ABB Solar inverters

Quick Installation Guide
PVI-10.0/12.5-TL-OUTD

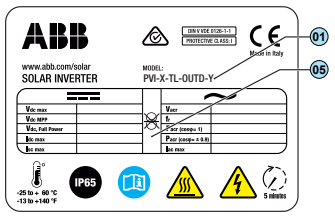
EN

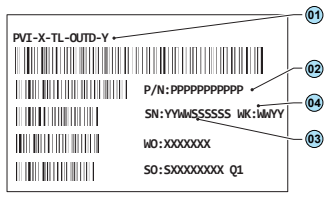
In addition to what is explained below, the safety and installation information provided in the installation manual must be read and followed. The technical documentation and the interface and management software for the product are available at the website.
The device must be used in the manner described 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

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 manufacture
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-

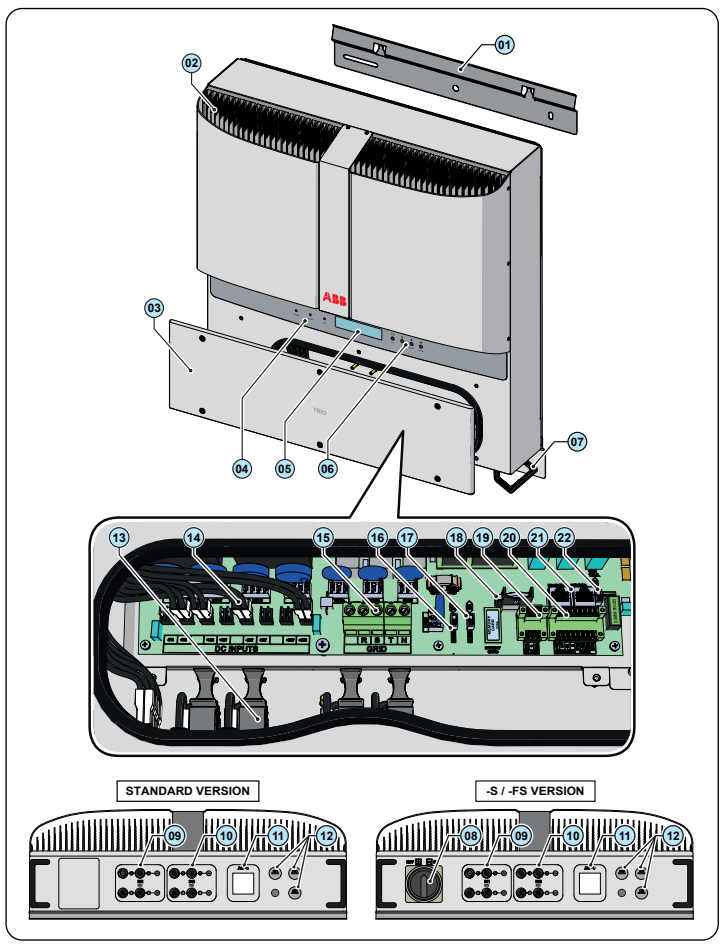
In the manual and/or in some cases on the equipment, the danger or hazard zones are indicated with signs, labels, symbols or icons.

Always refer to instruction manual	General warning - Important safety information	Hazardous voltage	Hot surfaces
IP65 Protection rating of equipment	Temperature range	Without 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

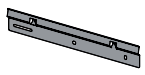
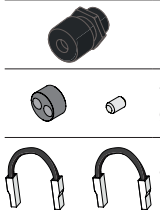
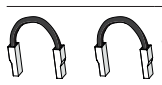
2. Inverter Models and Components

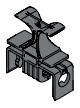
The models of inverter to which this guide refers are available in 2 power ratings: 10.0 kW and 12.5 kW. Three types are available for each model: Standard, with DC disconnect switch (Version -S) or with DC input protection fuses combined with DC disconnect switch (Version -FS).

