Grid Tie Solar Inverter

SVT series

PVIN02KS, PVIN03KS, PVIN04KS, PVIN05KS

User's Manual

imagination at work

VERSION 1.0

Contents

Foreword

Thank you for buying this inverter. Many years of experience in the design of power device have gone into construction of this device. We hope that this device will also give your solar system many years of trouble-free operation. However, it should be mentioned that an inverter is a complex electronic system which is also confronted with a wide variety of local conditions. If questions arise or a malfunction occurs, do not hesitate to call your specialized dealer. He or she will try to help you as quickly and straightforwardly as possible.

Please read this user's guide carefully to familiarize yourself with the device. Remember to pay special attention to the information on installing and commissioning the device.

SAFETY LEGEND

This manual contains important instructions that should be followed during installation and maintenance of the GE Solar Inverter. This manual must be read and understood prior to installing the system.

	Warning: Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

	Caution: Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

	Attention: Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

IMPORTANT SAFETY INSTRUCTIONS

General

	**Warning! Incorrect operation and work performed incorrectly can cause serious injury & damage! Only qualified staff are authorized to install your inverter and only within the scope of the respective technical regulations. Do not start operation or carry out maintenance work before you have read the chapter "IMPORTANT SAFETY INSTRUCTIONS "!**

	**Warning! These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the operating instructions unless you are qualified to do so.**

This manual contains important instructions for the SVT PVIN02KS, PVIN03KS, PVIN04KS, PVIN05KS that shall be followed during installation and maintenance of the inverters.

Housing

	Only qualified installers are authorized to open the connection area. Do not open the connection area when the inverter is in under-voltage condition. Only well-trained service staff may open the upper portion (power stage) of the inverter, and only when it is not in under-voltage condition.

Repair

	Only well-trained service staff is authorized to carry out repairs to the SVT unit.

Installation

	PV inverter has to be installed with all protection accessories.

PV module

Caution	Before connecting the solar modules, you must check whether the voltage parameters specified in the manufacturer's data correspond with the actual parameters.

When checking the voltage reading, please take into account that solar modules supply a higher no-load voltage when temperature is low and sunlight level remains unchanged. At -25 °C the open-circuit voltage of the PV modules must never exceed 500 V. The data sheet of the solar module will tell you the temperature factors applicable for ascertaining the theoretical open-circuit voltage at -25 °C. If the solar modules exceed an open-circuit voltage of 500 V, the SVT might be damaged and all warranty right will be voided.

The SVT includes a Residual current monitoring unit (RCMU) according to VDE0126-1-1. This device measures the ground current of the PV array and prevents the inverter from feeding the grid in case of a ground fault.

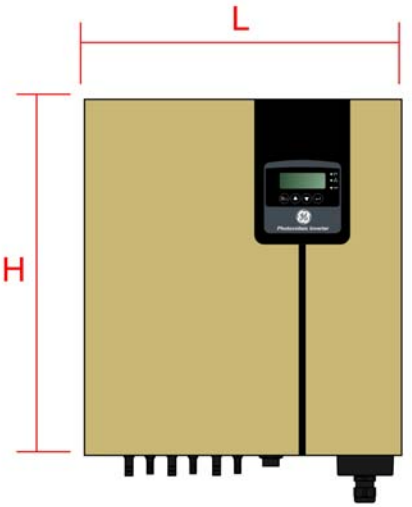
Grid connection

Warning	Only appropriately licensed contractors are authorized to connect the SVT to the grid.

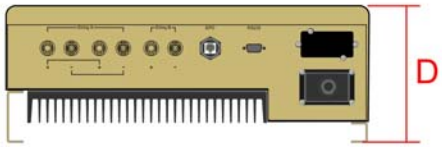
Caution	Consult your local authorities for specific requirements. Before connecting the SVT to the grid, permission for the connection must be granted by the utility company.

1. OVERVIEW

1.1 External dimensions



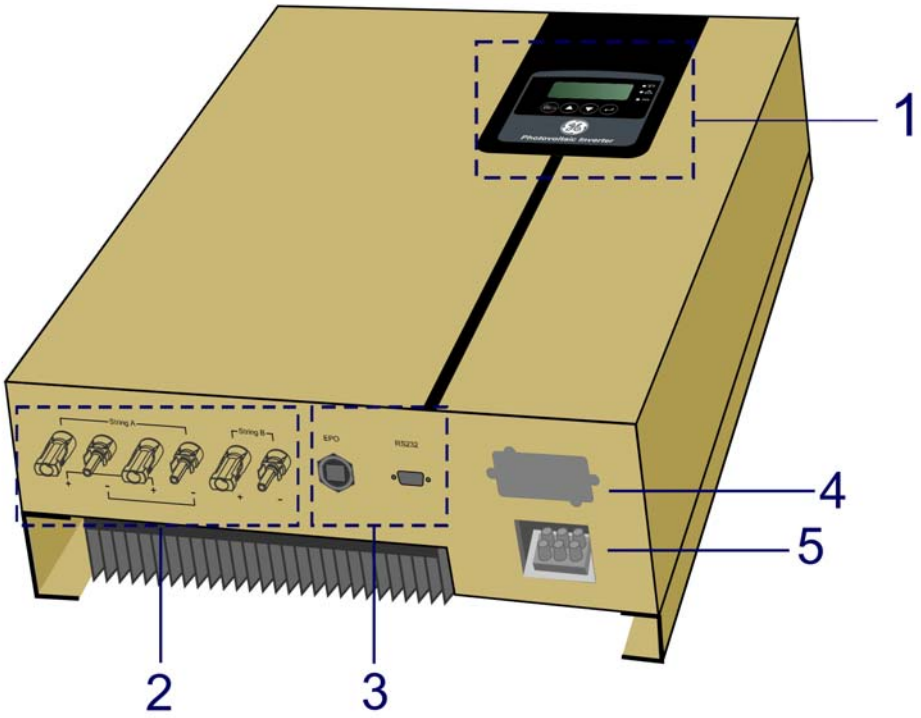
Front view



Bottom view

References / Dimensions (mm)	*PVIN02KS PVIN03KS*	*PVIN04KS PVIN05KS*
L	455	455
H	430	510
D	170	170

1.2 Unit Description



(1) LCD & LED Display: Showing the operation information and status of the inverter.

(2) Solar array input: Plug-and-play connectors the for connection of the solar modules (The SVT PVIN02/03KS/05KP only have one PV string input).

