



## **Installation Manual of SPH series**

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# 1 Brief Introduction

## 1.1 Preface

This manual will provide the users who use the SPH TL BL-UP Series of GROWATT NEW ENERGY TECHNOLOGY CO.LTD.SHENZHEN (Short for GROWATT New Energy as below) with the detailed product information and the installation instructions. Please read this manual carefully and put this manual on some place where is convenient to installation, operation, obtain. Any modifications of GROWATT new energy, we will not notify the user.

## 1.2 Target Group

SPH TL BL-UP inverter must be installed by professional electrical personnel who have obtained the certification of the relevant departments. We have two kinds of energy storage machine for different battery one is for lithium battery and the other is for lead-acid battery, we suggest: customer should decide which kind of energy storage machine you want, GROWATT can provide only lithium battery with energy storage machine, customer can choose lead-acid energy storage machine with no battery provide by GROWATT while they can buy these battery from market easily. Especially if customer choose energy storage system with lithium battery (which must be provide by GROWATT) but used for lead-acid battery or used lead-acid battery for lithium battery model, it will be dangerous. Installer can install energy storage machine of SPH TL BL-UP Series rapidly and troubleshooting, build communication system through read this manual carefully. If you have any questions in the process of installation, you can login in [www.growatt.com](http://www.growatt.com) and leave some message. Or you can call our 24-hour service hotline +86 (0)755 2747 1942

## 1.3 Glossary

### AC

Abbreviation for "Alternating Current"

### DC

Abbreviation for "Direct Current"

### Energy

Energy is measured in Wh (watt hours), kWh (kilowatt hours) or MWh (megawatt hours). The energy is the power calculated over time. For example, your inverter operates at a constant power of 4600 W for half an hour and then at a constant power of 2300 W for another half an hour, it has fed 3450Wh of energy into the power distribution grid within that hour.

### Power

Power is measured in W (watts), kW (kilowatts) or MW (megawatts). Power is an instantaneous value. It displays the power your inverter is currently feeding into the power distribution grid.

### Power rate

Power rate is the ratio of current power feeding into the power distribution grid and the maximum power of the inverter that can feed into the power distribution grid.

### Power Factor

Power factor is the ratio of true power or watts to apparent power or volt amps. They are identical only when current and voltage are in phase than the power factor is 1.0. The power in an ac circuit is

very seldom equal to the direct product of the volts and amperes. In order to find the power of a single phase ac circuit the product of volts and amperes must be multiplied by the power factor.

## **PV**

Abbreviation for photovoltaic

## **BAT**

BAT is an acronym for lithium or lead acid battery

## **Charging**

An SPH hybrid inverter charger uses PV energy or grid energy to charge a battery

## **Discharging**

It means that the SPH hybrid inverter supplies the battery energy to the load

## **wireless communication**

The external wireless communication technology is a radio technology that allows the inverter and other communication products to communicate with each other. The external wireless communication does not require line of sight between the devices and it is selective purchasing.

## **1.4 Product Description**

SPH Series is used to store energy generated by the photovoltaic cell panels or energy from grid if it is allowed in the battery, also energy can be sent to power grid through SPH for self consumption or when Grid power is lost, SPH can be used as backup power.

SPH series has six kinds of type:

- Growatt SPH3000.
- Growatt SPH3600.
- Growatt SPH4000.
- Growatt SPH4600.
- Growatt SPH5000.
- Growatt SPH6000.
- SPH 3000TL BL-UP
- SPH 3600 TL BL-UP
- SPH 4000TL BL-UP
- SPH 4600TL BL-UP
- SPH 5000TL BL-UP
- SPH 6000TL BL-UP

Note: We describe this series as "SPH" as below.

### **Note:**

In different country, we provide different power. Such as in Germany, we can provide SPH 3000~SPH 4600TL BL-UP& Growatt SPH3000~ Growatt SPH4600, but we don't provide SPH 5000TL BL-UP (Growatt SPH5000 )and SPH 6000TL BL-UP(Growatt SPH6000).

