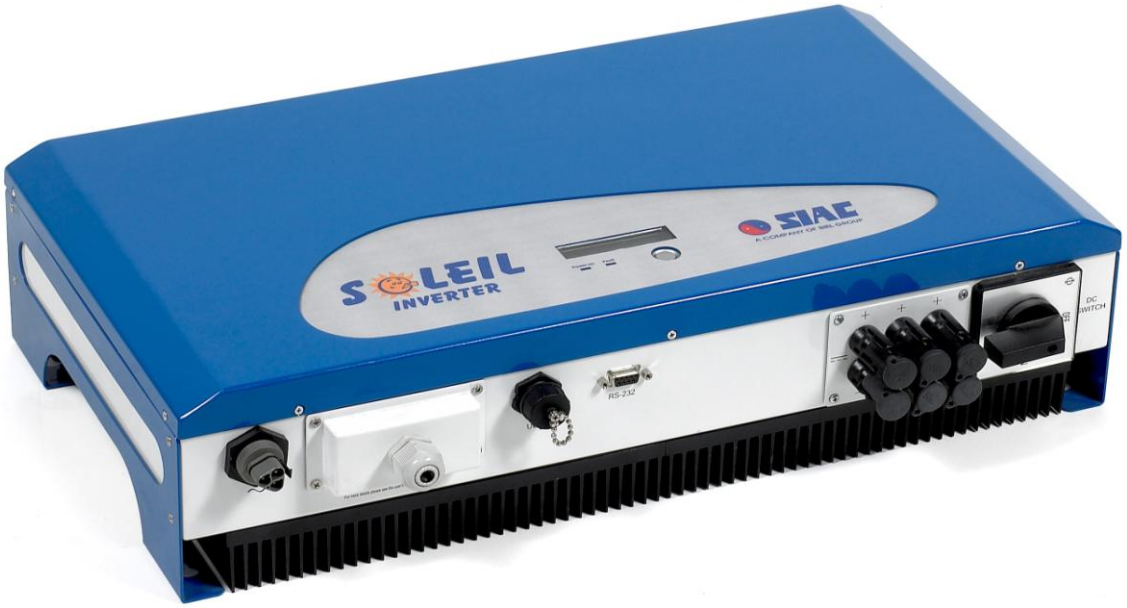
SOLEIL Grid PV-inverter

Installation and Operation Manual

SOLEIL 1500 – 2000 – 3000

SOLEIL 4000



SOLEIL 6000

Only an electro-skilled person or trained assembly staff can install or open the Inverter.

Before you start…

Thanks for purchasing SOLEIL-Inverter. SOLEIL-INVERTER is a highly reliable product due to innovative design and perfect quality control.
This manual contains important information of installation, operation and safety reminding of this unit. Be sure to read this manual carefully before enjoying this product.
If you encounter any problem during installing or running this unit, please check this manual first before contacting with your local dealer or representative. Most of the problems you encountered will be solved according to the instruction inside.

Thank you for purchasing our product again. Please keep this manual in safe place for later use.

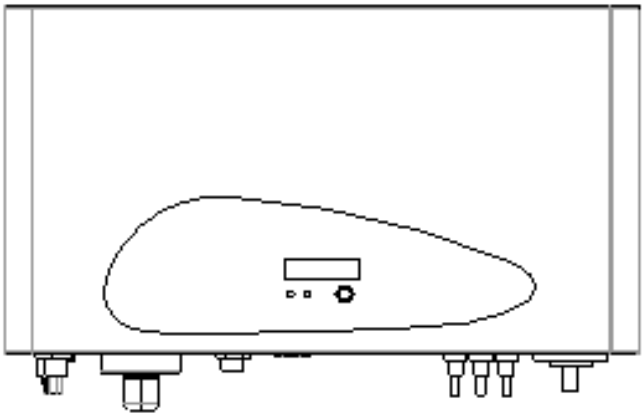
Safety instructions

- Risk of Electric Shock

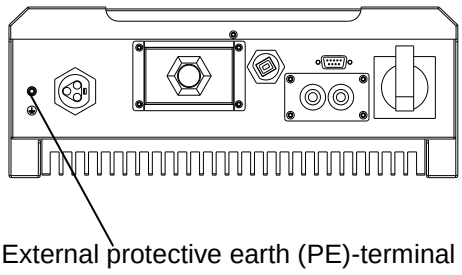
1. Do not remove the covers. No user serviceable parts inside. Refer service to qualified service personnel.
2. Both AC and DC voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing.
3. When a photovoltaic array is exposed to light, it supplies a DC voltage to this equipment.
4. Risk of electric shock from energy stored in capacitors. Do not remove cover until 3 hours after disconnecting all power sources.
5. This unit is designed to feed power to grid (utility) only, do not connect this unit to AC power supplier. If connecting to those facilities, AC power supplier will be damaged.
6. Please take out the unit from packaging box carefully. Check if there is any outside damage. If you find any damage, please contact with your local dealer.

WARNING: HIGH LEAKAGE CURRENT!
THE EXTERNAL PROTECTIVE EARTH (PE)-TERMINAL (SEE CHAPTER 1 “OVERVIEW”) MUST BE CONNECTED TO THE PE-CONDUCTOR BEFORE CONNECTING SUPPLY.