(3) Standard communication Port: EPO & RS232.

(4) Optional communication slot: USB, RS485, Dry contact, TCP/IP.

(5) AC output terminal: AC output for the utility supply.

2. Installation

Warning	Read the Safety Instruction guide (page 2 to 4) before installing the PV inverter.

2.1 Unpacking

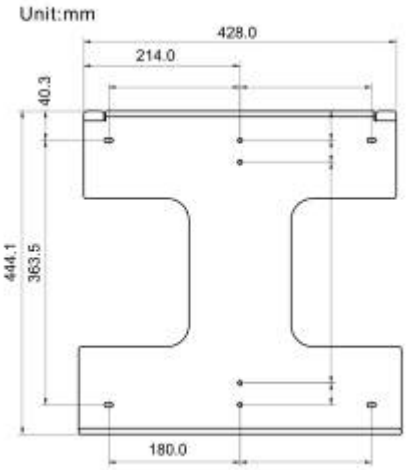
Inspect the PV inverter upon receipt. The manufacturer designed robust packaging for your product. However, accidents and damage may occur during shipment. Notify the forwarder and dealer if there is damage.

The packaging is recyclable; save it for re-use or dispose of it properly.

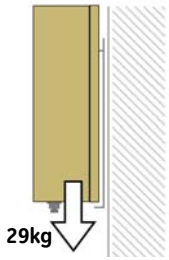
Remove the inverter from the carton box.

Check the package contents. Standard content shall include：

- ✓ 1 set of wires + connectors already assembled with cables
- ✓ 1 set of data CD-ROM (monitoring software, Multilanguage user's and software manuals, inverter certifications)
- ✓ 1 set of mounting frame Accessories Kit as below:



2.2 Installation Requirements

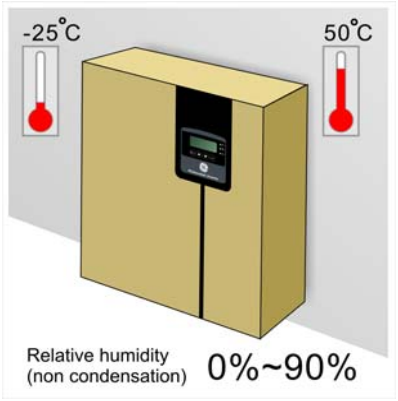
Caution	The SVT is heavy (25kg to 29kg). Take this weight into account when choosing the installation site and method of installation.	

To ensure proper operation and long operating life, always position the Inverter according to the following requirements:

(1)

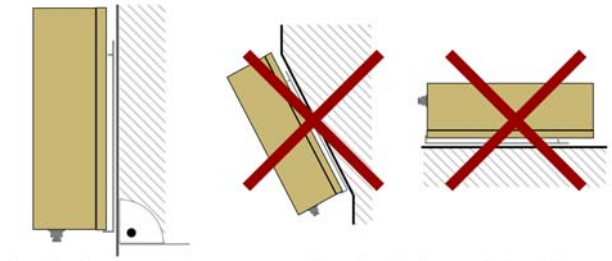
Caution	The SVT is designed for outdoor installation and must be installed nor in a place where it is exposed to direct sunlight, neither in an enclosure exposed to direct sunlight.

The yield of the PV system may reduce at increased ambient temperatures or when installed in poorly ventilated and warm indoor locations. We advise the ambient temperature inside the -25 °C to +50 °C range.



(2) The SVT is designed to be mounted on a vertical wall. If installing the unit outdoors, make sure that it is not slanting forward.

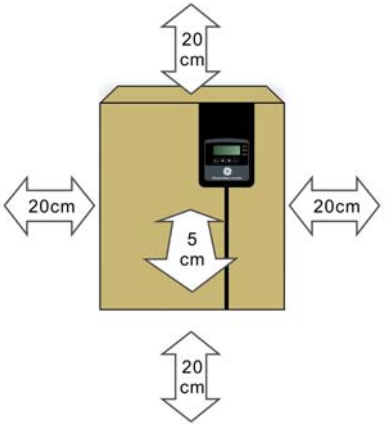
Attention	We advise against installing the unit in a horizontal position outdoors.



(3)

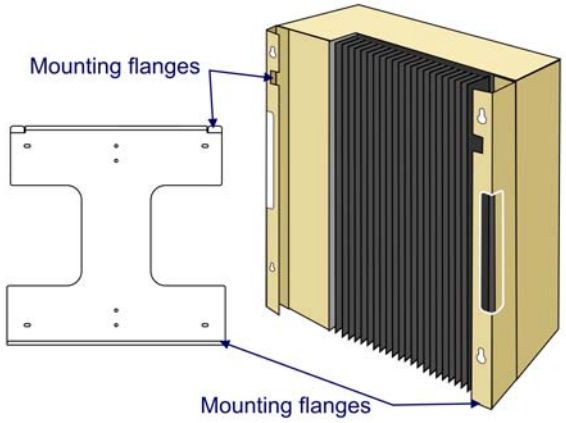
Attention	When choosing the installation site, ensure there is enough space for heat dissipation. Under normal conditions, the following guidelines should be applied for the space to be kept clear around the inverter:

	Minimum Clearance
Sides	20 cm
Top	20 cm
Underneath	20 cm
Front	5 cm



2.3 Mounting the unit

We recommend you to use the supplied wall-mounting bracket to mount the SVT. For vertical installation and installation on solid concrete or block walls, when selecting the mounting materials, be sure to take into account the weight of the SVT.



If you do not want to use the supplied wall mounting bracket as a template, observe the dimensions shown in the drawing above. The procedure for mounting the inverter using the wall mounting bracket is described on the following pages.

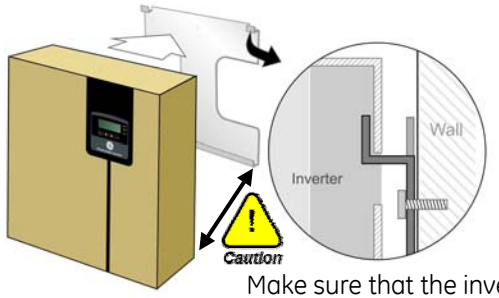
Installation step

Step1: Fit the wall-mounting bracket.

To mark the positions to drill the holes, you can use the wall-mounting bracket as a drilling template.

