

ABB Solar inverters

Quick Installation Guide

PVI-3.8/4.6-I-OUTD

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**

3.

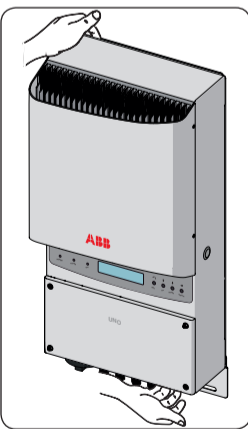
Available components	Quantity	Available components	Quantity
Bracket for wall mounting	1	Jumpers for configuration of the parallel input channels	2
Bolts and screws for wall mounting	3 + 3	Connector for connecting the configurable relay	2
M6x10 screw	1	Connector for the connection of the communication and control signals	2
D.18 Washer	4	Male quick fit connectors	4
L-key, TORX TX20	1	Female quick fit connectors	4
M20 Cable gland	1	Technical documentations	1
M32 Cable gland	1		
Two-hole gasket for M20 signal cable glands and cap TGM58	1 + 1		

4.

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 of 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.

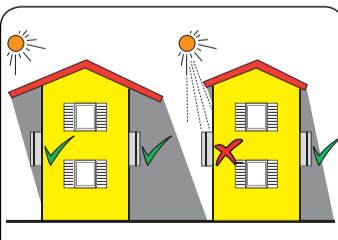


5.

Model	Mass weight
PVI-3.8-I-OUTD	24 Kg
PVI-4.6-I-OUTD	
PVI-4.6-I-OUTD-S	

Environmental checks

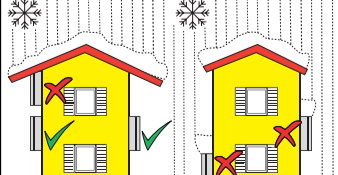
- Consult the technical data to check the environmental parameters to be observed
- Installation of the unit in a location exposed to direct sunlight must be avoided as it may cause:
 1. power limitation phenomena in the inverter (with a resulting decreased energy production by the system)
 2. premature 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.



Choice of installation location

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

ABB SOLAR INVERTER

MODEL: PVI-3.8-I-OUTD

Max. power: 3800 W @ 50°C amb.

Max. power @ 45°C amb.: 3600 W @ 45°C amb.

Max. power @ 25°C amb.: 4000 W @ 25°C amb.

ABB SOLAR INVERTER

MODEL: PVI-4.6-I-OUTD

Max. power: 4600 W @ 50°C amb.

Max. power @ 45°C amb.: 4400 W @ 45°C amb.

Max. power @ 25°C amb.: 4800 W @ 25°C amb.

PVI-X-X-I-OUTD-X

P/N: PVI-3.8-I-OUTD-X

SN: YYYWSSSSSS MK: 16YY

WO: XXXXXXXX

SO: XXXXXXXX Q1

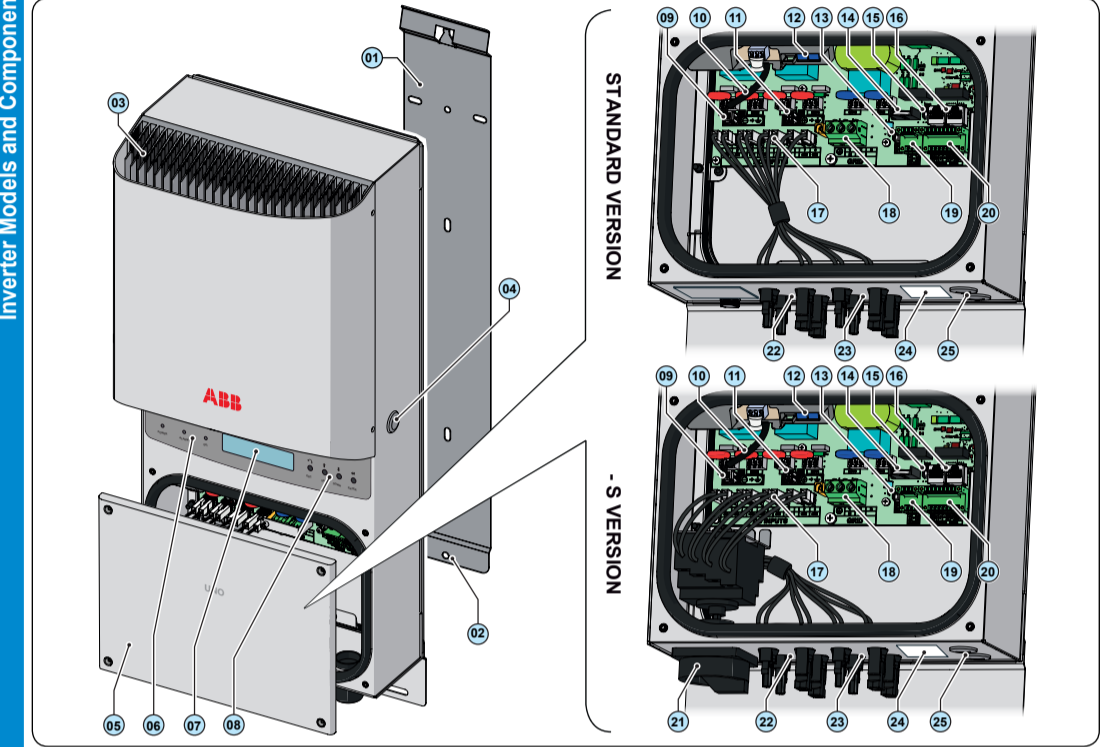
Legend:
 01 Inverter model
 02 Inverter Part Number
 03 Inverter Serial Number
 04 Week/Year of manufacture

