

ABB Solar inverters

Quick Installation Guide
PVI-10.0/12.0-I-OUTD-400

EN

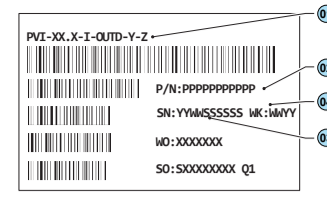
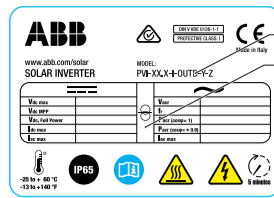


In addition to what is explained below, the safety and installation information provided in the installation manual must be read and followed. The technical documentation and the interface and management software for the product are available at the website. The device must be used in the manner described in the manual. If this is not the case the safety devices guaranteed by the inverter might be ineffective.

Power and productivity
for a better world™ **ABB**

1. Labels and Symbols

The labels on the inverter have the Agency marking, main technical data and identification of the equipment and manufacturer



- 01 Inverter model
- 02 Inverter Part Number
- 03 Inverter Serial Number
- 04 Week/Year of manufacturer
- 05 Main technical data

The labels attached to the equipment must NOT be removed, damaged, dirtied, hidden, etc... If the service password is requested, the field to be used is the serial number -SN: YYWWSSSSSS- shown on the label affixed to the top (inverter)

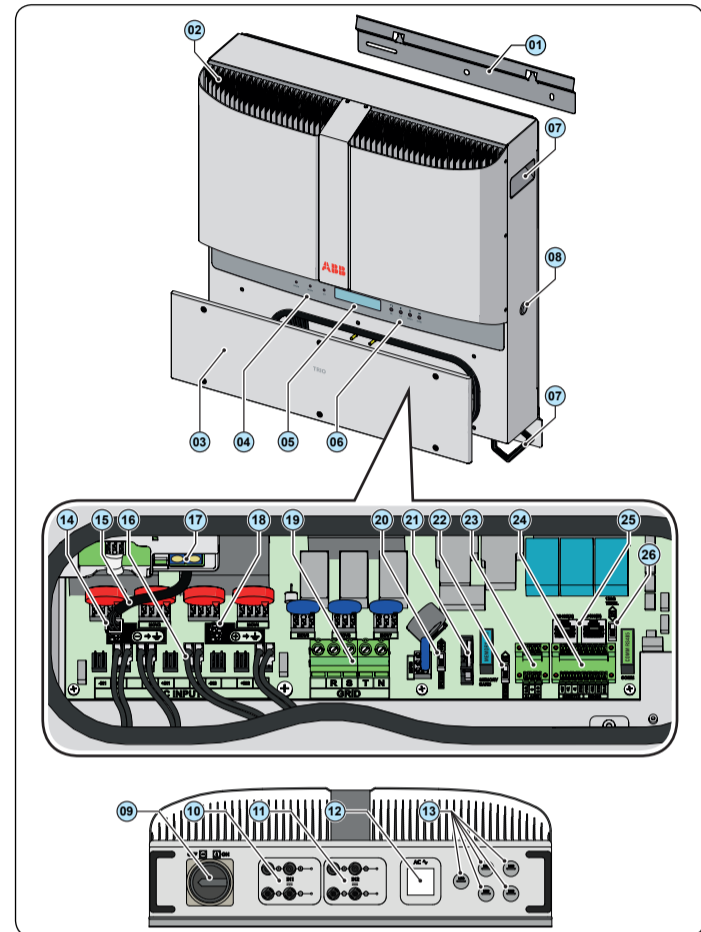
In the manual and/or in some cases on the equipment, the danger or hazard zones are indicated with signs, labels, symbols or icons.

Always refer to instruction manual	General warning - Important safety information	Hazardous voltage	Hot surfaces
Protection rating of equipment	Temperature range	With isolation transformer	Direct and alternating currents, respectively
Positive pole and negative pole of the input voltage (DC)	Always use safety clothing and/or personal safety devices	Point of connection for grounding protection	Time need to discharge stored energy

2. Inverter Models and Components

The models of inverter to which this guide refers are available in 2 power ratings: 10.0 kW and 12.0 kW. Two types are available for each model: Standard or with DC disconnect switch (Version -S).