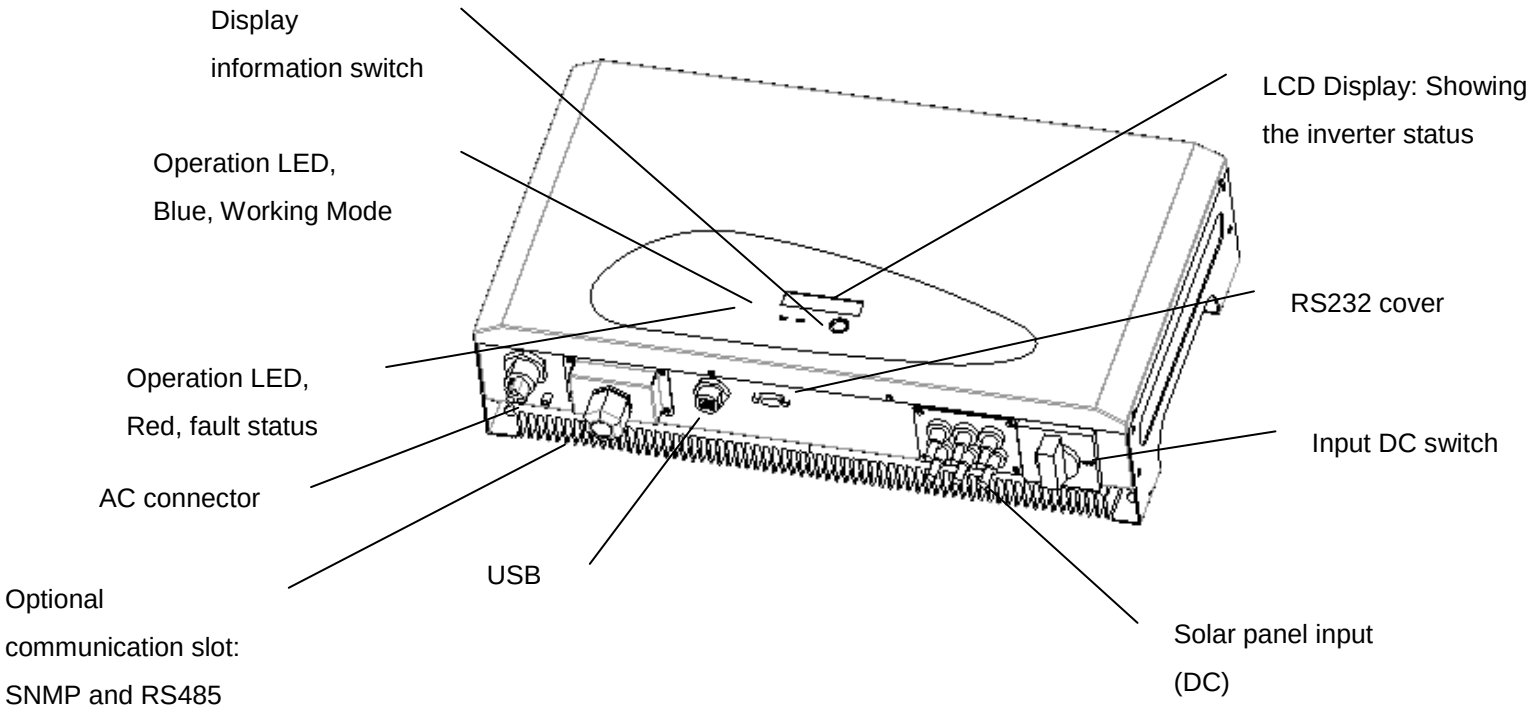
1. Overview



Front view



Bottom view



Display and connections

2. Installation

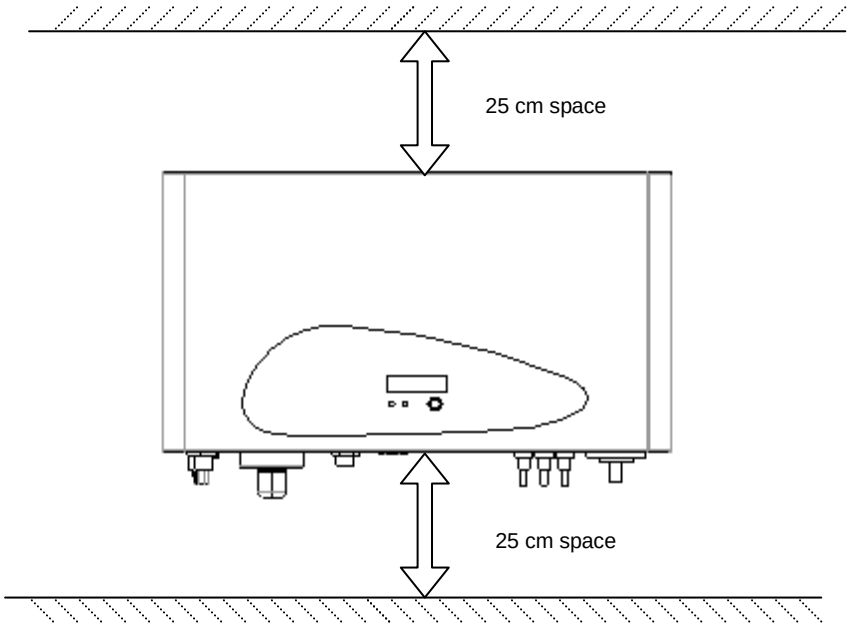
Before starting installation please check the following items:

- This unit is designed for indoor and outdoor usage. But it is suggested that the unit can't be exposed under rain or water directly and use a shelter to protect the unit would be better.
- Do not expose this unit to the sun directly. This may reduce the output power due to high temperature.
- Check the ambient temperature of installation is within specification (-25~+55°C).
- The grid to be connected is 230V system.
- The connection to grid is approved by utility company .
- The installation must be done by qualified personnel .

Though SOLEIL can be installed where temperature up to 50°C, we still strongly recommend that it should be installed where ambient temperature in the range of 0~40°C.