! Caution	Screws need to be appropriated to material of the wall and the weight of the device. Screw heads to be fully seated not stripped.

Step2: Now hang the SVT onto the wall-mounting bracket using its upper mounting plate so that it cannot be moved sideways.



Make sure that the inverter is also slotted in the mounting bottom frame

Step3: Make sure that the SVT is positioned securely on the bracket.

2.4 Electrical installation

The complete installation for the SVT is shown schematically in the following diagrams

(Fig. 1a & b):

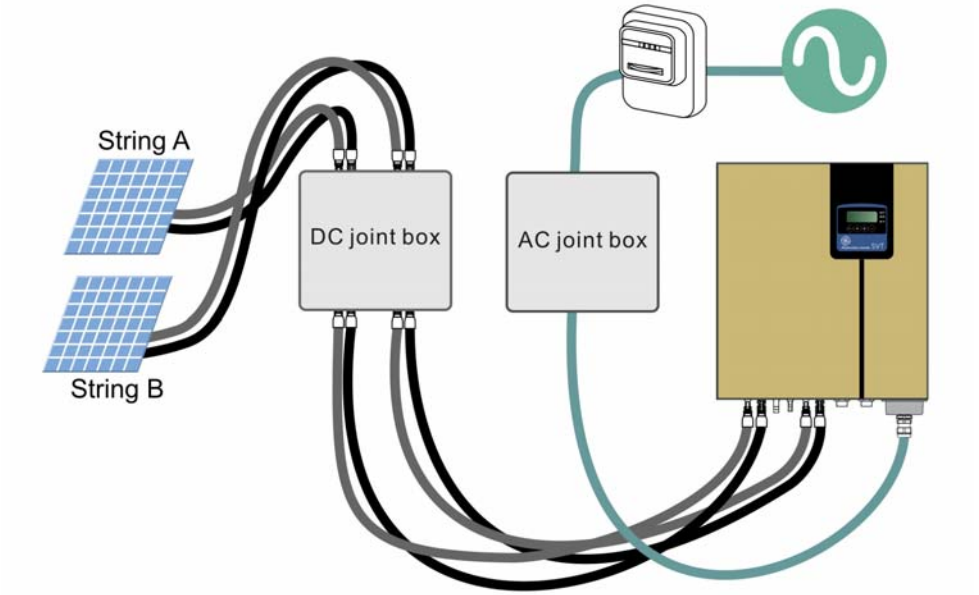


Fig. 1a

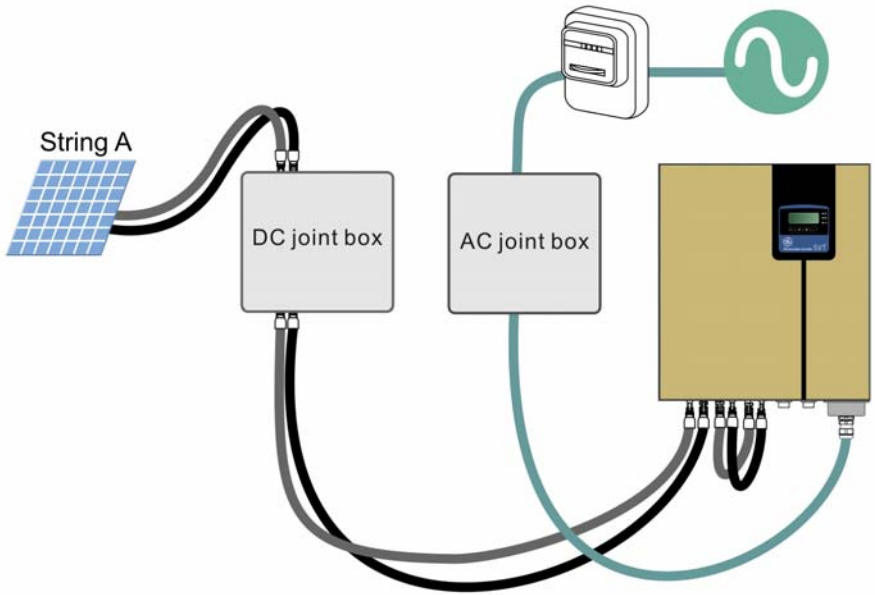


Fig. 1b

Warning	In order to chose size properly your cable application, please refer to the list of suggested cable width

References	Sides	Diameter Φ (mm)	Area (mm²)
PVIN02KS/ PVIN03KS	DC	>2.0	>3.5
	AC	>2.5	>5.0
PVIN04KS/ PVIN05KS	DC	>2.0	>3.5
	AC	>2.59	>5.5

The connectors are provided with a 3m cable already crimped and assembled.

Warning	In order to chose size properly your cable application, please refer to the list of suggested cable width

Reference	Sides	Diameter Φ (mm)	Area (mm2)
PVIN05KP	DC	>2.5	>5.0
	AC	>2.59	>5.5

The connectors are provided with a 3m cable already crimped and assembled.

2.4.1 Connecting the PV Array (DC)

2.4.1.1 PV Module requirements

The SVT is designed to be connected to one string for SVT 02KS/03KS/05KP or two strings for SVT 04KS/05KS, of which PV modules are wired in series.

Caution	Build your PV string having a homogenous structure (modules of the same type, identical orientation, tilt and number), the connecting cables from the PV Modules must also be fitted with this type of plug connector.

Warning	GE provides the connectors assembled and crimped to 3m cables. We recommend using this assembly to connect the inverter to the DC joint box.

List of cables and connectors provided with the inverter.

Unit	Qty	Area mm2	Length	Picture
PVIN02KS, PVIN03KS, PVIN04KS	3 3	3,31 3,31	3m 3m	
PVIN05KS	2 2 1 1 1 1	3,31 3,31 5,26 5,25 3,31 3,31	3m 3m 3m 3m 0,2m 0,2m	
All (sealing caps)	3	N/A	N/A	
	3	N/A	N/A	

Warning	Special wiring situation: If application requires alternative wiring, please take special care to crimp the connectors properly. Poor connection may create dangerous situations.