Main components	
01	Bracket
02	Heatsink
03	Front cover
04	LED Panel
05	Display
06	Keyboard
07	Handles
08	Stand-by Button
09	DC Disconnect switch (*only version -S)
10	Input connectors (MPPT1)
11	Input connectors (MPPT2)
12	AC cable gland
13	Service cable glands
14	Negative Grounding Connector
15	Grounding configuration wiring
16	DC Input terminal block
17	Grid standard rotary selectors
18	Positive Grounding Connector
19	AC Output terminal block
20	AC Grid configuration switch
21	Internal battery
22	Channel configuration switch
23	Alarm terminal block
24	Signal terminal block
25	RJ45 Connectors
26	RS485 line termination switch



3. List of supplied components

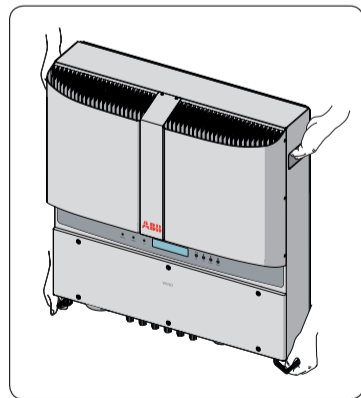
Available components	Quantity	Available components	Quantity
Bracket for wall mounting	1	Jumpers for configuration of the parallel input channels	2
Bolts and screws for wall mounting	5 + 5	Connector for connecting the configurable relay	2
D.18 Washer	5	Connector for the connection of the communication and control signals	2
L-key, TORX TX20	1	Male quick fit connectors	4
M20 Cable gland	1	Female quick fit connectors	4
M40 Cable gland	1	Technical documentations	1
Two-hole gasket for M20 signal cable glands and cap TGM58	1 + 1		

4. Lifting and transport

Transport and handling
Transport of the equipment, especially by road, must be carried out with suitable ways and means for protecting the components from violent shocks, humidity, vibration, etc.

Lifting
The means used for lifting must be suitable to bear the weight of the equipment.

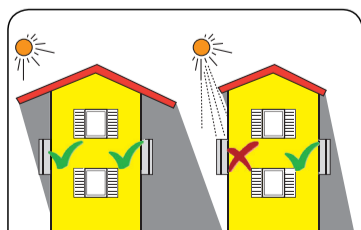
Unpacking and checking
The components of the packaging must be disposed on in accordance with the regulations in force in the country of installation. When you open the package, check that the equipment is undamaged and make sure all the components are present. If you find any defects or damage, stop unpacking and consult the carrier, and also promptly inform the Service ABB.



Equipment weight	Model	Mass weight
PVI-10.0-I-OUTD-400	PVI-12.0-I-OUTD-400	<48.5 kg
PVI-10.0-I-OUTD-S-400	PVI-12.0-I-OUTD-S-400	

5. Choice of installation location

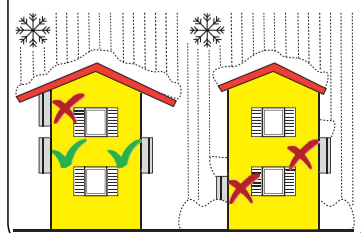
- Environmental checks**
- Consult the technical data to check the environmental parameters to be observed
 - Installation of the unit in a location exposed to direct sunlight must be avoided as it may cause:
 1. power limitation phenomena in the inverter (with a resulting decreased energy production by the system)
 2. premature wear of the electrical/electromechanical components
 3. premature wear of the mechanical components (gaskets) and of the user interface (display)
 - Do not install in small closed rooms where air cannot circulate freely
 - To avoid overheating, always make sure the flow of air around the inverter is not blocked
 - Do not install in places where gases or flammable substances may be present
 - Do not install in rooms where people live or where the prolonged presence of people or animals is expected, because of the noise (about 50dB(A) at 1 m) that the inverter makes during operation



Installations above 2000 metres

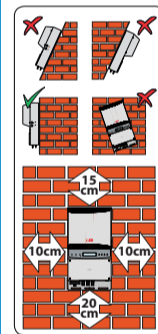
On account of the rarefaction of the air (at high altitudes), particular conditions may occur:

- 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



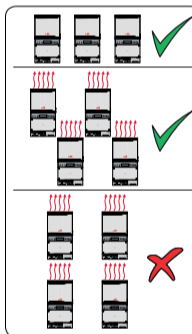
All installations at altitudes of over 2000 metres must be assessed case by case with the ABB Service department.