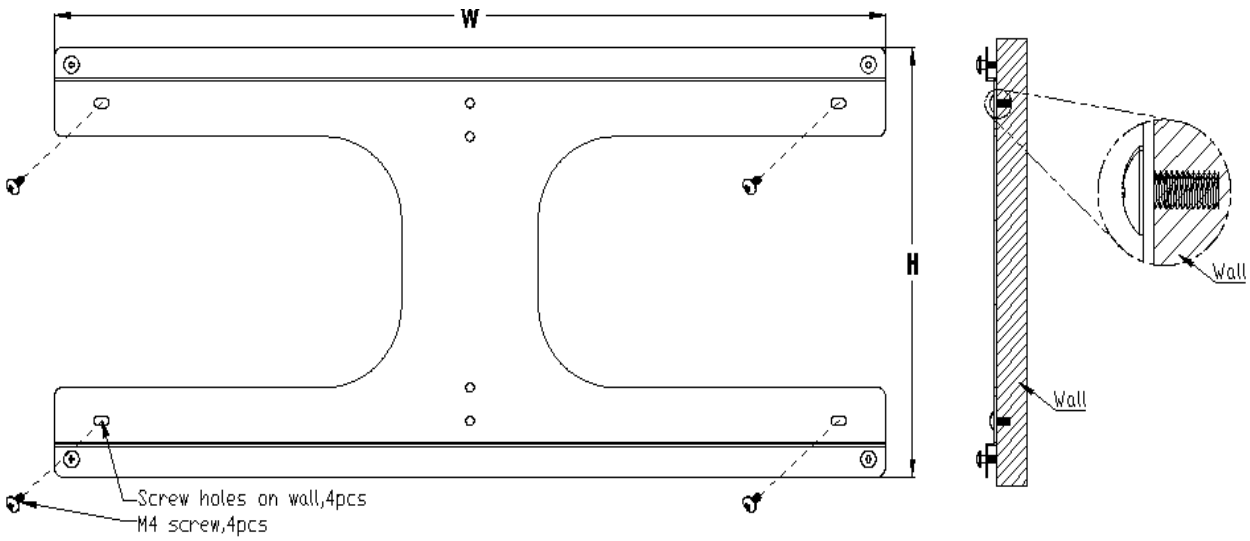
Mount SOLEIL to the wall

1. Select a wall or solid place can support the inverter.
2. Convection cooling space required. To dissipate the heat generated by inverter, 25cm space at least on the top and bottom is necessary.
3. Mark the hole position according to following table or mounting template attached.

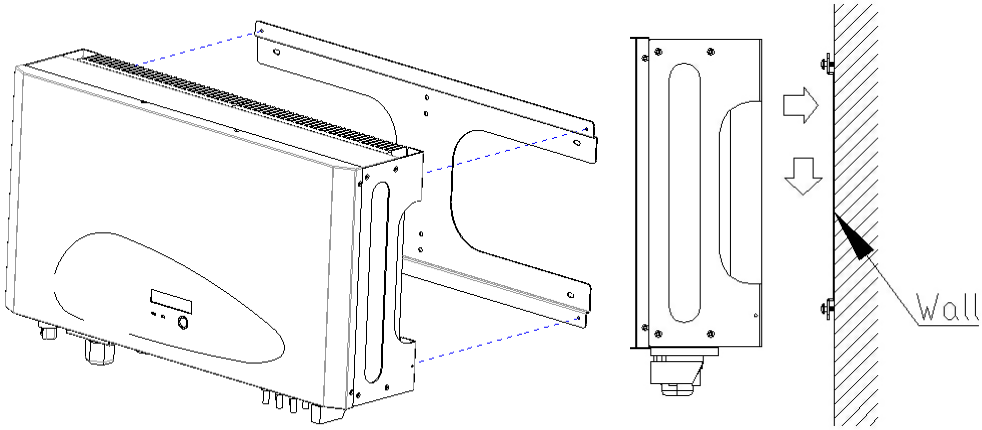


	SOLEIL1500	SOLEIL 2000	SOLEIL 3000	SOLEIL 4000	SOLEIL 6000
W (mm)	347.6	347.6	347.6	546	546
H (mm)	257	257	257	257	327

4. Drill the holes with screw.



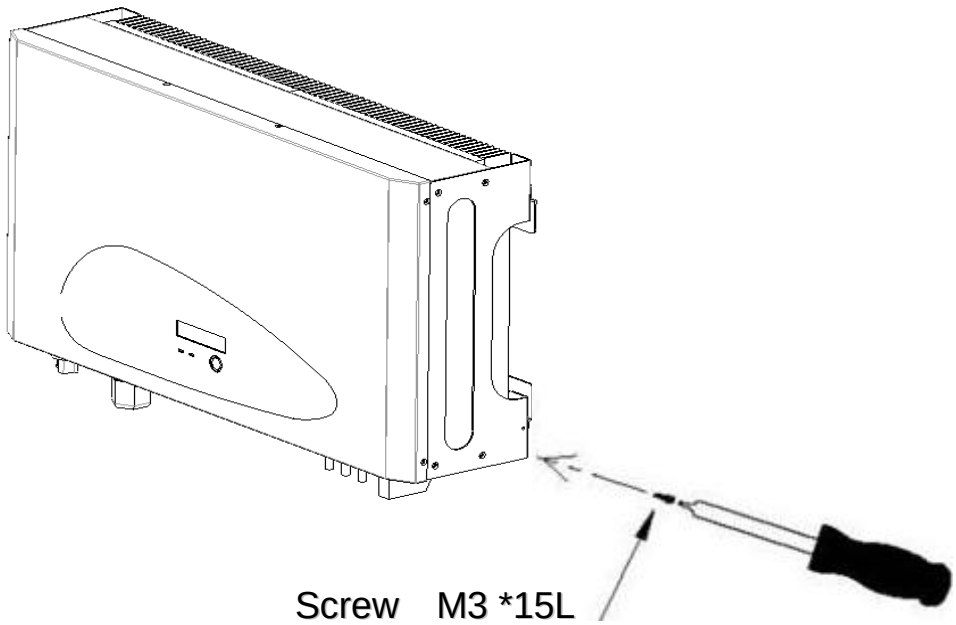
5. Hang the inverter on the 4 screws.