Main components	
01	Bracket
02	Heatsink
03	Front cover
04	LED Panel
05	Display
06	Keyboard
07	Handles
08	DC Disconnect switch
09	Input connectors (MPPT1)
10	Input connectors (MPPT2)
11	AC cable gland
12	Service cable glands
13	Fuse board (*only version -FS)
14	DC Input terminal block
15	AC Output terminal block
16	AC Grid configuration switch
17	Channel configuration switch
18	Internal battery
19	Alarm terminal block
20	Signal terminal block
21	RJ45 Connectors
22	RS485 line termination switch



3. List of supplied components

Available components		Quantity
	Bracket for wall mounting	1
	Bolts and screws for wall mounting	5 + 5
	D.18 Washer	5
	M20 Cable gland	1
	M40 Cable gland	1
	Two-hole gasket for M20 signal cable glands and cap TGM58	1 + 1
	Jumpers for configuration of the parallel input channels	2

Available components		Quantity
	Connector for connecting the configurable relay	2
	Connector for the connection of the communication and control signals	2
	L-key, TORX TX20	1
	Technical documentations	1
	Fuse holder extractors (*only -FS version)	4
	Input Fuses 15A / 1000Vdc (*only -FS version)	4

4. Lifting and transport

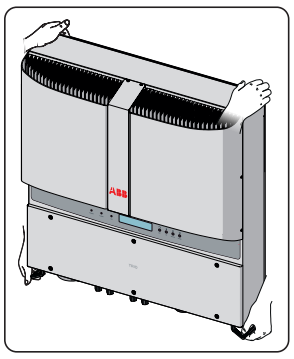
Transport and handling
Transport of the equipment, especially by road, must be carried out with by suitable ways and means for protecting the components from violent shocks, humidity, vibration, etc.

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

Models		Mass weight
PVI-10.0-TL-OUTD	PVI-12.5-TL-OUTD	
PVI-10.0-TL-OUTD-S	PVI-12.5-TL-OUTD-S	<41.0 Kg
PVI-10.0-TL-OUTD-FS	PVI-12.5-TL-OUTD-FS	



5. Choice of installation location

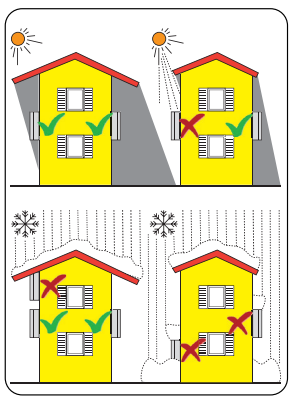
Environmental checks

- 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 (otherwise the warranty will be cancelled) 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 presence of flammable materials in the close surroundings (3m minimum distance)
- Do not install on walls made of wood or flammable materials.
- Do not install in rooms where people live or where the prolonged presence of people or animals is expected, because of the high noise level that the inverter produces during operation. The level of the sound emission is heavily influenced by where the inverter is installed (for example: the type of surface around the inverter, the general properties of the room, etc.) and the quality of the electricity supply.

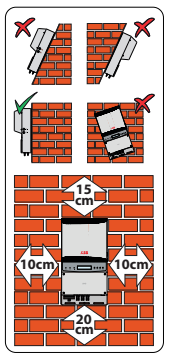
Installations above 2000 metres

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.

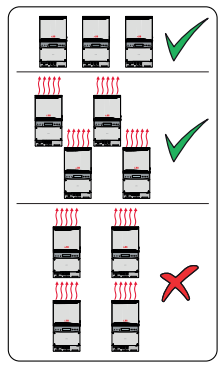


Choice of installation location



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.