6. Choice of installation location



Installation position

- Install on a wall or strong structure capable of bearing the weight of the equipment
- Install in safe, easy to reach places
- If possible, install at eye-level so that the display and status LEDs can be seen easily
- Install at a height that considers the heaviness of the equipment
- Install vertically with a maximum inclination of +/- 5°
- Choose a place with enough space around the unit to permit easy installation and removal of the object from the mounting surfaces; comply with the indicated minimum distances
- For a multiple installation, position the inverters side by side; if the space available does not allow this arrangement, position the inverters in a staggered arrangement as shown in the figure so that heat dissipation is not affected by other inverters



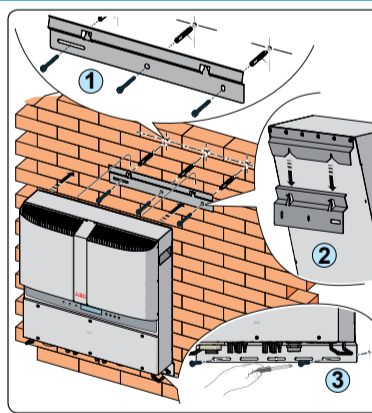
Final installation of the inverter must not compromise access to any disconnection devices that may be located externally.
Please refer to the warranty terms and conditions available on the website and evaluate any possible exclusion due to improper installation.

7. Assembly instruction

Wall mounting

During installation, do not place the inverter with its front facing towards the ground.

- Position the bracket (01) so that it is perfectly level on the wall and use it as a boring template.
- Drill the 3 holes required using a drill with 10mm bit. The holes must be about 70mm deep. On bracket (01) there are 3 fastening holes.
- Fix the bracket to the wall with the 3 wall anchors, 10mm in diameter, supplied. (Step 1).
- Hook the inverter to the bracket springs in correspondence with the insertion points in the bracket on the back of the inverter (Step 2).
- Drill 2 holes in correspondence with the slots on the inverter lower bracket, using a drill with a 10 mm diameter bit. The holes must be approximately 70 mm deep.
- Anchor the lower part of the inverter using No. 2 plugs with a diameter of 10 mm, supplied (Step 3).
- Unscrew the 6 screws and open the front cover (03) in order to make all the necessary connections.
- Once the connections have been made, close the cover by tightening the 6 screws on the front to a minimum tightening torque of 1.5 Nm.

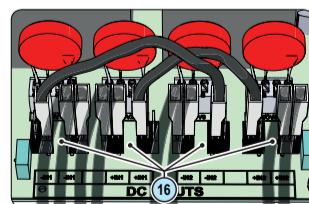
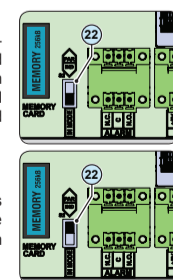


8. Input configuration (DC)

All versions of the inverter are equipped with two input channels (therefore with double maximum power point tracker MPPT) independent of each other, which can however be connected in parallel using a single MPPT.

Configuration of independent channels (default configuration)

This configuration involves the use of the two input channels (MPPT) in independent mode. This means that the jumpers between the two channels (positive and negative) of the DC input terminal block (16) must not be installed and the switch (22) located on the main board must be set to "IND". N.B.: Independent channel configuration can only be used in the event that the negative input pole is grounded (Negative Grounding).