6. Drive “fix screw” on bottom leg to fix the inverter.

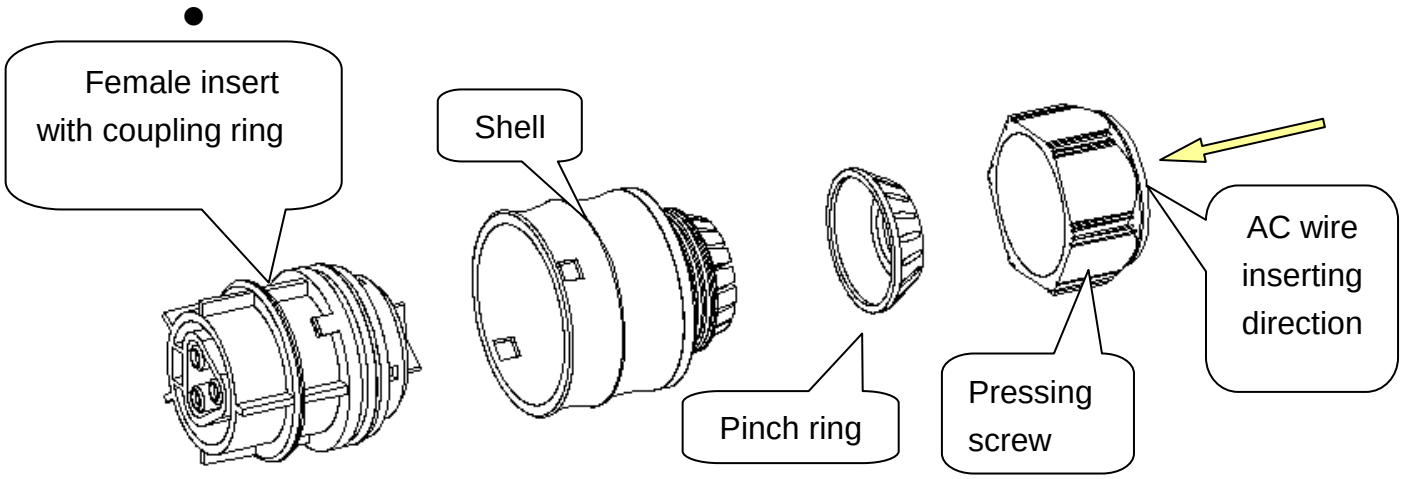
Be sure to check the mounting of inverter. Try to lift up the inverter on the bottom, make sure it is firmly attached.

Select the installation location carefully. The height of inverter is recommended to be seeable, so that user can check the inverter status easily; the wall must be firmly enough, this can prevent slight vibration during inverter working.



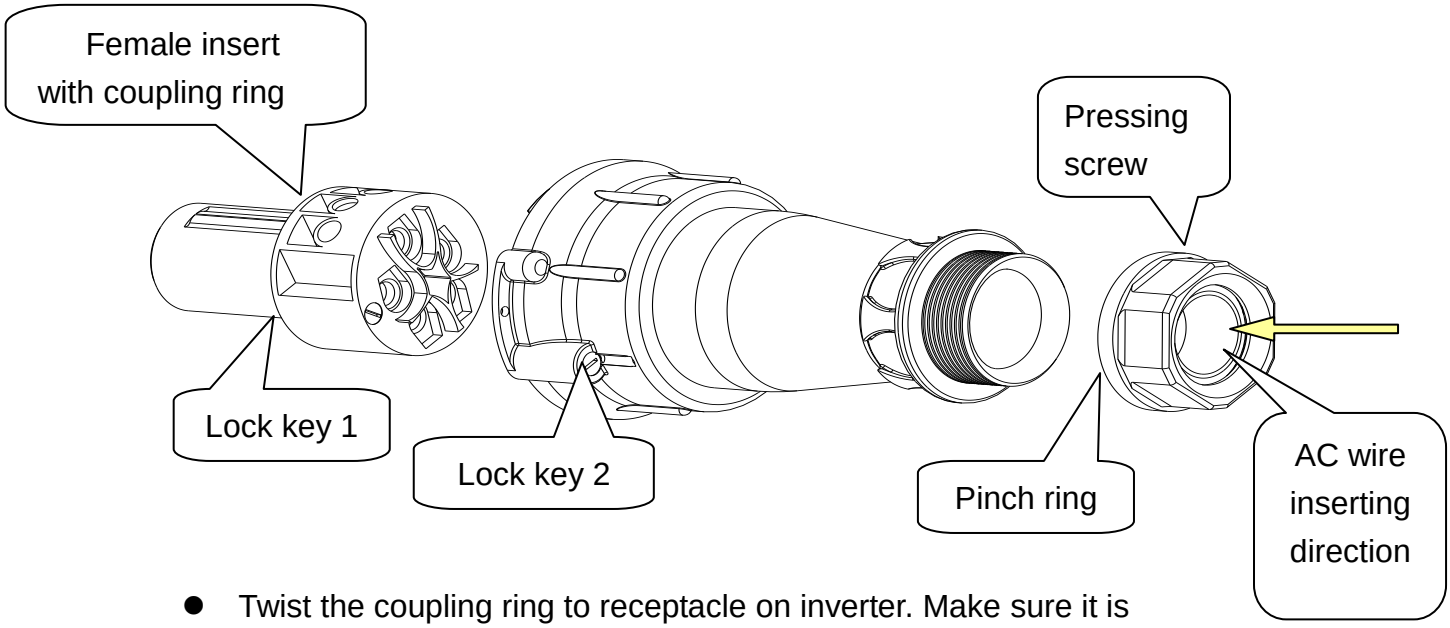
Connect to grid (AC utility)

1. Check the grid (utility) voltage and frequency, 230VAC (or 220VAC), 50/60Hz, single phase.
2. Open the AC breaker or fuse between AC wire and utility.
3. For SOLEIL 4000 3000 2000 1500, connect AC wires as follows:
   - Disassemble female socket.
   - Connect AC wires to connection socket as indication:



- Insert Line wire to **L**, Neutral wire to **N** and Ground wire to pin ⏚
- Assembly the socket again. Insert the whole socket set to inverter.
- Twist the coupling ring to receptacle on inverter. Make sure it is perfectly matched.

4. For SOLEIL-6000, connect AC wires as follows:
   - Disassemble female socket and turn on the lock key 1.
   - Connect AC wires to connection socket as indication:
   - Insert Line wire to **1** or **L**, Neutral wire to **N** and Ground wire ⏚ to pin
   - Assembly the socket again and turn off the lock key **1**. Insert the whole socket set to inverter and turn off the lock key **2**.