6. Assembly Instruction

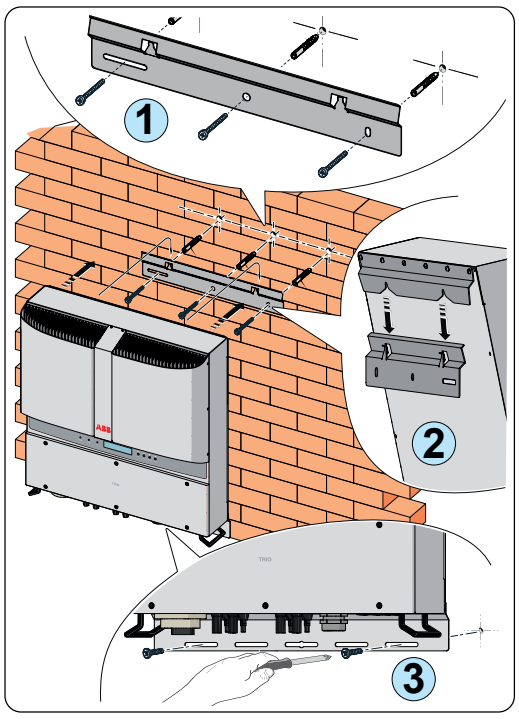
Wall mounting

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.

Do not open the inverter in the case of rain, snow or a high level of humidity (>95%)

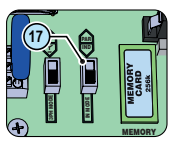
- Once the connections have been made, close the cover by tightening the 6 screws on the front to a minimum tightening torque of 1.5 Nm.



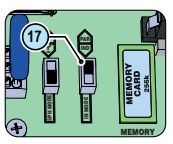
7. Input configuration (DC)

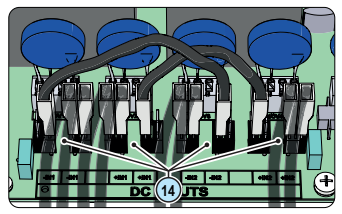
All versions of the inverter are equipped with two input channels (therefore with double maximum power point tracker MPPT) independent of each other, which can however be connected in parallel using a single MPPT.

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 14 must not be installed and the switch 17 located on the main board must be set to “IND”.



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 14 must be installed and the switch 17 located on the main board must be set to “PAR”.





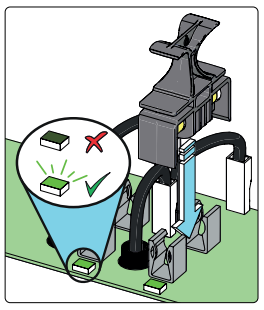
8. Input connection (DC)

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.

Warning! The inverters to which this document relates to are WITHOUT ISOLATION TRANSFORMER (transformer-less). This type involves the use of insulated photovoltaic panels (IEC61730 Class A Rating) and the need to maintain the photovoltaic generator floating with respect to earth: no pole of the generator must be connected to earth.

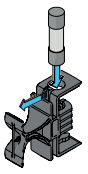
For the string connections it is necessary to use the quick fit connectors (usually Weidmüller PV-Stick or WM4, MultiContact MC4 and Amphenol H4) located on the bottom of the mechanic (09) (10).

- Check the quick fit connector model on the inverter (checking the conforming corresponding part on the manufacturer's website) and crimp the respective corresponding parts of the DC connectors to the string cables.



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

- Connect all the strings included in the design of the system, always checking the tightness of the connectors and checking the input polarity is correct.



In the -FS version each input is supplied with protection fuses (not factory fitted) and an input polarity control. To check the polarity, connect all the strings and check that the LEDs on the fuse board (13) are lit up; if one or more LEDs is off, the polarity of the corresponding strings is to be considered INCORRECT. Once the check has been carried out, DISCONNECT the strings and, checking there is no voltage at the DC inputs, install the protection fuses (supplied) with the aid of fuse holders; reconnect the quick-fit connectors. Check also that the fuse current rating is the correct size for the photovoltaic modules installed.

- 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.