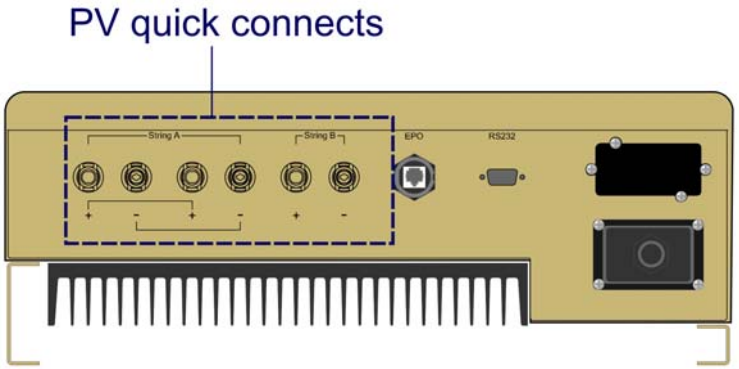
The order codes for the various connectors are as follows:

Male cable coupler	**Sealing caps**	**Male panel receptacle**
PV-KST4/6 II	PV-SVK4	PV-ADSP4/6
Female cable coupler	**Sealing caps**	**Female panel receptacle**
PV-KBT4/6 II	PV-BVK4	PV-ADBP4/6

For more information, please refer: www.multi-contact.com

2.4.1.2 Wiring to PV Module

The SVT is equipped with PV quick connects for connecting up to two PV strings (Only SVT references PVINK04KS/ PVINK05KS).



The Guidelines for Matching PV Array to the SVT PV-Inverter Input for determining the number of panels required in the PV string (panels connected in series), you must ensure that the following three requirements are met:

Caution	**1.** To avoid damage to the inverter, make sure the maximum open circuit voltage (Voc) of each PV string is less than 500 VDC under any condition. Voltage over 500 VDC will damage the inverter.

Caution	**2.** Do not exceed the maximum array short circuit-current rating marked on the inverter.

Attention	**3.** To achieve maximum energy harvest from your array, ensure that the VMP (voltage at maximum power) does not drop below 150 VDC or increase above 450 VDC under most conditions.

To wire the PV array to the SVT inverter **PVIN02KS, PVIN03KS** with several strings, follow these steps:

Warning	**Step 1:** Make sure the DC breaker on the joint box is switched OFF. **Step 2:** Check that the PV generator connectors have the right polarity and do not exceed the maximum string voltage.

Step 3: Connect the POSITIVE (+) wire from the #1 PV string to Inverter PV positive (+) quick connect.

Step 4: Connect the NEGATIVE (–) wire from the #1 PV string to Inverter PV negative (–) quick connect.

Step 5: If necessary, repeat step 2 and Step 3 for the others PV string. Double checks that the wires are in the proper locations.

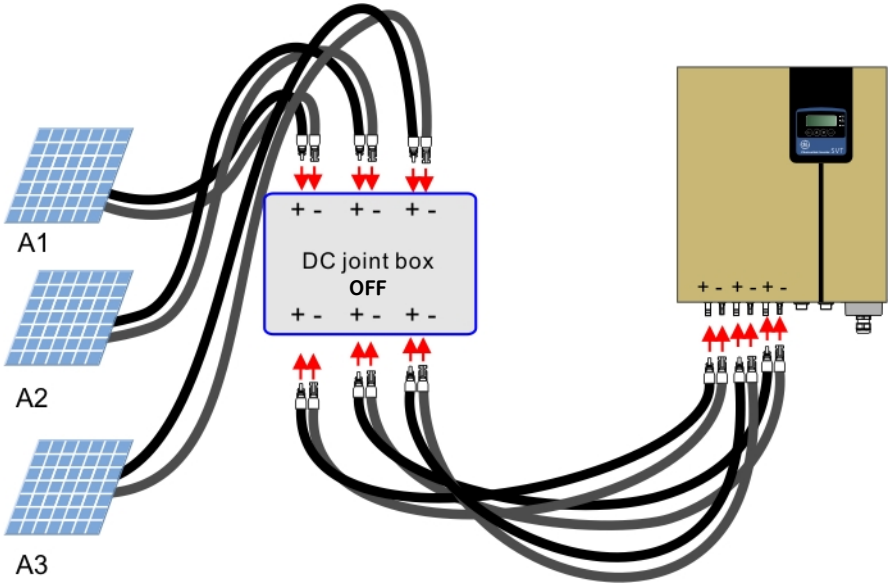


Fig. 2a - DC Connections for a 3-String PV Array

To wire the PV array to the SVT inverter **PVIN02KS, PVIN03KS** with only one string, follow these steps:

Warning	**Step 1:** Make sure the DC breaker on the joint box is switched OFF. **Step 2:** Check that the PV generator connectors have the right polarity and do not exceed the maximum string voltage.

Step 3: Connect the POSITIVE (+) wire from the #1 PV string to Inverter PV positive (+) quick connect String A.

Step 4: Connect the NEGATIVE (–) wire from the #1 PV string to Inverter PV negative (–) quick connect String A.

Caution	**Step 5:** Close off the unneeded DC input sockets using the protective caps supplied in the accessories kit.

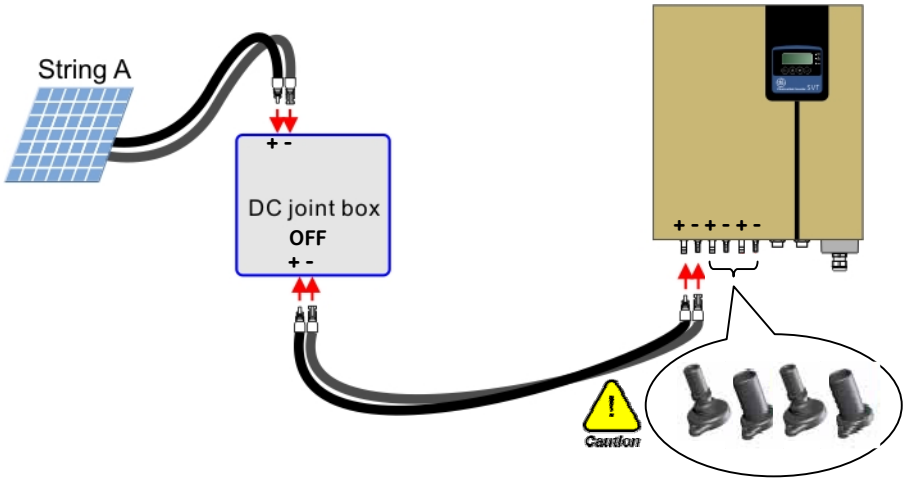


Fig. 2b - DC Connections for a Single-String PV Array

To wire the PV array to the SVT inverter **PVIN04KS, PVIN05KS**, follow these steps:

Warning	**Step 1:** Make sure the DC breaker on the joint box is switched OFF. **Step 2:** Check that the PV generator connectors have the right polarity and do not exceed the maximum string voltage.