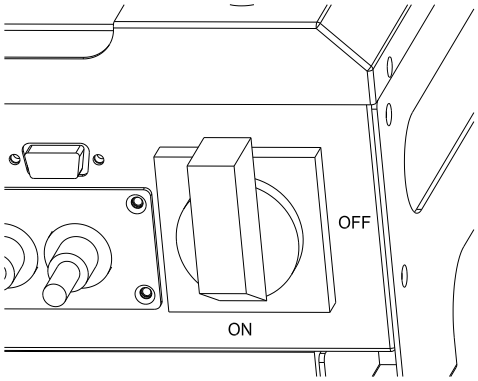
- Twist the coupling ring to receptacle on inverter. Make sure it is perfectly matched.

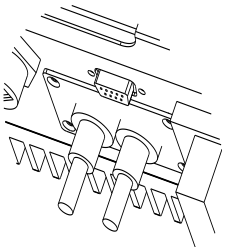
5. Suggested wire size for AC cable:

Model	ϕ (mm)	AWG no.
SOLEIL-1500	≥1.29	≤16
SOLEIL -2000	≥1.29	≤16
SOLEIL -3000	≥1.72	≤14
SOLEIL -4000	≥2.05	≤12
SOLEIL -6000	≥2.85	≤8

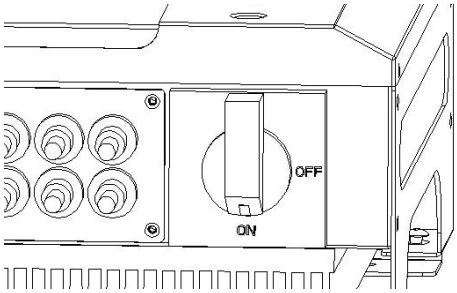
Connect to PV array (DC)

SOLEIL 3000 2000 1500

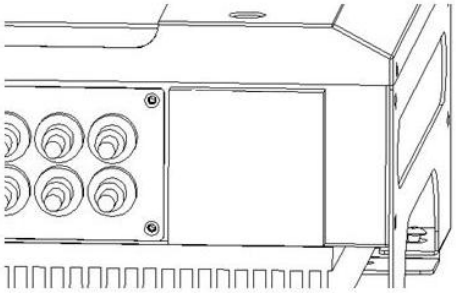




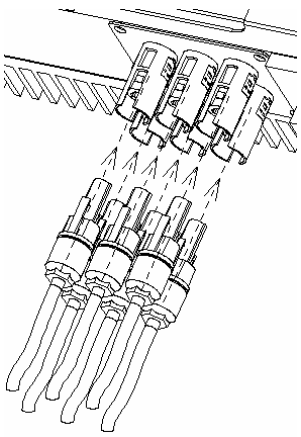
SOLEIL 4000



SOLEIL 6000



1. Turn off the DC switch.
2. Make sure **the maximum open circuit voltage (V_{oc})** of each PV string is less than 500V UNDER ANY CONDITION**(SOLEIL 6000 is 600V)**. We recommend use PV array which **V_{oc}** is less than **430VDC** under 25°C ambient.
3. Use MC (Multi-contact® or Tyco) connectors as PV array terminals.
4. Connect positive from array to (+) terminals and negative to (-) terminals. Each DC terminal on SOLEIL can withstand 20A DC current at most**(SOLEIL 6000 is 30A)**.
5. Turn on the DC switch.



Note:

Before connecting to DC terminals, please make sure the polarity is correct. Incorrect connection will damage the unit forever!

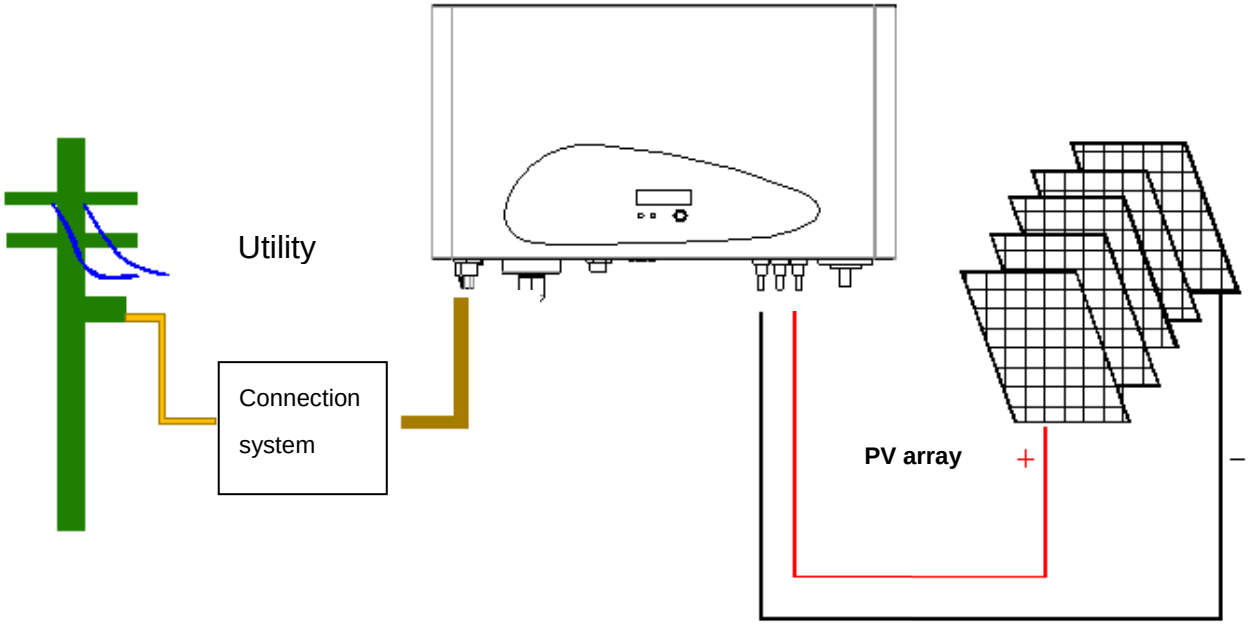
Checking

1. After connecting DC[1], the message on the LCD display should be in the sequence of “INV Waiting” → “No Utility” and the RED fault LED keeps on.
2. Close the AC breaker or fuse in previous section, check whether the inverter starts to work.
3. If inverter works normally, the LCD will show “Working mode”. That is the power feed to grid.
4. The checking is completed.