9. Line cable and protection devices

Load protection breaker (AC disconnect switch) and line cable sizing

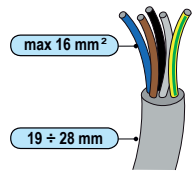
To protect the AC connection line of the inverter, we recommend installing a device for protection against over current and leakage with the following characteristics:

	PVI-10.0-TL-OUTD	PVI-12.5-TL-OUTD
Type	Automatic circuit breaker with differential thermal magnetic protection	
Nominal Voltage / Nominal Current	400 Vac / 20 A	400 Vac / 25 A
Magnetic protection characteristic	B/C	
Number of poles	3/4	
Type of differential protection	A/AC	
Differential sensitivity	300 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

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-TL-OUTD	PVI-12.5-TL-OUTD
4 mm²	34 m	28 m*
6 mm²	51 m	42 m
10 mm²	85 m	70 m
16 mm²	136 m	113 m

* Up to 45 °C Ambient temperature

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

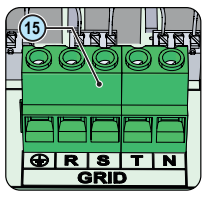
10. Output connection (AC)

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 (11)
- 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 labelled with the ⏚ symbol on the terminal block (15)

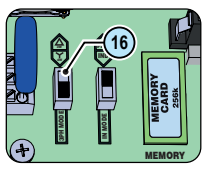


Warning! ABB inverters should be earthed (PE) via the terminal with the protective earth label ⏚, using a cable with an appropriate cross-section of the conductor for the maximum ground fault current that the generating system might experience

- 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 (16) with the screen-printed marking "3PH MOD" and set it to "3W Δ".

- Connect the phase cables to the terminals labelled with the letters **R**, **S** and **T**



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 (15) is complete, screw in the cable gland firmly (tightening torque 5.0Nm) and check the tightness.

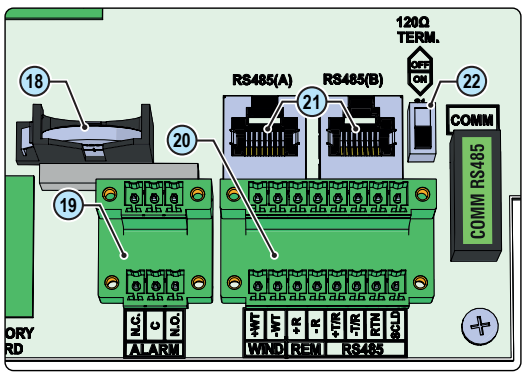
11. Connection of the communication and control signals

Each cable which must be connected to the connectors of the communication and control signals must pass through one of the three service cable glands (12). 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 (21) (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 (22).



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, Alarm, Alarm (Configurable) and Crepuscolar.

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)

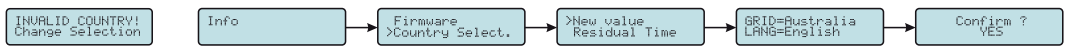
Using the REM terminal block

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

12. Commissioning

The inverter commissioning procedure is as follows:
- Switch the integrated switch (08) (versions –S and –FS) 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.
- When the inverter is turned on for the first time you will be asked to select the "Country" of installation. This selection allows the inverter to automatically configure its parameters to ensure that compliance with local standards; the default language corresponding to the selected "Country" will also be set.



Warning! After the grid standard was set you have 24 hours to make any changes to the grid standard value; 24 hours later the "Country Select." functionality will be blocked, and any subsequent changes can only be made using a password provided on request by ABB

- After you have set the "Country" value, the message "Inizializing...Please Wait" is displayed. Depending on the input voltage value, the inverter will show various messages on the display and change the behaviour of the three LED (04):

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.