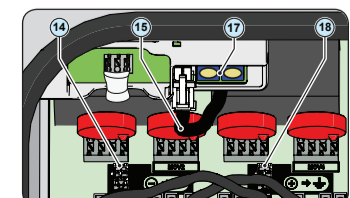
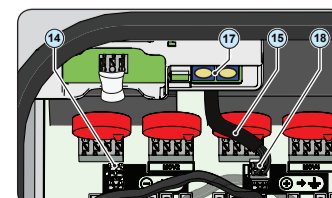
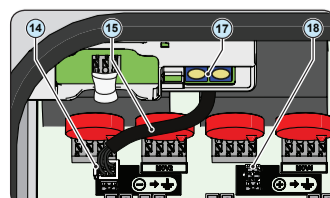


Configuration of parallel-connected channels

This configuration uses the two input channels (MPPT) connected in parallel. This means that the jumpers between the two channels (positive and negative) of the DC input terminal block (16) must be installed and the switch (22) located on the main board must be set to "PAR".

9. Grounding of the DC inputs

The configuration of the grounding of the inputs must be done before any connections or testing takes place. No pole of the array can have earthing connection points located outside the inverter. Incorrect configuration may cause damage to the system and photovoltaic panels!
For the correct operation of some types of photovoltaic panels it may be necessary to ground one of the two input poles (positive or negative), or to have both of the input poles floating in regards to ground potential. In order to achieve this, it is possible to vary the Grounding configuration by connecting the wiring (15) for connector (14) (negative grounding) to connector (18) (positive grounding), or inserting the wiring into the support provided (floating configuration).
N.B.: Positive or floating grounding must NOT be used in the case of INDEPENDENT input channel configuration.



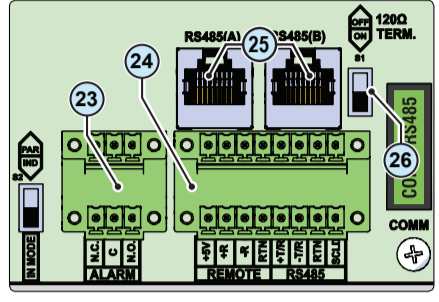
Check for correct polarity in the input strings and absence of any leakage to ground in the PV generator. When exposed to sunlight, the PV panels supply DC direct voltage to the inverter. The inside of the inverter may only be accessed after the equipment has been disconnected from the grid and from the photovoltaic generator.

- For the string connections it is necessary to use the quick fit connectors (multicontact or weidmüller) located on the bottom of the mechanic (10) (11).
- Crimp the Multicontact/Weidmüller MC4/MM4 quick fit connector counterparts (supplied) to the string cables or to the cables wired to the DC disconnect switches (external)
- Connect all the strings included in the design of the system and always check the tightness of the connectors
- If some of the string inputs should not be used you must proceed to verify the presence of covers on DC input connectors and then install them should they be absent: this operation is necessary for the tightness of the inverter and to avoid damaging the free connector that could be used at a later date.

Each cable which must be connected to the connectors of the communication and control signals must pass through one of the five service cable glands (13). An M20 cable gland (that takes cables from 7 mm to 13 mm in diameter) and a gasket with two holes to insert into the cable gland which enables two separate cables of a maximum diameter of 5 mm to be accommodated, are available.

Warning! To ensure environmental protection IP65 it is necessary to fix the cable glands to the inverter chassis with a minimum tightening torque of 7 Nm

Connection to the RS485 communication line
The RS485 communication port is the inverter's communication port. The ABB inverters use an RS485 HALF-DUPLEX communication line made up of two transmission and reception cables (+T/R and -T/R) and a communication reference cable (RTN): all three cables must be connected in daisy-chain configuration. The chain connection can be made without distinction by using the RJ45 connector couples (25) (one for in and one for out) or the terminal block (24). The last inverter in the daisy chain must be "terminated" or the 120 Ohm communication line termination resistance must be activated by switching the dip-switch (26).



Using the alarm terminal block
Terminal block (23) connecting to the configurable relay that allows connection of external devices which, according to the mode selected in the menu "SETTINGS > Alarm" can, for example, signal malfunctions. The operating modes that can be set are: Production, Alarm, Alarm (Configurable) and Crepuscular.