[1] The AC is not connected yet!

3. System diagram

1. The connection of whole PV system is indicated as figure.
2. PV array: Provide DC power to SOLEIL inverter.



3. SOLEIL inverter: Convert DC power from PV array to AC (Alternative Current) power. Because SOLEIL is a grid-connected inverter, it works to control its current amplitude according to power provided from PV array. SOLEIL always try to get maximum power from PV array.
4. Connection system: The “interface” between Utility and inverter. It may consist of electrical breaker, fuse and terminals for connection. To make sure safety, this part must be designed by qualified technician.
5. Utility: It is also call “grid” in this manual. The way your power company provides power to your place. Please note that, SOLEIL can connect to low-voltage system (namely, 220, 230VAC) system only.

4. Auto test function

(1) How to enter “Auto Test Procedure”

In “Working Mode”, press the button over 5 sec., LCD will show “Setting” PV inverter will enter function setting mode, after that toggle the button, you will see the following setting items:

Contrast Set
Language Set
Auto Test Set

When you see “Auto Test Set”, press the button over 5 seconds, LCD will show “Setting” then PV inverter will start “Auto Test Procedure”.

(2) How to escape “Auto Test Procedure” during “Auto Test Procedure”

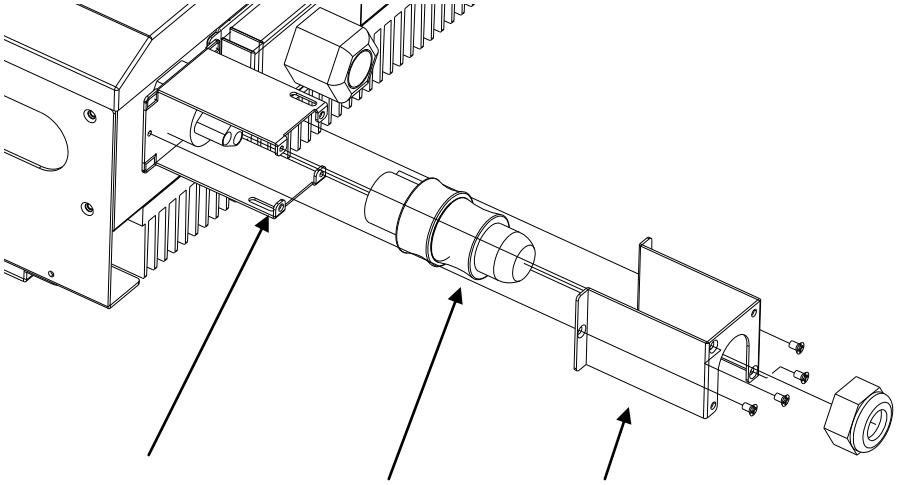
During the “Auto Test Procedure”, if user press button over 5 seconds, LCD will show “Escape Auto Test” then PV inverter will stop “Auto Test Procedure”.

5. Sealing wire

We provide a sealing box to ENEL service personal (the local installer) to seal the AC output connector.