Step 3: Connect the POSITIVE (+) wire from the #1 PV string to Inverter PV positive (+) quick connect.

Step 4: Connect the NEGATIVE (–) wire from the #1 PV string to Inverter PV negative (–) quick connect.

Step 5: If necessary, repeat step 2 and Step 3 for the others PV string. Double checks that the wires are in the proper locations.

Caution	**Step 6:** Close off the unneeded DC input sockets using the protective caps supplied in the accessories kit.

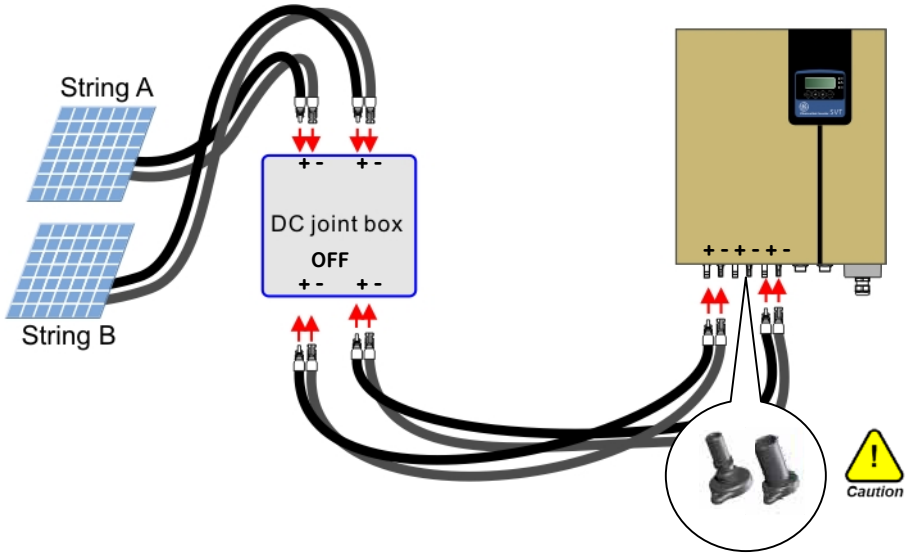


Fig. 2c - DC Connections for a Two-String PV Array

To wire the PV array to the SVT inverter **PVIN05KP**, follow these steps:

Warning	**Step 1:** Make sure the DC breaker on the joint box is switched OFF. **Step 2:** Check that the PV generator connectors have the right polarity and do not exceed the maximum string voltage.

Step 3: Connect the POSITIVE (+) wire from the #1 PV string to Inverter PV positive (+) quick connect String A.

Step 4: Connect the NEGATIVE (–) wire from the #1 PV string to Inverter PV negative (–) quick connect String A.

Caution	**Step 5:** Connect the Inverter PV positive (+) quick connect String A to the Inverter PV positive (+) quick connect String B. **Step 6:** Connect the Inverter PV positive (-) quick connect String A to the Inverter PV positive (-) quick connect String B.

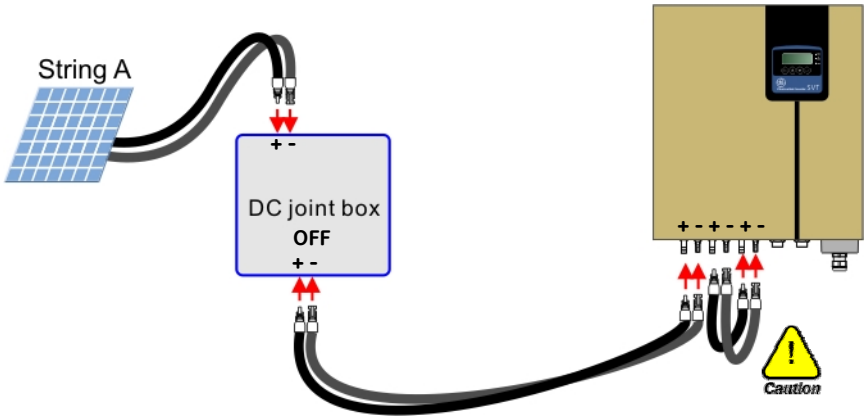


Fig. 2d - DC Connections for a Single-String PV Array

2.4.2 Connecting to the grid (AC utility)

To connect the AC cable, proceed as follows:

Warning	**Step 1:** Before wiring the PV-Inverter, make sure the DC breaker and the AC breaker on the joint boxes are switched OFF.

Step 2: Confirm grid's (utility's) voltage and frequency. For the limit values, please refer to the certificates provided with the inverters. The voltage and frequency of Utility are dependant on different setting in each country.

Step 3: **(A)** Remove the screws that secure the case of the SVT and carefully remove the cover.

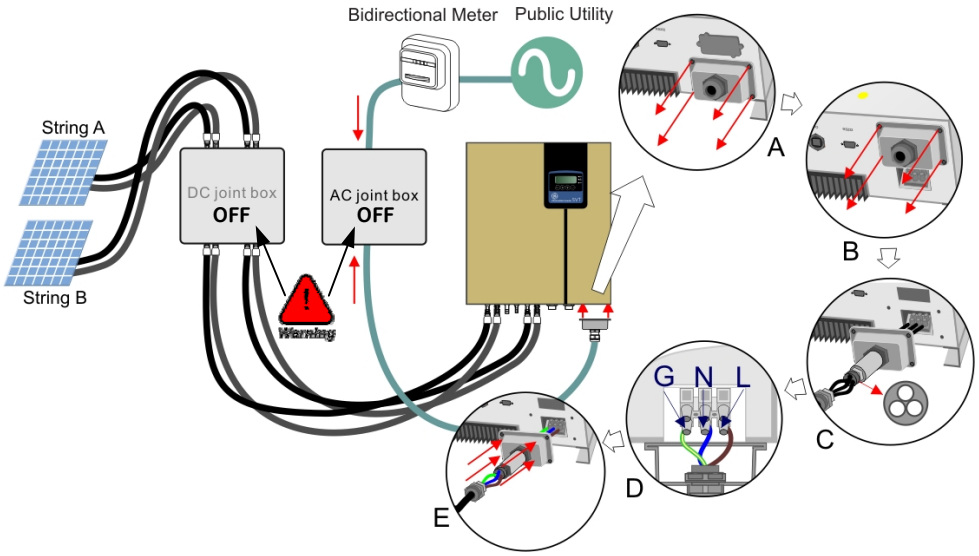


Fig. 3

(B) Remove the plastic cover protecting the communication boards.