The ALARM contact can be used only with systems that ensure a safety isolating additional at least (supplementary insulation in relation to the DC input voltage)

Using the REMOTE terminal block
The REMOTE terminal block (24), if suitably configured, allows the "Remote ON/OFF" function to be used: this function allows remote disconnection of the inverter from the grid

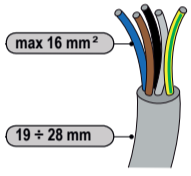
For further information regarding the configuration and use of the communication and control signals terminal block, please see the manual

Load protection breaker (AC disconnect switch) and line cable sizing
To protect the AC connection line of the inverter, we recommend installing a device for protection against over current and leakage with the following characteristics:

Type	Automatic circuit breaker with differential thermal magnetic protection
Nominal Voltage / Nominal Current	400 Vac / 25 A
Magnetic protection characteristic	B/C
Number of poles	3/4
Type of differential protection	A/IAC
Differential sensitivity	100 mA

ABB declares that the ABB high-frequency isolated inverters, in terms of their construction, do not inject continuous ground fault currents and therefore there is no requirement that the differential protection installed downstream of the inverter be type B in accordance with IEC 60755 / A.2.

Characteristics and sizing of the line cable
For the connection of the inverter to the grid, you can choose between a star connection (3 phases + neutral) and a delta connection (3 phases). The cross-section of the AC line conductor must be sized in order to prevent unwanted disconnections of the inverter from the grid due to high impedance of the line that connects the inverter to the power supply point.

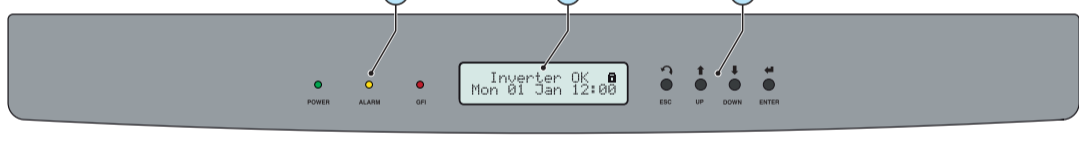


Cross-section of the line conductor	Maximum length of the line conductor	
	PVI-10.0-I-OUTD-400	PVI-12.0-I-OUTD-400
4 mm²	34 m	28 m*
6 mm²	51 m	42 m
10 mm²	85 m	70 m
16 mm²	136 m	113 m

The values are calculated in nominal power conditions, taking into account:
1. a power loss of not more than 1% along the line
2. copper cable, with HEPR rubber insulation, laid in free air

*Up to 45 °C Ambient temperature

LEDs and BUTTONS, in various combinations, can be used to view the status or carry out complex actions that are described more fully in the manual.



LED POWER	GREEN On if the inverter is working correctly. Flashes when checking the grid or if there is insufficient sunlight.	ESC	It is used to access the main menu, to go back to the previous menu or to go back to the previous digit to be edited
LED ALARM	YELLOW The inverter has detected an anomaly. The anomaly is shown on the display.	UP	It is used to scroll up the menu options or to shift the numerical scale in ascending order
LED GFI	RED Ground fault on the DC side of the PV generator. The error is shown on the display.	DOWN	It is used to scroll down the menu options or to shift the numerical scale in descending order
		ENTER	It can be used to confirm an action, to access the submenu for the selected option (indicated by the > symbol) or to switch to the next digit to be edited