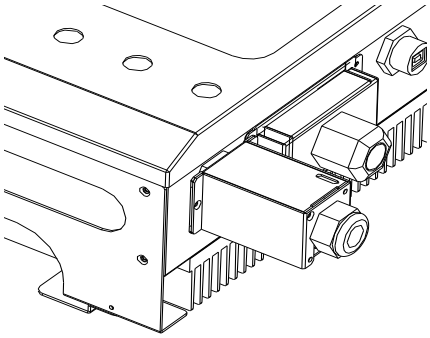
SOLEIL 4000 3000 2000 1500

1. Please insert the **sealing box 1** to AC connector.

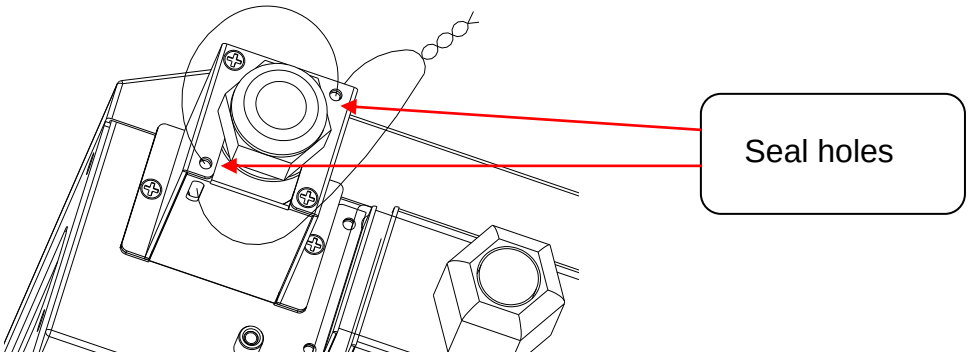


Sealing box 1 AC connector **sealing box 2**

2. Please insert the AC connector and **sealing box 2**.

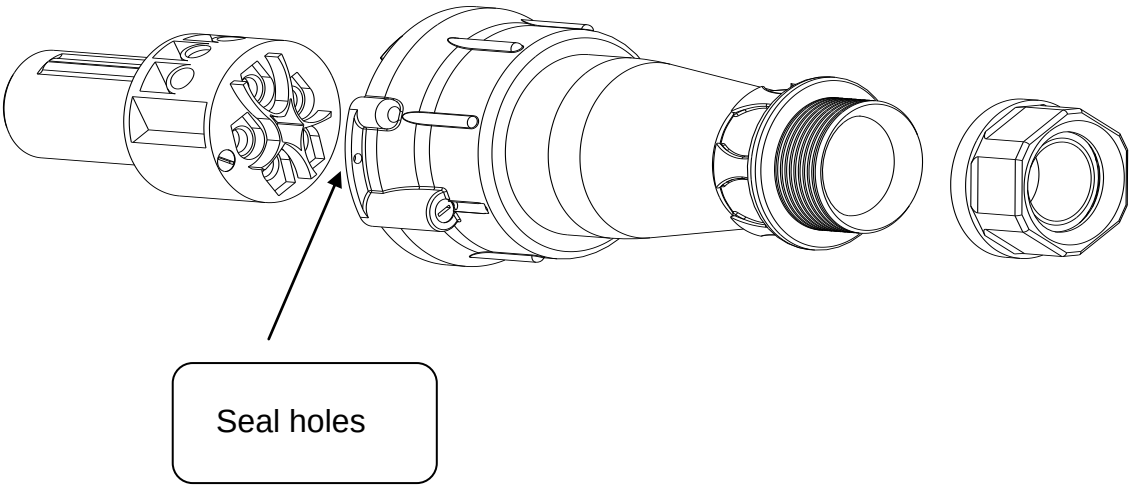


3. Turn the screw to tighten it.



4.The seal wire through the two seal holes and tighten it.

SOLEIL 6000



6. Inverter status

SOLEIL is designed to be friendly, therefore, the status of inverter can be easily understood by panel display. All the possible information is shown in the following table.

Display information

LED

There are 2 LED's on SOLEIL, one is blue and the other is red.

1. Power on (Blue LED): It lights when SOLEIL is working.
   It will be dark when fault mode or shutdown mode.
2. Fault (red LED): Once the LED light, it means inverter meets "fault" or "failure" conditions. The detail conditions can be found in the table below.

LCD

(A) In generally, LCD will show "Working Mode" as SOLEIL is working.

(B) When LCD shows "Working Mode", press button over 3 sec., LCD will show "Setting" then enter setting function mode:

LCD Contrast setting > press button over 3 sec. to enter
Press button to select: Contrast 1 to Contrast 5
Then press button over 3 sec.
LCD will show "Setting", Contrast setting is OK.

LCD Language setting > press button over 3 sec. to enter
Press button to select: English or French or German.
Then press button over 3 sec.
LCD will show "Setting", Language setting is OK.

If user doesn't touch button over 5 sec.,
LCD will escape setting function mode.

(C) In "Working Mode", you can toggle button to enter meter value mode,
LCD will show general meter value by turns:
O/P WATT =
PV VOLT =
GRID VOLT =
GRID FREQ =

O/P CUR =
xxx KWH (O/P energy)
RATING= xx KW (PV Inverter Rating)
M CPU Ver xxx (Firmware version of Mater CPU)
S CPU Ver xxx (Firmware version of Slave CPU)

1). If user doesn't touch button over 5 sec., LCD will escape meter value mode then LCD shows "Working Mode".
2). During meter value mode, if user press button over 5 sec., the current screen will "Freeze" (Lock).
3). If screen is freezing (Lock), user press button over 5 sec., the current screen will "Unfreeze" (Unlock).

(D) Error Message:

No Utility	No AC Line
PV Over Voltage	PV Voltage is too high
DC Bus High	DC bus voltage is too high
DC Bus Low	DC bus voltage is too low
Over Temperature	Temperature is too high
Grid Fault	Grid Voltage or Grid Frequency is wrong
Device Fault	Hole sensor, GFCI Device or AD Reference Voltage Fault
Isolation Fault	PV Panel isolation problem
Impedance Fault	Grid Impedance Fault
Ground I Fault	Output ground leakage current too high
Relay Failure	Output Relay Fail
DC INJ High	Output DC injection too high
Ref 2.5V Fault	2.5V reference voltage inside problem
DC Sensor Fault	Output DC sensor abnormal
GFCI Fault	GFCI detection problem
Sci Fault	Communication between Master and Slave problem
Consistent Fault	The value of Master and Slave are mismatch
CPU Ver Mismatch	Firmware Version of Master and Slave are not the same
EEPROM Fault	EEprom problem
Grid V Mismatch	The Grid V of Master and Slave are mismatch
Grid F Mismatch	The Grid F of Master and Slave are mismatch

Grid Z Mismatch	The Grid Impedance of Master and Slave are mismatch
GFCI Mismatch	The GFCI value of Master and Slave are mismatch
DC Curr Mismatch	The Output DC current of Master and Slave are mismatch

Message table in English

Operating conditions	Display message	Description
Normal working status		
Power off	No display	PV inverter is totally shutdown, IPV <=90V.
Standby	INV Standby	90V< Input voltage < =100V.
Initialization & waiting	INV Waiting	Input voltage range 100~150V during start-up. After PV voltage is higher than 100V, inverter is waiting for feeding to grid.
Check grid	Testing	When PV voltage> 150V, inverter is checking feeding conditions.
Feeding grid, MPPT	Working Mode	Inverter is feeding power.
Updating Master CPU firmware	Master Flash	The internal program is updating Master CPU through RS232 interface.
Updating Slave CPU firmware	Slave Flash	The internal program is updating Slave CPU through RS232 interface.
Monitoring parameters		
Instantaneous Output power	O/P Watt=xxxxW	The real time output power in xxxx W.
Accumulated energy information	xxxxx KWh	Total energy which has been feed to grid since inverter was installed.
Grid voltage	GRID VOLT=xxx.xV	Grid voltage in xxx.x VAC.
Grid frequency	GRID FREQ=xx.xHz	Grid frequency in xx.x Hz.
AC feeding current	O/P CUR=xx.xA	AC grid current amount in xx.x A.
PV panel voltage	PV VOLT=xxx.xV	Input voltage from PV panel, xxx.x VDC.
System fault		
Isolation failure	Isolation Fault	Earth fault of the PV-panels or failure of surge voltage protection.
GFCI (Ground Fault Current Interrupter) active	Ground I Fault	Current on ground conductor is too high.