(C) Insert utility wires through cable gland.

(D) Connect wires according to polarities indicated on terminal block.

L means LINE (brown), N means Neutral (blue) and G means system ground(yellow-green) as shown in Fig. 4(a)

L1 means LINE1 (black), L2 means LINE2 (black), G means system ground(yellow-green) as shown in Fig. 4(b)

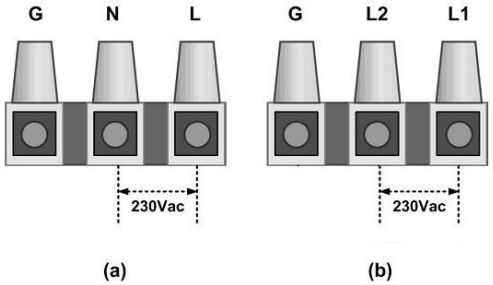


Fig. 4

(E) Fix the housing cover of the SVT and evenly tighten the four screws.

Warning	To prevent risk off electric shock, ensure the ground wire is properly earthed before operating the PV Inverter.

Caution	Recommended torque: 1.2Nm

(F) Tight the screw of the gland to insure the IP65 protection.

3. Front panel Functional Descriptions

① LCD Display	
Symbol	**Description**
LINE	Utility Source
	Inverter Working in specified mode
	Solar Cell
	Inverter operation mode Flow Chart
	4 Digits Measurement Display

LED Indicators		
②		RED LED steadily lights up to indicate that the Ground fault or DC input isolation fault.
③		YELLOW LED steadily lights up to indicate that the utility (ex. Voltage, frequency etc.) is not matches with the input standard of the inverter.
④		Green LED steadily lights up to indicate that the Solar Cell power is greater than sleep power; the LED flashes flickeringly to indicate that the Solar Cell power is smaller than sleep power.

Control Keypads		
⑤		Special Function Log in /out
⑥		Go to previous page.
⑦		To re-confirm the change of Inverter Setting
⑧		Go to previous page.

4. Starting the inverter

4.1 Configuration Instructions

Caution	Before any connection to the grid, make sure the inverter is properly configured with the country specifics settings. To do so, you have 2 solutions:

SOLUTION 1 - Front Panel Setting Mode

Warning	Only qualified and well-trained installers are authorized to enter in the Setting Mode and change the country setting of the inverter

Warning	**Step 1:** After having completed all the hardware installation described at section 2,make sure that • The housing cover is securely screwed tight. • The AC breaker is OFF. • The DC cables (PV strings) are fully.

Step 2: Connect the PV string voltage by switching ON the DC circuit breaker. The inverter starts automatically when it receives DC voltage greater than 120Vdc. All of the LEDs will light up. LCD will illustrate as Fig. 5a.

Fig. 5a

After 3 seconds, LCD will illustrate as Fig 5b and Fig 5c.
The Green LED flashes flickeringly to indicate that the DC input power is smaller than sleep power. The yellow LED steadily lights up to indicate that no utility exists.

Fig. 5b

Meaning of **A120V**
A is the name of the string (A or B)
120 is the numerical value of the measurement
V is the unit of the measurement

Fig. 5c

Meaning of **AL14**
AL stands for alarm, it can also be ER for error
14 is the number of the alarm or error

For further explanations, refer to the section 4.2.

4.2 Connection to the grid

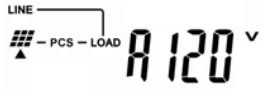
4.2.1 Switch ON the AC breaker. If Utility specification (ex. Voltage, frequency etc.) is matched with the specs of the inverter, after 30 seconds the LCD display will illustrate Fig. 6a. And the Yellow LED will go out to indicate that the utility is acceptable by the inverter. If Utility's specification (ex. Voltage, frequency etc.) is not matched with the specs of the inverter then an error code or error status will be shown on the screen.

Fig. 6a 

4.2.2 After 5 seconds, if the DC soft start of the inverter is successful, the LCD display will illustrate Fig. 6b. The Green LED still flashes flickeringly.

Fig. 6b 

4.2.3 After 10 seconds, if the AC soft start of inverter is successful the LCD display will illustrate Fig. 6c.

Fig. 6c 

4.2.4 If the inverter is in failure (ex. Output Current Over Range), then an error code or status will be shown on the screen. (EX. Fig. 6d)

Fig. 6d 

4.2.5 If start-up operation of the inverter is completely and successful. The LCD display will illustrate Fig. 6c.

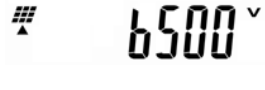
4.3 Check Measured Values & Figures detected by the inverter

If you would like to check the measured values & figures detected by the Inverter, please use scroll up ▲ and scroll down ▼ keypads. When you use scroll down keypad, the LCD display will illustrate as:

4.3.1 Input DC Voltage of String A, as Fig. 7a.

Fig. 7a 

4.3.2 Input DC Voltage of String B, as Fig. 7b.

Fig. 7b 

4.3.3 Input DC Current of String A, as Fig. 7c.

Fig. 7c 

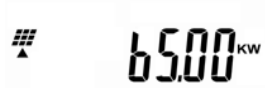
4.3.4 Input DC Current of String B, as Fig. 7d.

Fig. 7d 

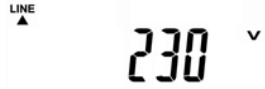
4.3.5 Output Power of Booster A, as Fig. 7e.