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: YYYWSSSSSS-

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
IP65 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

The models of inverter to which this guide refers are available in 2 power ratings: 3.8 kW and 4.6 kW. Two types are available for each model: Standard or with DC disconnect switch (Version -S).



Main components

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

3.

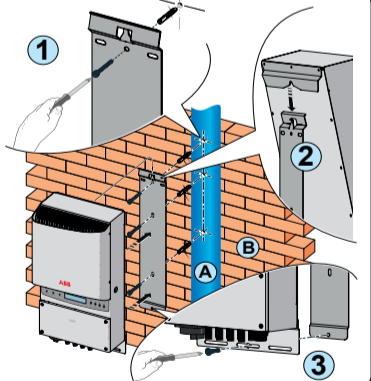
Choice of installation location

4.

Assembly instruction

Wall/Pole 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.
- Make the 3 holes required, using a drill with a 10 mm diameter bit. The depth of the holes should be about 70 mm. On the bracket (01) there are 5 holes with which to secure it: just 3 are enough to support the inverter if installed on stable, robust supports.
- Secure the bracket to the wall (B) or to the pole (A) with the no. 3 10 mm wall plugs supplied with it (Step 1). Check the stability of the bracket and if necessary use all the fixing points (5) there are on the bracket
- Hook the inverter to the bracket spring corresponding with the insertion point in the bracket on the back of the inverter (Step 2).
- Proceed to anchor the inverter to the bracket (01) by tightening the locking screw (02) located on the lower side (Step 3).
- Unscrew the 4 screws and open the front cover (05) in order to make all the necessary connections.
- Once the connections have been made, close the cover by tightening the 4 screws on the front to a minimum tightening torque of 1.5 Nm.



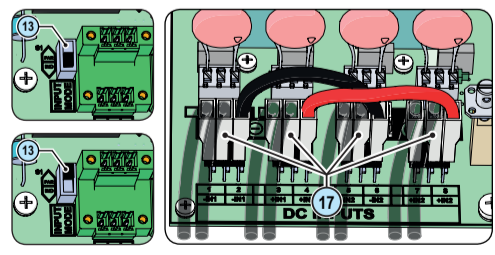
5.

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 (17) must not be installed and the switch (13) 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 (17) must be installed and the switch (13) located on the main board must be set to "PAR".



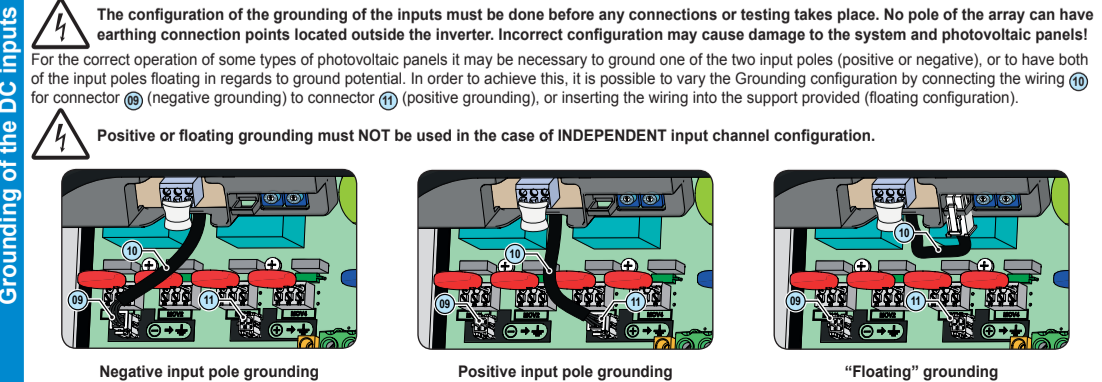
6.