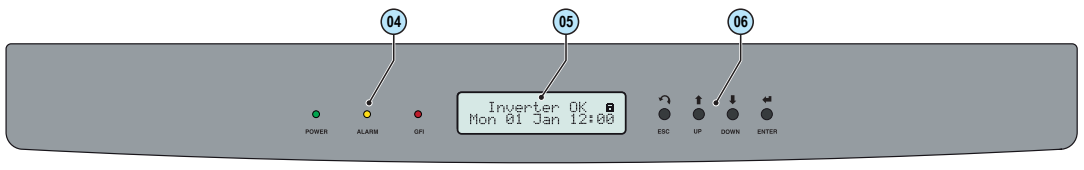
- With the inverter in "Missing Grid" status, close the AC switch downstream the inverter so as to supply the grid voltage to the inverter: the inverter performs the grid voltage check, measures the photovoltaic generator insulation resistance against earth and carries out other self-diagnosis checks. 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 completes parallel connection with the grid SOLELY if the grid parameters meet the ranges provided for by the regulations in force and if the insulation resistance is greater than 1Mohm.

- 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.

13. Instruments

LEDs and **BUTTONS**, in various combinations, can be used to view the status or carry out 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.
LED ALARM	**YELLOW** The inverter has detected an anomaly. The anomaly is shown on the display.
LED GFI	**RED** Ground fault on the DC side of the PV generator. The error is shown on the display.

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
UP	It is used to scroll up the menu options or to shift the numerical scale in ascending order
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

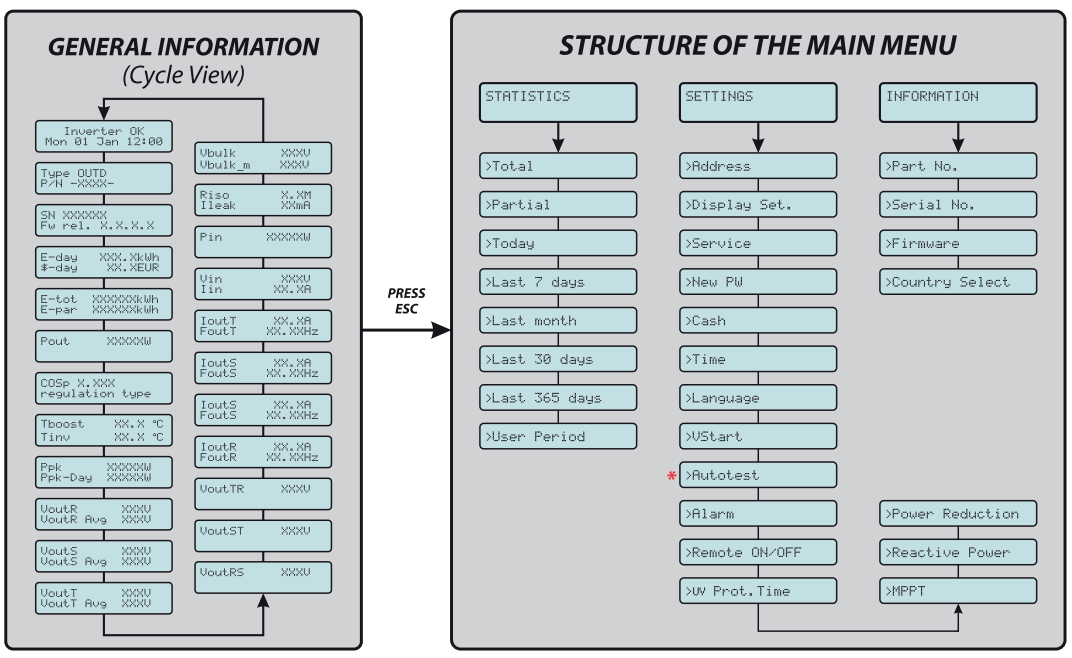
14. Structure of the display menu

ABB inverters are equipped with a Display (05), 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*