Fig. 7e 

4.3.6 Output Power of Booster B, as Fig. 7f.

Fig. 7f 

4.3.7 Output Voltage of Inverter (Utility Voltage) , as Fig. 7g.

Fig. 7g 

4.3.8 Output Frequency of Inverter (Utility Frequency) , as Fig. 7h.

Fig. 7h 

4.3.9 Output Current supplied to Load, as Fig. 7i.

Fig. 7i 

4.3.10 Output Power Supplied to Load, as Fig. 7j.

Fig. 7j

4.3.11 Energy KWH Supplied to Load, as Fig. 7k.

Fig. 7k

4.3.12 INVERTER Inner Temperature (ºC, ºF) , as Fig. 7l.

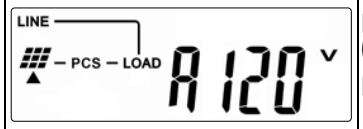
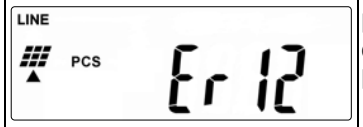
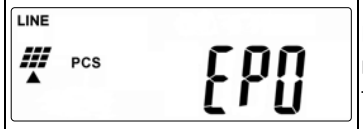
Fig. 7l

4.3.13 Heat sink Temperature (ºC, ºF) , as Fig. 7m.

Fig. 7m

4.4 Inverter status descriptions

SVT starts up automatically when DC power from the PV panel is sufficient. Once the inverter starts, it enters into one of the following status:

Operation mode	LCD panel display	Description
Normal		In this mode, the SVT works normally. Whenever the supplied power from PV panel is sufficient (500VDC>PV>120VDC), the SVT converts power to the grid as generated by the PV panel. In normal mode, the green LED is on to indicate that it feeds power to the grid.
Stand-by		If the power is insufficient, (60VDC<PV<120VDC) the SVT enters into a standby mode but attempts to connect to the grid.
Error	 	The internal intelligent controller can continuously monitor and adjust the system status. If the SVT finds any unexpected conditions such as grid problems or internal failure, it will display the information on its LCD and light up the red LED.
EPO		Emergency Power Off Mode. In this mode, the SVT does not take any power from the grid.
Shutdown		In case of little or no sunlight, The SVT automatically stops running. In this mode, the SVT does not take any power from the grid. The display and all of the LEDs on the front panel do not work.

5. The communications interface

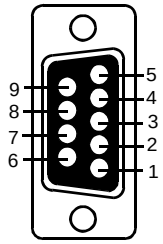
5.1 Standard communication interfaces

5.1.1 RS232 interface definition

5.1.1.1 The RS232 interface shall be set as follows:

Baud Rate	**9600 bps**
Data Length	**8 bits**
Stop Bit	**1 bit**
Parity	**None**

5.1.1.2 The Pin Assignments of true RS232 type. The pin assignments of true RS232 type are illustrated as follows:



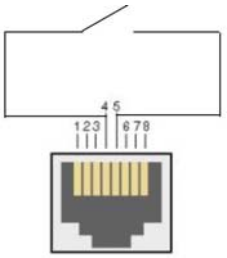
Pin 2: RS232 Rx

Pin 3: RS232 Tx

Pin 5: Ground

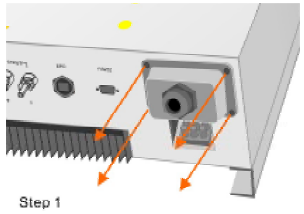
5.1.2 EPO (Emergency Power Off) RJ45 connector

To activate EPO, Pin 4 and Pin 5 have to be shorted together.

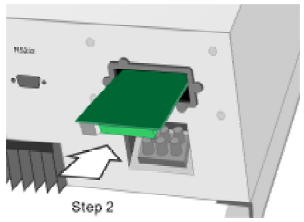
Caution	Make sure the connection between the RJ45 connector and the pair of wires is properly done. Ensure that the functionality of the EPO fits with your application by testing the inverter while it is injecting current; check that it stops injecting the current.	

5.2 Option communication cards

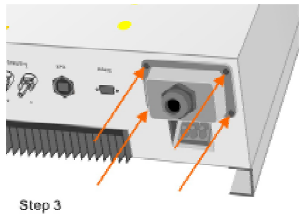
5.2.1 Hardware Installation Procedure



Open the top and sides of the cabinet



Put the communication card into the slot



Screw back the side & top cover and complete the installation

5.2.2 RS485 Interface Card

- **CN1** is for the function of the terminal resistor (which can be monitored on the provided software). Short pin1-2 to enable the function and short pin2-3 to disable it.

- **CN2** is for RS485.

- **CN3** is for remote power.

Adaptor recommendation

The boards should work with all the RS485 communication ports and adaptors. However, if you don't have direct RS485 port, we recommend using the RS485/UBS adaptor ADAM-4561:

http://www.manz-automation.com/dynamisch/data/zubehoer/Communication-Converter_ADAM-4561.pdf

Pin assignment

CN2

1	2	3

1 → Ground

2 → A/Data+

3 → B/Data-

CN3

1	2

1 → AC+

2 → AC-

Driver configuration

Baud Rate	9600 bps
Data Length	8 bits
Stop Bit	1 bit
Parity	None

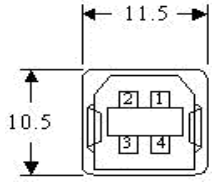
5.2.3 USB card

CN2 for USB

Comply with USB 1.1 & USB 2.0

USB human interface device class (plug & play)

The Pin Assignments of the USB card:



1 → VCC (+5V)

2 → D−

3 → D+

5.2.4 True Relay Contact Board (DCE-B card)

The pin assignments of 10-Pin Terminal:

1	2	3	4	5	6	7	8		

Pin 1: Voltage of utility is abnormal.

Pin 2: PV strings voltage is normal.

Pin 3: PV strings voltage is abnormal.

Pin 4: Frequency of utility is abnormal.

Pin 5: Anti-islanding.

Pin 6: Output current of inverter is exceeds range.

Pin 7: Temperature of heat sink is too high.

Pin 8: Common.

- The capacity of each relay contact is 40Vdc/25mA.

- Flexible signal output for N.C. (Normally close) or N.O. (Normally open) contact by shorting pin1-2 or pin2-3 from JP1-5.

5.2.5 TCP/IP Cards

SNMP/WEB card

For installation, refer to the **Software Installation Guide**.

Position: slot 2 (CHB)

Driver configuration

Speed	10M for 10BASE-T Ethernet
Protocol	TCP/IP

6. Inverter Status diagnostics and repair

Inverters SVT Series are equipped with a self-diagnostic system that automatically identifies a large number of possible operation issues by itself and displays them on the screen. Therefore it is possible to quickly isolate technical issues, and to distinguish between errors related to the installation versus internal errors of the inverter. Whenever the self-diagnostic system has identified a particular issue, the respective code is displayed on the screen.