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 (10) for connector (09) (negative grounding) to connector (11) (positive grounding), or inserting the wiring into the support provided (floating configuration).

Positive or floating grounding must NOT be used in the case of INDEPENDENT input channel configuration.



Choice of installation location

9. 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.

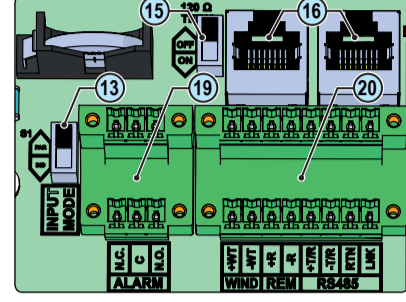
For the string connections it is necessary to use the quick fit connectors (multicontact or weidmüller) located on the bottom of the mechanic (22) (23).

- Crimp the Multicontact/Weidmüller MC4/WM4 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.

10. Each cable which must be connected to the connectors of the communication and control signals must pass through one of the two service cable glands (25). 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 (19) (one for in and one for out) or the terminal block (20). 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 (14).



Using the alarm terminal block
 Terminal block (19) 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 and Alarm.

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 REM terminal block
 The REM terminal block (20), 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

11. 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:

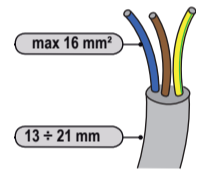
	PVI-3.8-TL-OUTD	PVI-4.6-TL-OUTD
Type	Automatic circuit breaker with differential thermal magnetic protection	
Nominal Voltage / Nominal Current	230 Vac / 20 A	230 Vac / 25 A
Magnetic protection characteristic		B/C
Number of poles		2
Type of differential protection		A/AC
Differential sensitivity		30 mA

ABB declares that the ABB transformerless 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.

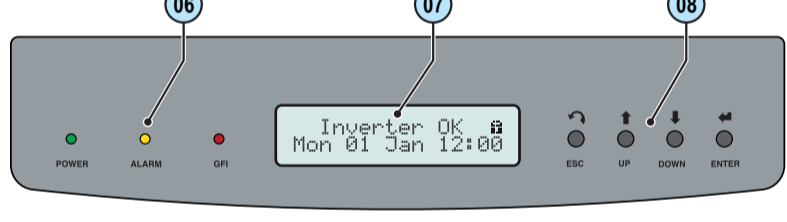
Characteristics and sizing of the line cable
 Three-pole cable required. The cross-section of the AC line conductor must be sized in order to prevent unwanted disconnections of the inverter from the grid due to high impedance of the line that connects the inverter to the power supply point.

Cross-section of the line conductor (mm ²)	Maximum length of the line conductor (mt)	
	PVI-3.8-I-OUTD	PVI-4.6-I-OUTD
4 mm ²	15 m	11 m
6 mm ²	23 m	16 m
10 mm ²	40 m	28 m
16 mm ²	64 m	45 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



15. 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

16. ABB inverters are equipped with a graphic Display (06), consisting of 2 lines of 16 characters each, which can be used to:

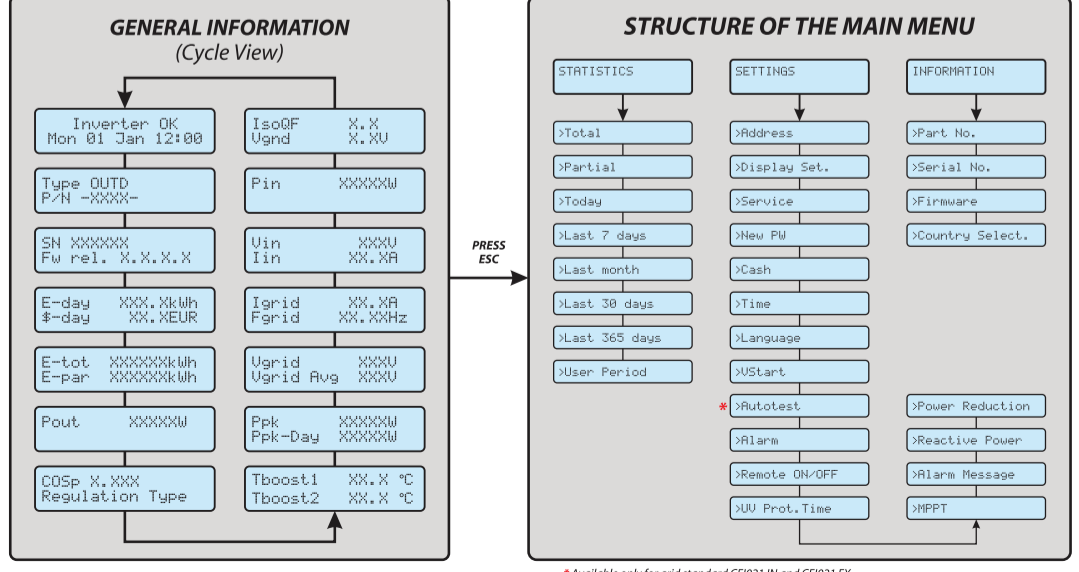
- Display the operating state of the inverter and the statistical data
- Display the service messages for the operator
- Display the alarm and fault messages for the operator
- Changing the settings of the inverter

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

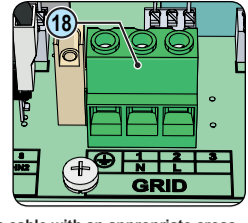
Refer to the manual for details regarding use and functions available in the menu



* Available only for grid standard CEI021 IN and CEI021 EX

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

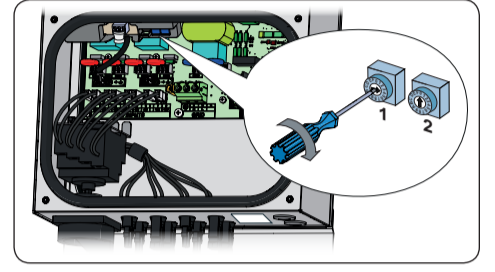
- Remove the protective film located on the hole to be used for the AC cables (24)
- Insert the M32 cable gland in the hole and secure it using the special M32 lock nut (supplied)
- Warning!** To ensure environmental protection IP65 it is necessary to fix the cable gland to the inverter chassis with 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 labelled with the symbol on the terminal block (18)
- Warning!** ABB inverters should be earthed (PE) via the terminal with the protective earth label (18), 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
- Connect the phase cable to the terminal labelled with the letter L
- Warning!** The AC cables must be tightened on the terminal block with a minimum torque of 1.5 Nm



Once the connection to the terminal board (18) is complete, screw in the cable gland firmly (tightening torque 5.0Nm) and check the tightness.

13. Before connecting the inverter to the distribution grid it is necessary to set the country standard by manipulating the two rotary switches (12). 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	Switch 1	Switch 2	Country Grid Standard (name displayed)	Display language
0	0	NON-ASSIGNED	ENGLISH	1	F	BRAZIL @ 220V (BRAZIL)	ENGLISH
0	1	GERMANY VDE 0126 @ 230V Single Phase (VDE 0126)	ENGLISH	2	0	CLC/FprTS 50549 (TURKEY LV)	ENGLISH
0	5	ENEL GUIDA @ 230V Single Phase (ENEL)	ENGLISH	2	1	ANRE no.30/17.V.2013 (ROMANIA)	ENGLISH
0	6	SPAIN RD 1699 @ 230V (RD 1699)	SPANISH	2	2	Slovenian (SLOVENIA)	ENGLISH
0	7	UK - G83 @ 230V (UK G83)	ENGLISH	2	3	CLC/FprTS 50549 (TURKEY HV)	ENGLISH
0	8	UK - G59 @ 230V (UK G59)	ENGLISH				
0	9	IRELAND @ 230V (IRELAND)	ENGLISH				
0	A	AUSTRALIA @ 230V (AS 4777)	ENGLISH				
0	D	FRANCE @ 230V (FRANCE)	FRENCH				
0	E	NETHERLANDS @ 230V (NETHERL)	ENGLISH				
0	F	GREECE @ 230V (GREECE)	ENGLISH				
1	0	PORTUGAL @ 230V (PORTUGAL)	ENGLISH				
1	1	CORSICA @ 230V (CORSICA)	FRENCH				
1	2	HUNGARY @ 230V (HUNGARY)	ENGLISH				
1	6	CHECA REPUBLIC @ 230V (CZECH)	CZECH				
1	7	GERMANY-VDE AR-N-4105 @ 230V (VDE 4105)	GERMAN				
1	8	CEI-021 @ 230V INTERNAL Protection (CEI021 IN)	ITALIAN				
1	9	CEI-021 @ 230V EXTERNAL Protection (CEI021 EX)	ITALIAN				
1	D	BELG C10-11 100% @ 230V (C1011 100)	FRENCH				
1	E	BELG C10-11 110% @ 230V (C1011 110)	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