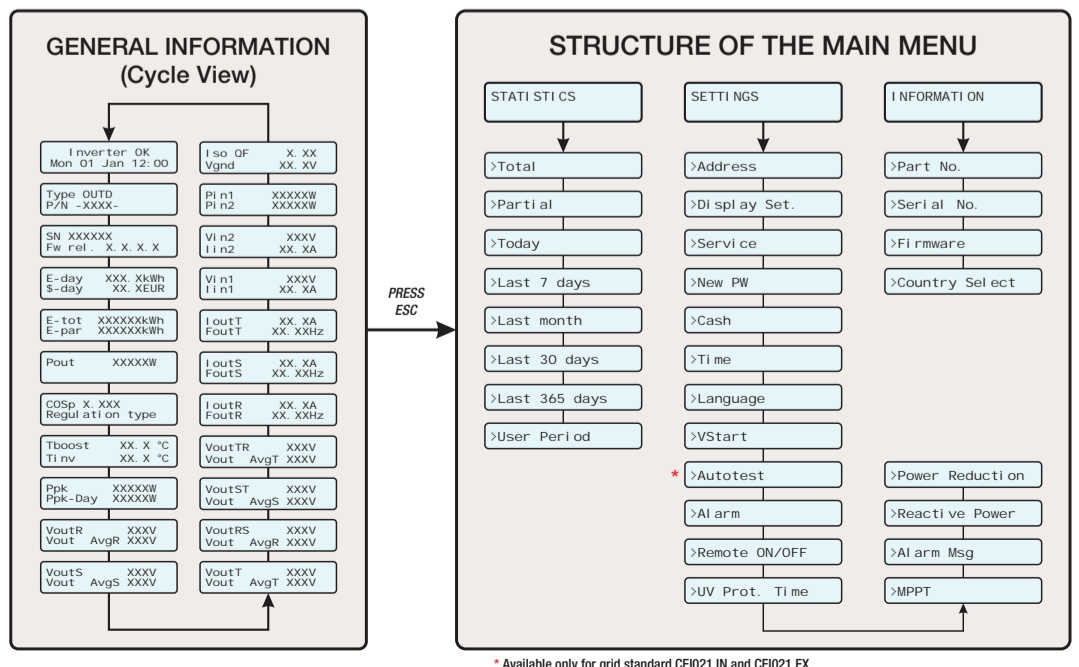
ABB inverters are equipped with a graphic Display (16), consisting of 2 lines of 16 characters each, which can be used to:

- Display the operating state of the inverter and the statistical data
- Display the service messages for the operator
- Display the alarm and fault messages for the operator
- Changing the settings of the inverter

During the normal operation of the inverter the display cycles through the **GENERAL INFORMATION**. This information relates to the input and output parameters and the inverter identification parameters. By pressing **ENTER** it is possible to lock scrolling on a screen to be constantly displayed.

- Press **ESC** to access the three main menus, which have the following functions:
- STATISTICS:** Displays the statistics
 - SETTINGS:** Modify the settings of the inverter
 - INFO:** View service messages for the operator

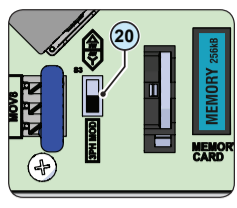
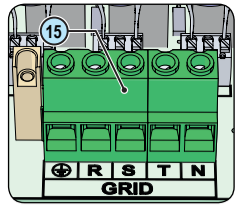
Refer to the manual for details regarding use and functions available in the menu



* Available only for grid standard CEI021 IN and CEI021 EX

Warning! Before performing any of the operations described below, ensure the AC line downstream the inverter has been correctly disconnected

- Remove the protective film located on the hole to be used for the AC cables (12)
- Insert the M40 cable gland in the hole and secure it using the special M40 lock nut (supplied)
- Warning!** To ensure environmental protection IP65 it is necessary to fix the cable gland to the inverter chassis with a minimum tightening torque of 8.0 Nm
- Strip 10 mm of sheathing from the AC grid connection cables
- Plug the AC line cable into the inverter, passing it through the previously installed cable gland
- Connect the protective earth (yellow-green) cable to the contact labeled with the symbol on the terminal block (19)
- Warning!** ABB inverters should be earthed (PE) via the terminal with the protective earth label (19), using a cable with an appropriate cross-section of the conductor for the maximum ground fault current that the generating system might experience
- Connect the neutral cable (normally blue) to the terminal labelled with the letter N

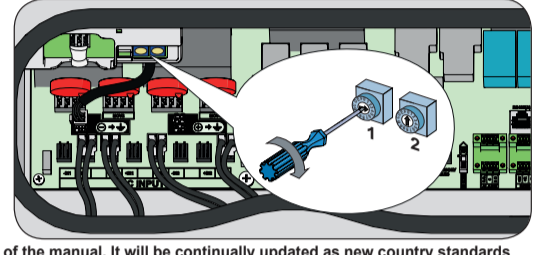


N.B.: When connecting to the AC grid in "delta" configuration (without neutral wire) turn the grid type selection switch (20) with the screen-printed marking "3PH MOD" and set it to "3W Δ".

Once the connection to the terminal board (19) is complete, screw in the cable gland firmly (tightening torque 5.0Nm) and check the tightness.

