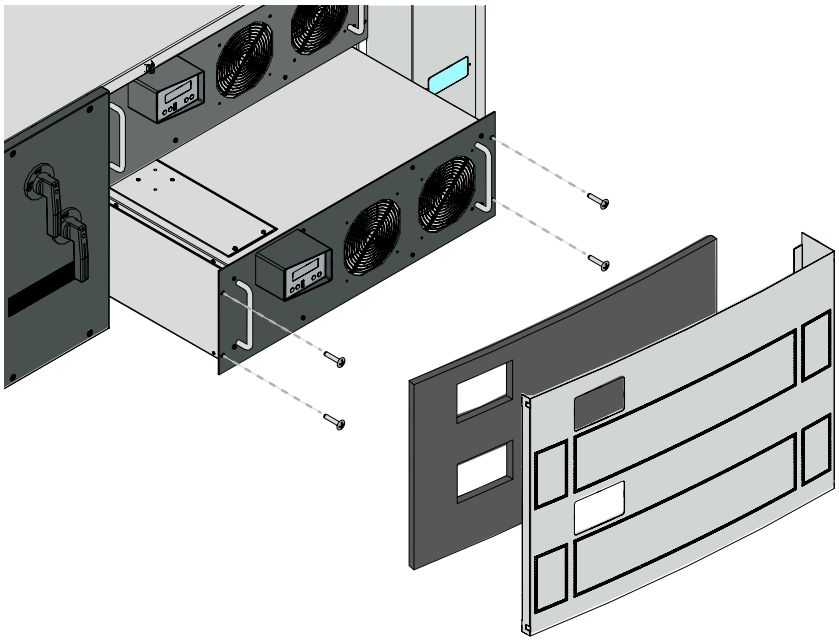
The weight of a module cannot be borne by a single person. It is therefore necessary to move the module with the help of another person or a mechanical support to facilitate the extraction and subsequent insertion.

Removal of the conversion module

1. Turn off the inverter following the instructions provided in the section “Turning off the inverter”.
2. Remove the conversion modules front panel.
3. Remove the 4 conversion module lock screws.
4. Pull the module to a distance of approximately 15 cm from the framework.

If available, bring the lifting cart into position.

5. Fully extract the module from its position.



Insertion of the conversion module

1. Use a mechanical aid or the help of another person to align the module to the Framework rails.
2. Push the module in the framework until it protrudes by approximately 15 cm.
3. Firmly push the conversion module inside the framework.
4. Tighten the 4 lock screws on the front of the module.
5. Mount back the conversion modules front panel.

Once the conversion module replacement is completed, proceed with the inverter recommissioning following the appropriate instructions.

Removal and insertion of the DC fuse drawer

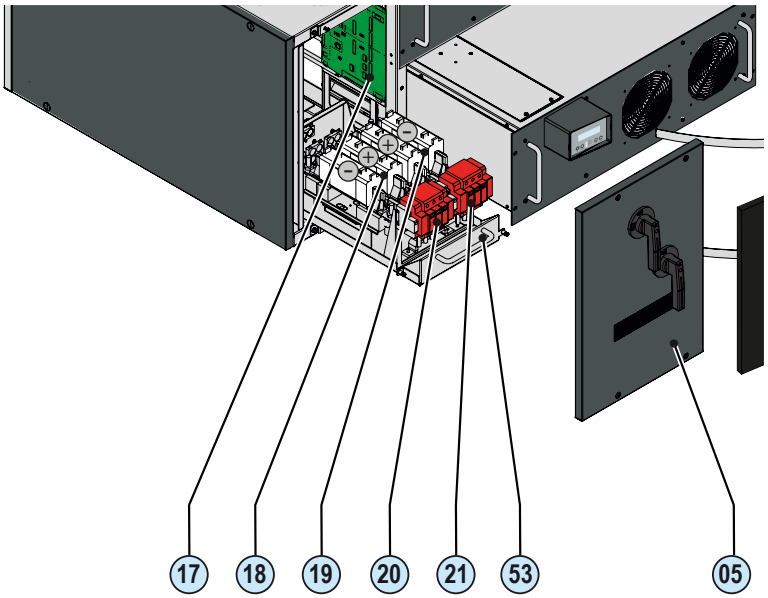
Some maintenance operations may require the removal of the DC fuse drawer from its housing in the framework (for instance if a DC fuse needs to be replaced).

1. Isolate the conversion modules from the photovoltaic generator.
2. Remove the DC front panel where the disconnector switches of the DC disconnect switches are located.

To remove the panel it is necessary to disconnect the earth lug. Reconnect it before closing the panel.

Caution! Fuses are always live, unless the inverter has been isolated upstream.

3. Disconnect the signalling cables of the J13 and J17 surge arresters from the configuration board located on the right side of the DC fuse compartment



4. Slacken the two DC drawer lock screws.
5. Extract the drawer until end stop.
6. Slightly lift the DC drawer and complete the extraction while supporting the weight from below with the free hand.

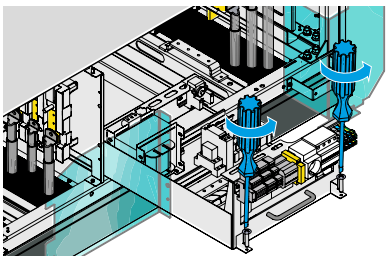
Once the maintenance operations are completed, follow the procedure in reverse order and proceed with the inverter recommissioning according to the relative instructions.

Removal and insertion of the AC extractable drawer (transformerless models only)

Some special maintenance operations may require the removal of the AC drawer from its housing in the transformerless AC BOX (for instance if the AC surge arrester cartridges need to be replaced).

1. Open the AC disconnect switch
2. Remove the TL AC BOX front panel

To remove the panel it is necessary to disconnect the earth lug. Reconnect it before closing the panel.



3. Slacken the two AC extractable drawer lock screws

Before extracting the AC drawer, ensure the cables connected to the signal terminal block and to the auxiliary input during installation are long enough to allow the safe extraction of the drawer, without causing damage.

4. Extract the AC drawer using the dedicated handle, until end stop
5. Perform all necessary maintenance, such as replacing the overvoltage surge arresters cartridges and fuses or setting the fans thermostat.

Removal of the AC drawer
The extraction of the AC drawer is only allowed under exceptional circumstances. For these cases it is important to observe the complete “inverter dismissal” procedure.
1. Extract the drawer from the AC BOX until end stop.
2. Disconnect all the connectors on the drawer (signal terminal block connectors, power supply connectors, earth lug, etc.)
3. Slightly lift the AC drawer and complete the extraction while supporting the weight with the free hand.

Once the maintenance operations are completed, follow the procedure in reverse order and proceed with the inverter recommissioning according to the relative instructions.

Storage and dismantling

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 FIMER for storage instructions. The equipment must be stored in well-ventilated indoor areas that do not have characteristics that might 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.

Dismantling, decommissioning and disposal

FIMER CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.

If the equipment is dismantled, in order to dispose of the products that it is composed of, you must adhere to the regulations in force in the country of destination and in any case avoid causing any kind of pollution.

Dispose of the various types of materials that the parts of the equipment consist of in dumps that are suitable for the purpose.

Table: disposal of components

COMPONENT	MATERIAL OF CONSTRUCTION
Frame, brackets, supports	Arc-welded steel FE37
Casing or covers	ABS, plastic
Paint and	RAL
Gaskets and seals	Rubber / Teflon / Viton
Electrical cables	Copper / Rubber
Conduits	Polyethylene / Nylon
Back-up battery	Nickel / Lead/ Lithium

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For more information
please contact
your local FIMER
representative or visit:

fimer.com

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