14. Commissioning
 The inverter commissioning procedure is as follows:

- Switch the integrated switch (2) (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 (06).

INPUT VOLTAGE	DISPLAY MESSAGE	LED STATUS	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 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 stays lit whereas the others are off.

17. Characteristics and technical data

	PVI-3.8-I-OUTD	PVI-4.6-I-OUTD
Input		
Absolute Maximum Input Voltage (V _{max,abs})	520 V	520 V
Input Activation Voltage (V _{start})	200 V (adj. 120...350 V)	200 V (adj. 120...350 V)
Input Operating Range (V _{domin...} V _{dommax})	0.7 x Vstart...520 V	0.7 x Vstart...520 V
Rated DC Input Power (P _{DC})	4000 Wp	4800 Wp
Number of Independent MPPTs	2 (6)	2 (6)
Maximum Input Power for each MPPT (P _{MPPT,max})	3000 W	3000 W
MPPT Input DC Voltage Range (V _{MPPT,min} f...V _{MPPT,max} f) at P _{DC}	160...470 V	180...470 V
Maximum DC Input Current (I _{DC,max}) / for each MPPT (I _{MPPT,max})	25.0 A / 12.5 A	28.0 A / 14.0 A
Maximum Input Short Circuit Current for each MPPT	22.0 A	22.0 A
Maximum Backfeed current (from AC to DC side)	Negligible	Negligible
Number of DC Inputs Pairs for each MPPT	2	2
DC Connection Type	Connettore PV Tool Free 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. 25.0 A / 600 V	
Output		
AC Grid Connection Type	Monophase	
Rated AC Power (P _{AC})	3800 W	4600 W
Maximum AC Output Power (P _{AC,max})	4200 W (1)	5000 W (2)
Rated AC Grid Voltage (V _{AC})	230 V	
AC Voltage Range	180...264 Vac (4)	
Maximum AC Output Current (I _{AC,max})	18.2 A (5)	22.5 A
Inrush Current	Negligible	
Maximum Output Fault Current	<25Arms (100ms)	
Rated Output Frequency (f)	50 Hz / 60 Hz	
Output Frequency Range (f _{min} ...f _{max})	47...53 / 57...63 Hz (6)	
Nominal Power Factor (Cosphi _{ac})	>0.995 adj. ± 0.9 with Pacr= 3.8 kW	>0.995 adj. ± 0.9 with Pacr= 4.6 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	25.0 A
Output Overvoltage Protection - Varistor	2 (L - N / L - PE)	
Operating performance		
Maximum Efficiency (η _{max})	96.8%	
Weighted Efficiency (EURO/CEC)	96.5% / -	
Power Input Threshold	24.0 W	
Stand-by Consumption	< 8.0 W	
Communication		
Wired Local Monitoring	PVI-USB-RS232 485 (opz.), PVI-DESKTOP (opz.)	
Remote Monitoring	PVI-AEC-EVO (opz.), VSN700 Data Logger (opz.)	
Wireless Local Monitoring	PVI-DESKTOP (opz.) with PVI-RADIOMODULE (opz.)	
User Interface	LCD Display with 16 characters x 2 line	
Environmental		
Ambient Temperature Range	-25...+60°C / -13...140°F	-25...+60°C / -13...140°F with derating above 50°C/122°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)	712 x 325 x 222 mm / 28.0 x 12.8 x 8.7 inch	
Weight	< 24.0 kg / 53.0 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	I	
Marking	CE (50Hz only)	

1. Limited to 3800 W for Germany
 2. Limited to 4600 W for Germany
 3. Limited to 16 A for UK G83/1 standard
 Remark: Features not specifically listed in the present data sheet are not included in the product

Contact us
 www.abb.com/solarinverters
 PVI-3.8.4.6-I-OUTD-Quick Installation Guide EN-RevB
 EFFECTIVE 2014-03-13
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 Specifications subject to change without notice.