Before connecting the inverter to the distribution grid it is necessary to set the country standard by manipulating the two rotary switches (17). **Note: The settings become fixed after 24 hours of operation of the inverter (the PV generator simply has to be under power).**

Switch 1	Switch 2	Country Grid Standard (name displayed)	Display language
0	0	NON-ASSIGNED (SET COUNTRY)	ENGLISH
0	1	GERMANY - VDE 0126 @ 400V (VDE 0126)	ENGLISH
0	5	ITALY - ENEL DK 5950 @ 400V (ENEL)	ENGLISH
0	6	SPAIN RD 1663/2000 @ 400V (RD 1699)	SPANISH
0	7	UK - G83 @ 400V (UK G83)	ENGLISH
0	8	UK - G59 @ 400V (UK G59)	ENGLISH
0	9	IRELAND - VDE @ 400V (IRELAND)	ENGLISH
0	A	AUS - AS 4777 @ 400V (AS 4777)	ENGLISH
0	D	FRANCE - VDE @ 400V (FRANCE)	FRENCH
0	E	BELGIUM - VDE @ 400V (NETHERL)	DUTCH
0	F	GREECE - VDE @ 400V (GREECE)	ENGLISH
1	0	PORTUGAL @ 400V (PORTUGAL)	ENGLISH
1	1	CORSICA @ 400V (CORSICA)	FRENCH
1	5	TAIWAN @ 400V (TAIWAN)	ENGLISH
1	6	CZECH REPUBLIC - VDE @ 400V (CZECH)	CZECH
1	7	GERMANY-VDE AR-N-4105 @400V (VDE 4105)	GERMAN
1	8	CEI-021 EXTERNAL PROTECTION @ 400V (CEI021 EX)	ITALIAN
1	B	SOUTH AFRICA @ 400V (S. AFRICA)	ENGLISH
1	C	SPAIN RD 1565 @ 400V (RD 1565)	SPANISH
1	D	BELG C10-11 100% @ 400V (C1011 100)	FRENCH



The list of grid standards given in the table was valid at the time of issue of the manual. It will be continually updated as new country standards with which the inverter is compatible are introduced.

The inverter commissioning procedure is as follows:
- Switch the integrated switch (18) (version -S) to the ON position or close the external switches: If the input voltage applied to one of the two input channels is greater than the minimum starting voltage, the inverter will start up.
- The message "Initializing...Please Wait" will be displayed; Depending on the input voltage value, the inverter will show various messages on the display and change the behaviour of the three LED (16):

INPUT VOLTAGE	DISPLAY MESSAGE	LED STATUS (16)	DESCRIPTION
Vin < Vstart	Waiting Sun	Green = FLASHING Yellow = OFF Red = OFF	The input voltage is not sufficient to permit connection to the grid.
Vin > Vstart	Missing Grid	Green = FLASHING Yellow = ON Red = OFF	There is sufficient input voltage to permit connection to the grid: the inverter waits until there is grid voltage to carry out the parallel connection.

The inverter is powered **ONLY** by the voltage coming from the photovoltaic generator: presence of grid voltage alone **IS NOT SUFFICIENT** to permit the inverter to start up.

With the inverter in "Missing Grid" status, close the AC switch downstream the inverter so as to supply the grid voltage to the inverter: the inverter performs the grid voltage check, measures the photovoltaic generator insulation resistance against earth and carries out other self-diagnosis checks. During the checks before the parallel with the grid, the green LED (16) keeps flashing, the others are off.

During the grid voltage check and measurement of the insulation resistance, the values for the grid voltage and frequency and the insulation resistance measured by the inverter are shown on the display. The inverter **ONLY** creates a parallel with the grid if the grid parameters fall within the range foreseen by current regulations and if the insulation resistance falls within the set parameters.

If the preliminary checks for parallel connection to the grid are successful, the inverter connects to the grid and begins to export power to the grid. At this stage, the display shows the inverter's parameters in cycles. The green LED (16) stays lit whereas the others are off.