Table 2. Inverter error code and description

Code	Designation	Description	Repair
Er00	DC_BUS pre-Charge fail	The Inverter is in soft start procedure, but the DC Bus can not reach and maintain anticipative charging voltage	1. Disconnect ALL PV (+) or PV (-) 2. Wait for few seconds 3. After the LCD switches off, reconnect and check again
Er03	Inverter voltage abnormal	Output voltage is abnormal	
Er07	DC_BUS over-voltage	The DC BUS inside is lower or high than expected	
Er08	DC_BUS under-voltage		
Er17	EEPROM ERROR on the control board	EEPROM Data is wrong	
Er19	DC_BUS discharge fail	Capacitors of the DC Bus cannot be discharged	
Er22	Output Relay fail	Output Relay is abnormal	
Er24	Output Current sense fail	The Inverter Output Current fails to detect.	
Er25	BOOSTER_A over-current	The current in the DC network is larger than specified.	
Er26	BOOSTER_B over-current		
Er30	Rating setting of Driver board is not match EEPROM of Control board	EEPROM Data is wrong	
Er06	EPO	Inverter enters into EPO mode (Emergency Power Off)	Remove the short circuit occurred at the EPO terminal.
Er09	Inverter Output over-current	The current in the AC network is larger than specified.	Turn off AC breaker, then check the peripheral AC system configuration and the grid conditions.
Er11	Inverter over-load	The load in the AC network is larger than specified.	
Er13	Inverter short-circuit	Short-circuit on the AC side.	
Er14	Inverter PLL fail	The phase of Inverter cannot synchronize with the utility.	
Er29	Inverter output DC current over spec.	The DC component of the electricity fed into the grid is longer than permissible range.	
Er10	Inverter Over temperature	Internal temperature is too high.	Try to reduce the ambient temperature. Move the inverter to cooler place.
Er18	Heat sink Over temperature	Heat sink temperature is too high.	
Er01, Er02, Er04, Er05, Er12, Er15, Er16, Er20, Er21, Er23, Er27, Er28, Er31			Reserved

If error code keeps recurring, contact your local distributor for help.

Table 3. Grid fault alarm code and description

Code	Designation	Description	Repair
AL00	Utility Voltage Over-Voltage	Utility Voltage Greater or Smaller than the permissible value.	1. Wait for 1 minute, if the grid returns to normal, the inverter automatically restarts. 2. Check grid connection, such as wires and connectors. 3. Make sure grid voltage and frequency meet the proper specifications.
AL01	Utility Voltage Under-Voltage		
AL02	Utility Voltage Over-Frequency	Utility Frequency Greater or Smaller than the permissible value.	
AL03	Utility Voltage Under-Frequency		
AL04	BOOSTER_A Input Over-Voltage	Over or Under voltage at DC input.	1. Disconnect ALL PV (+) or PV (-). 2. Check the open PV voltage is outside the 120Vdc ~ 500Vdc. 3. If PV voltage is normal and the problem still occurs, contact your local distributor for help.
AL05	BOOSTER_A Input Under-Voltage		
AL06	BOOSTER_B Input Over-Voltage		
AL07	BOOSTER_B Input Under-Voltage		
AL08	Anti-Islanding	No Utility or Utility fail	1. Disconnect ALL PV (+) or PV (-) 2. Check grid connection, such as wires and connectors. 3. Check grid usability.
AL 13	Phase of Utility is fail		
AL14	Waveform of Utility is fail		
AL09	Inverter Voltage unbalance	Inverter Voltage Waveform is in unbalance	1. Shut down inverter (Unplug PV generator from the input). 2. Check grid usability and Restart inverter (plug PV generator from the input).
AL10	CFDI	Leakage current on ground conductor is too high.	1. Unplug PV generator from the input, check AC peripheral system 2. After the problem is cleared, re-plug the PV. Check the PV-Inverter status.
AL11	Isolation Fault	The impedance is between PV (+) & PV(-) and Ground is smaller than 2MΩ.	1. Disconnect ALL PV (+) or PV (-). 2. Check the impedance between PV (+) & PV (-) and Ground. The impedance must be larger than 2MΩ.
AL12, AL15 ~ AL 31			Reserved

If error code keeps recurring, contact your local distributor for help.

7. Specifications

References / Item	817502 PVIN02KS	817503 PVIN03KS	817504 PVIN04KS	817505 PVIN05KS
Rated AC Power	2000W	3000W	4000W	5000W
Max. AC Power Output	2200W	3300W	4200W	5300W
Inverter Technology	High frequency PWM Transformer-less Design			
DC Input				
Rated Voltage	360Vdc			
Maximum Voltage	500Vdc			
Operation Voltage	120Vdc ~ 500Vdc			
No. of input connection	1	1	2	2
Max current for each connection	14.6A	22A	14A	17.65A
MPPT Range	150Vdc ~ 450Vdc			
AC Output				
Phase/Wire	1-phase/2-wires (LN) or 1-phase/3-wires (LNG)			
Rated Voltage	230Vac (184 ~ 253Vac)			
Rated Frequency	50Hz			
Rated AC Current	8.7A	13A	17.4A	21.7A
Max. AC Current	10.2A	15.3A	20.4A	25.5A
Current Distortion	Total Harmonic current: Less than 5% Single Harmonic current: Less than 3%			
Power Factor	>0.99 with nominal AC current			
Efficiency Data				
Euro Efficiency	94% Euro Efficiency = 0.03 η5% + 0.06 η10% + 0.13 η20% + 0.1 η30% + 0.48 η50% + 0.2 η100%			
Max. conv. efficiency	96%			
Environmental				
Operating Temperature	-25 °C ~ +50 °C			
Humidity	30 to 90% (Without condensation)			
Altitude	0~2000m			
Noise Level	＜35dBA			
Mechanical				
Dimensions (H x W x D)	484 x 455 x 170mm		564 x 455 x 170 mm	
Weight	25 kg		29 kg	
Protection class	IP65, outdoor			
Cooling	Free convection			

Protection	
Utility	Over/under Voltage, Over/under Frequency, Ground fault, DC Isolation fault
Islanding operation detection	Passive: Voltage phase jump detection Active: Reactive power control
Short circuit	DC input: Input Diode / Electronic Circuit AC output: Output Relay /Electronic Circuit
EPO	Emergency Power Off: Inverter shuts down immediately
Communication	
Interface	Standard: RS232, Ethernet
	Optional: USB, RS485, Dry contact