15. Characteristics and technical data

	PVI-10.0-TL-OUTD	PVI-12.5-TL-OUTD
Input		
Absolute Maximum Input Voltage ($V_{max,abs}$)	900 V	
Input Activation Voltage (V_{start})	360 V (adj. 250...500 V)	
Input Operating Range (V_{dcmin}...V_{dcmax})	0.7 x Vstart...850 V	
Rated DC Input Power (P_{dcr})	10300 Wp	12800 Wp
Number of Independent MPPTs	2	
Maximum Input Power for each MPPT ($P_{MPPT\,max}$)	6500 W	8000 W
MPPT Input DC Voltage Range ($V_{MPPT\,min}$,f ... $V_{MPPT\,max}$,f) at P_{acr}	300...750 V	360...750 V
Maximum DC Input Current ($I_{dc\,max}$) / for each MPPT ($I_{MPPT\,max}$)	34.0 A / 17.0 A	36.0 A / 18.0 A
Maximum Input Short Circuit Current for each MPPT	22.0 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 Weidmüller PV-Stick / Weidmüller WM4 / MultiContact MC4 / Amphenol H4	
Input protection		
Reverse Polarity Protection	Inverter protection only, from limited current source, for standard and -S versions, and for -FS version when max 2 strings are connected	
Input Overvoltage Protection for each MPPT - Varistor	Yes	
Photovoltaic Array Isolation Control	According to local standard	
DC Switch Rating (-S / -FS Version)	Max. 32.0 A / 1000 V	
Fuse Rating (-FS Version)	Max. 15.0 A / 1000 V	
Output		
AC Grid Connection Type	Three phase 3W or 4W+PE	
Rated AC Power (P_{acr})	10000 W	12500 W
Maximum AC Output Power ($P_{ac\,max}$)	11000 W (1)	13800 W (2)
Rated AC Grid Voltage (V_{acr})	400 V	
AC Voltage Range	320...480 Vac (3)	
Maximum AC Output Current ($I_{ac\,max}$)	16.6 A	20.0 A
Inrush Current	Negligible	
Maximum Output Fault Current	<25Arms (100mS)	
Rated Output Frequency (f_r)	50 Hz / 60 Hz	
Output Frequency Range (f_{min}...f_{max})	47...53 / 57...63 Hz (4)	
Nominal Power Factor (Cosphi$_{acr}$)	>0.995 (adj. ± 0.9 with Pacr= 10.0 kW, ± 0.8 with max 11.5kVA)	>0.995 (adj. ± 0.9 with Pacr= 12.5 kW, ± 0.8 with max 13.8kVA)
Total Harmonic Distortion of Current	< 2%	
AC Connection Type	Screw terminal block, Cable Gland M40	
Output protection		
Anti-Islanding Protection	According to local standard	
Maximum AC Overcurrent External protection	25.0 A	
Output Overvoltage Protection - Varistor	4, plus gas arrester	
Operating performance		
Maximum Efficiency (η_{max})	97.8%	97.8%
Weighted Efficiency (EURO/CEC)	97.1% /-	97.2% /-
Power Input Treshold	30.0 W	
Night-time consumption	< 1.0 W	
Communication		
Wired Local Monitoring	PVI-USB-RS232_485 (opz.)	
Remote Monitoring	PVI-AEC-EVO (opz.), VSN700 Data Logger (opz.), VSN300 Wifi Logger Card (opz.)	
Wireless Local Monitoring	VSN300 Wifi Logger Card (opz.)	
User Interface	LCD Display with 16 characters x 2 line	
Environmental		
Ambient Temperature Range	-25...+60°C /-13...140°F with derating above 55°C/131°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	
Typical noise emission pressure	50 dBA @ 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	<41 kg / 90.4 lb	
Mounting System	Wall bracket	
Overvoltage Category in accordance with IEC 62109-1	II (DC input) III (AC output)	
Safety		
Isolation Level	Transformerless (TL)	
Safety Class	I	
Marking	CE (50Hz only), RCM	

1. Limited to 10000 W for Belgium and Germany
2. Limited to 12500 W for Germany
3. The AC voltage range may vary depending on specific country grid standard
4. The Frequency range may vary depending on specific country grid standard

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

Contact us

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PVI-10.0_12.5-TL-OUTD-Quick Installation Guide EN-RevC
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