Characteristics and technical data

	PVI-10.0-I-OUTD-400	PVI-12.0-I-OUTD-400
Input		
Absolute Maximum Input Voltage (V _{max,abs})	520 V	
Input Activation Voltage (V _{start})	200 V (adj. 120...350 V)	
Input Operating Range (V _{min} ...V _{max})	0.7 x Vstart...520 V	
Rated DC Input Power (P _{DC})	10500 Wp	12300 Wp
Number of Independent MPPTs	2 ⁽¹⁾	
Maximum Input Power for each MPPT (P _{MPPT,max})	6800 W	
MPPT Input DC Voltage Range (V _{MPPT,min} ...V _{MPPT,max}) at P _{DC}	220...470 V	250...470 V
Maximum DC Input Current (I _{DC,max}) for each MPPT (I _{MPPT,max})	48.0 A / 24.0 A	50.0 A / 25.0 A
Maximum Input Short Circuit Current for each MPPT	29.0 A	
Maximum Backfeed current (from AC to DC side)	Negligible	
Number of DC Inputs Pairs for each MPPT	2	
DC Connection Type	Tool Free PV Connector WM / MC4	
Input protection		
Reverse Polarity Protection	Yes, from limited current source	
Input Overvoltage Protection for each MPPT - Varistor	2	
Photovoltaic Array Isolation Control	According to local standard	
DC Switch Rating (-S Version)	Max. 32.0 A / 600 V	
Output		
AC Grid Connection Type	Three phase 3W or 4W+PE	
Rated AC Power (P _{AC})	10000 W	12000 W
Maximum AC Output Power (P _{AC,max})	11000 W ⁽²⁾	12500 W ⁽³⁾
Rated AC Grid Voltage (V _{AC})	400 V	
AC Voltage Range	320...480 Vac ⁽⁴⁾	
Maximum AC Output Current (I _{AC,max})	16.0 A	18.0 A
Inrush Current	Negligible	
Maximum Output Fault Current	<25Arms (100mS)	
Rated Output Frequency (f _o)	50 Hz	
Output Frequency Range (f _{min} ...f _{max})	47...53 Hz ⁽⁵⁾	
Nominal Power Factor (Cosφ _{nom})	>0.995 (adj. ± 0.9 with Pacr= 10.0 kW)	>0.995 (adj. ± 0.9 with Pacr= 12.0 kW)
Total Harmonic Distortion of Current	< 2%	
AC Connection Type	Screw terminal block	
Output protection		
Anti-Islanding Protection	According to local standard	
Maximum AC Overcurrent Protection	20.0 A	
Output Overvoltage Protection - Varistor	3, plus gas arrester	
Operating performance		
Maximum Efficiency (η _{max})	97.3%	
Weighted Efficiency (EURO/CEC)	97.0% / -	
Power Input Threshold	30.0 W	
Stand-by Consumption	< 8.0 W	
Communication		
Wired Local Monitoring	PVI-USB-RS232 485 (opt.), PVI-DESKTOP (opt.)	
Remote Monitoring	PVI-AEC-EVO (opt.), VSN700 Data Logger(opt.)	
Wireless Local Monitoring	PVI-DESKTOP (opt.) with PVI-RADIOMODULE (opt.)	
User Interface	LCD Display with 16 characters x 2 line	
Environmental		
Ambient Temperature Range	-25...+60°C / -13...140°F with derating above 50°C/122°F	-25...+60°C / -13...140°F with derating above 45°C/113°F
Storage Temperature	-40...80°C (-40...+176°F)	
Relative Humidity	0...100% condensing	
Environmental pollution classification for external environment	3	
Noise Emission	< 50 dB(A) @ 1 m	
Maximum Operating Altitude without Derating	2000 m / 6560 ft	
Environmental Category	External	
Physical		
Environmental Protection Rating	IP 65	
Cooling	Natural	
Dimension (H x W x D)	716 x 645 x 224 mm / 28.2 x 25.4 x 8.8 inch	
Weight	<45.8 kg / 99.0 lb	
Mounting System	Wall bracket	
Overvoltage Category in accordance with IEC 62109-1	II (DC input) III (AC output)	
Safety		
Isolation Level	HF transformer	
Safety Class		
Marking	CE (50Hz only)	

Remark. Features not specifically listed in the present data sheet are not included in the product

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