Grid failure	Grid Fault	Grid measured data is beyond the specification (voltage & frequency).
Abnormal Grid Impedance	Impedance Fault	1. Grid impedance higher than the permissible value. 2. Grid impedance change is higher than limit.
No grid utility voltage	No Utility	1. Inverter is not connected to grid 2. Grid is absent.
DC-Input voltage too high	PV Over Voltage	DC-Input voltage higher than the permissible 500V.
Inverter failure		
Consistent failure	Consistent Fault	The readings of 2 microprocessors are not consistent. It is probably caused of CPU and/or other circuit do not function well.
Bus failure	DC Bus High DC Bus Low	DC-Bus voltage too high or too low.
Device failure	Device Fault	The device is unable to return to normal status.
Temperature too high	Over Temperature	The internal temperature is higher than specified normal value.

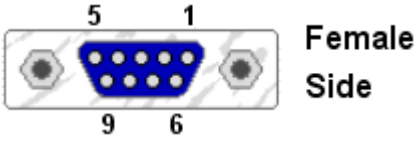
5. Communication

SOLEIL is equipped with power communication interface and options. User can use “Solar Control” software to monitor the status of inverter with PC. Also, qualified personnel can upgrade the f/w inside through RS232 port.

1. RS232: To use RS232 port, you have to remove the RS232 cover on bottom side of SOLEIL. It is a DB9 socket, the pin definition is :

Pin	Assignment Description
1	N.C.
2	TxD
3	RxD
4	N.C.
5	Common
6	N.C.
7	N.C.
8	N.C.
9	N.C.

N.C. means “No Connection”



2. Optional communication slot: This slot is a very powerful extension slot now and future. SOLEIL can accept card special design for the slot only. There are 2 kinds of cards can be applied now. One is RS485 card and the other is SNMP (Simple Network Management Protocol) card. In the future, extension card such as data logger or others may be developed. For card detail information, please refer to use manual of individual card.
3. F/W upgrade: To keep the firmware newest, one can use RS232 port and special program to upgrade inside F/W. To do this, please contact with your local representative.

We do not suggest end-user to upgrade the f/w himself. There is risk to do that without proper operations!

6. Trouble shooting

In this section, the trouble-shooting techniques are stated. This can help the technician to understand the problem and decide a proper action.

Tools to be prepared:

1. Digital Multi-Meter: For checking DCV, ACV, ACF (AC frequency) and open-short circuit.
2. Screwdriver: For removing unit form bracket and disconnect wiring
3. This manual.
4. Laptop computer with the installation of PCM solar control and Firmware upgrade program.
5. Standard RS232 cable.
6. Oscillate Scope (Not necessary).

Fault condition message in English

Fault	Display	Possible actions
System fault	Isolation Fault	1. Check the impedance between PV (+) & PV (-) and earth ground. The impedance must be larger than 8MΩ. 2. If above action is useless, the isolation detection circuit fails, replace one unit.
	Ground I Fault	1. This is caused by too high ground current. 2. Unplug PV generator from the input, check AC peripheral system. 3. After the cause is cleared, plug PV input again. Check the status of the inverter. 4. If above actions are useless, the GFCI circuit fails, replace one unit.
	Grid Fault	1. Wait for 30 seconds, if the grid come back to normal, inverter will start again automatically. 2. Make sure grid voltage and frequency meet the specifications. 3. Use PCM solar control to adjust operation range. 4. If above actions are useless, replace one unit.
	Impedance Fault	1. Grid impedance higher than the permissible value. 2. Wait for 30 seconds, see if it works again. 3. Check the wires between inverter and grid. Change larger wires if necessary. 4. Adjust impedance parameter by PCM solar control program. 5. If useless, the impedance circuit inside failure, please replace another one.

	No Utility	1. Grid is not connected; check the AC connection by multi-meter. 2. Check grid connection, such as wire and connector to the inverter. 3. Check breaker between inverter and grid; if it is tripped, DO NOT CLOSE again, replace another unit.

Fault	Display	Possible actions
Inverter failure	PV Over Voltage	1. Check the PV open voltage, see if it is more than or too close to 500VDC. 2. If PV voltage is much less than 500VDC (e.g. <430V), measure the DCV by multi-meter, compare the readings on meter and LCD, if >5%, replace another unit.
	Consistent Fault	1. It is caused by the reading between main and redundant controllers are different. 2. Disconnect PV (+) or PV (-) from the input, start the unit again. 3. If this does not work, replace another one.
	Device Fault	1. Caused by improper operation of the circuit. 2. Disconnect PV (+) or PV (-) from the input, start the unit again. 3. If it does not work, replace another one.
	Over Temperature	1. The internal temperature is higher than specified normal value. 2. Reduce the ambient temperature by some other ways or move inverter to cooler place. 3. If it is not effective, the temperature sensors fails, replace another one.

7. Specification:

Model	SOLEIL-1500	SOLEIL-2000	SOLEIL-3000	SOLEIL-4000-	SOLEIL-6000
Output power	1500W	2000W	3000W	4000W	6000W
Maximum power	1650W	2200W	3300W	4400W	6000W
Input					
Nominal DC voltage	360 VDC				
Maximum PV open voltage	500 VDC				600V
MPPT range	150 to 500VDC				150 to 600VDC
Working range	100 to 500VDC				100 to 600VDC
Max. input current	7.5ADC	10ADC	15ADC	20ADC	30ADC
Output					
Operational voltage	230VAC				
Operational frequency	50/60Hz, auto selection				
Current distortion	< 3%				
Power factor	> 0.99				
Conversion efficiency (max)	>94%	>95%	>95%	>96%	>96%
European efficiency	>93%	>94%	>94%	>95%	>95%
Environment					
Protection degree	IP 65				
Operation temperature	-25 to 55ºC, output power derating at 40 °C and higher				
Humidity	0 to 95%, non-condensing				
Heat Dissipation	Convection				
Acoustic noise level	<40dB,A-weighted.				
Communication & features					
Comm. Interface	RS232 standard, USB, SNMP & RS485 optional				
F/W upgrade	Yes, via RS232				
Mechanical					
W×D×H (mm)	352x300x133	352x300x133	352x300x143	550x300x133	550x420x143
Weight (kg)	14	14	14	21	27

∗The product's specifications are subject to change without notice.

Rev.	Data Modifica	Descrizione modifica	Compilato	Verificato	Emesso
000	2010-07-13	- Prima emissione	C. Carminati	E. Rusconi	P. Baggi