### **Overview:**

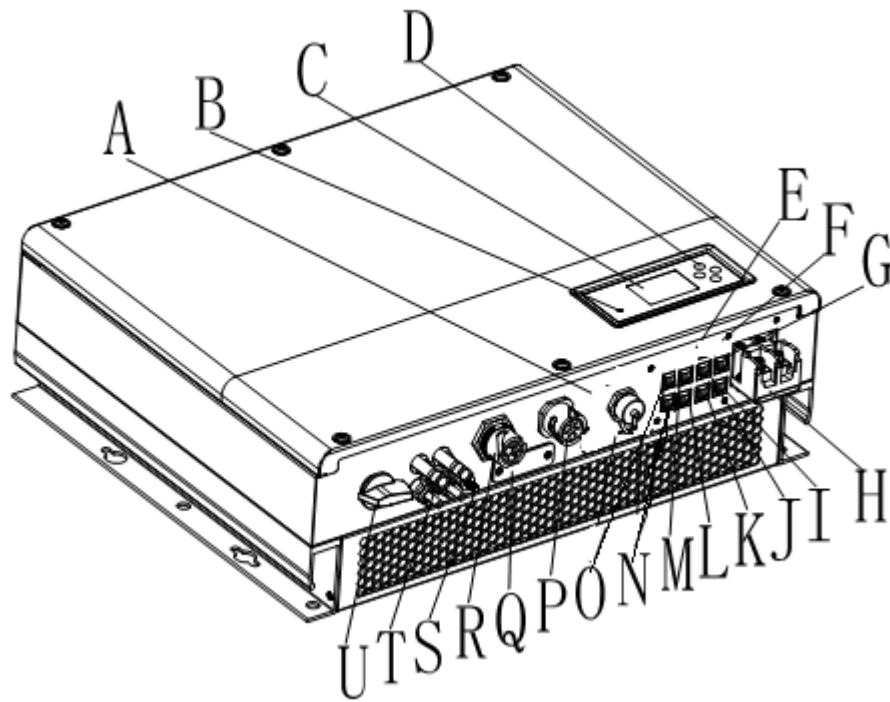


Chart 1.1

Position	Description
A	USB interface
B	LED of status display
C	LCD screen
D	Function button
E	DIP switch ( set safety standard )
F	Dry contact
G	RS485 communication interface of Lithium battery
H	Battery terminal
I	CAN communication interface of Lithium battery
J	RJ45 interface of DRMs(used only in Australia)
K	NTC: Lead-acid temperature sensor terminal
L	RS485 communication interface of meter
M	CT input terminal
N	RS485-1 communication
O	VPP communication
P	AC Grid (on grid connection)
Q	RSD(do not open except by Professional staff)
R	EPS output(off grid connection)
S	Ground point
T	PV input
U	PV switch

## **1.5 Safety Instructions**

1. Please be clear which kind of battery system you want, lithium battery system or lead-acid battery system, if you choose the wrong system, SPH can't work normally.

2. Please read this manual carefully before the installation, the company has the right not to quality assurance, if not according to the instructions of this manual for installation and cause equipment damage.

3. All the operation and connection please professional electrical or mechanical engineer.

4. During installation, please don't touch the other parts within the box.

5. All the electrical installation must comply with the local electrical safety standards.

6. If equipments needs to maintain, please contact with local specify system installation and maintenance personnel.

7. Use the equipment to combined to grid needs to obtain the permission of local power supply department.

8. When install PV modules in the daytime, please turn off the PV switch, Otherwise it will be dangerous as high terminal voltage of modules in the sunshine.

## **2 Safety**

### **2.1 Purpose Use**

The system chart of SPH:

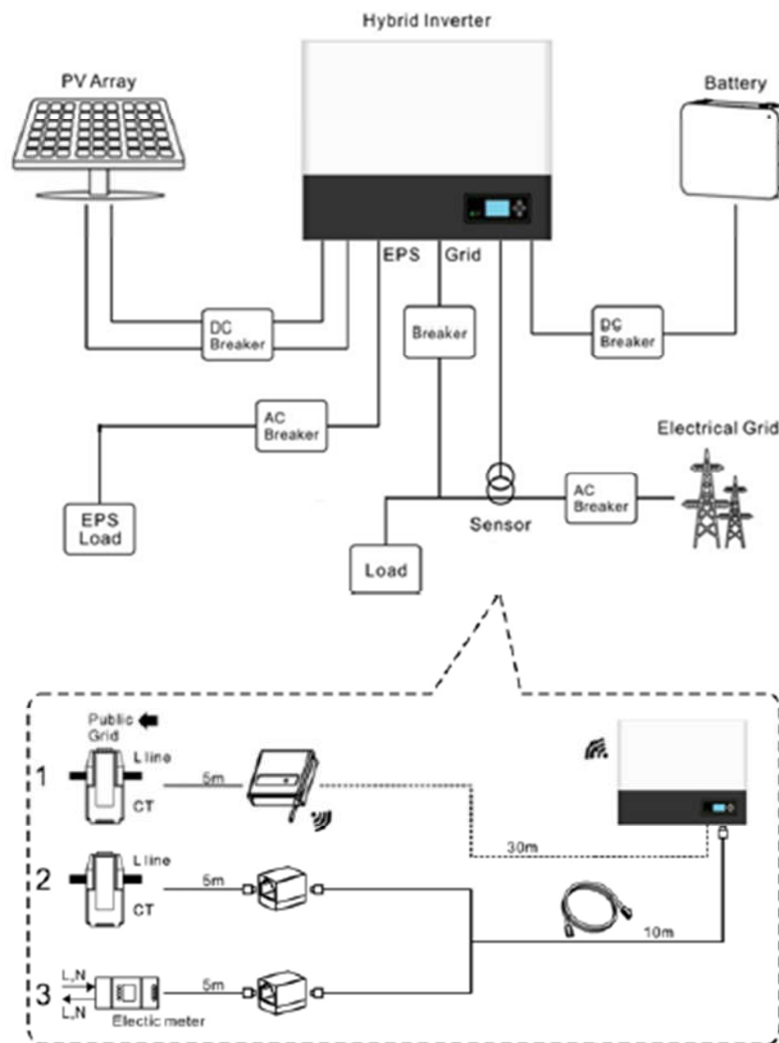


Chart 2.1

As shown above, a complete grid-connected system of SPH TL BL-UP consists of PV modules, SPH TL BL-UP inverter, battery, utility grid and other components.

**Attention:**

As the system refer to battery use, we must make sure ventilation of the service environment and temperature control in order to prevent the danger of battery explosion, battery recommended installation environment must be strictly in accordance with the specification, if the specification is IP20 environment, the pollution degree of the unit is PD2, meanwhile the temperature should be control in the 0-40°C of indoor ventilation and the humidity should be 5%-85%. If the chosen PV modules needs to positive or negative ground connection, please contact with Growatt for technical support before installation.

**2.2 Safety Measure**





DANGER

**Risk of high voltage !**

- Relevant operation for professional personnel
- Please notice children, disabled, laypeople do not close
- Supervise and make sure children don't play near the installation position of energy storage machine



DANGER

**Risk of burns on the parts shell of SPH inverter !**

- During the work, Cover, shell around, radiator is likely to be hot



CAUTION

**SPH inverter exists radiation maybe affect health !**

Don't stay a long time within 20cm range from SPH inverter









**SPH inverter ground connection**

Please ensure SPH inverter ground connection is reliable for make sure people's safety

**2.3 Symbols introduction on the SPH inverter**



Symbol	Description
	Caution: Risk of electrical shock!
	Caution : hot surface
	Caution: risk of danger

	<p>Danger to life due to high voltage in SPH</p> <p>There is residual voltage in SPH, SPH requires 5 minutes to discharge.</p> <p>Please wait 5 minutes before you open the upper lid or the DC lid.</p>
	<p>Protective conductor terminal</p>
	<p>Direct Current(DC)</p>
	<p>Alternating Current(AC)</p>
	<p>The machine complies with the requirements of the applicable CE guidelines</p>
	<p>Refer to the operating instructions.</p>

### 3 Product Description


#### 3.1 SPH TL BL-UP series inverter

##### Marks of SPH

Mark	Description	Explanation	
	<p>Push-button</p>	<p>Operation of display screen and set system</p>	
	<p>Status symbol of SPH</p>	<p>Green light on</p>	<p>SPH run normally</p>
		<p>Red light on</p>	<p>Fault state</p>
		<p>Green light blinking</p>	<p>1.Alarm state</p>
		<p>Red light blinking</p>	<p>2.Software updating</p>

#### 3.2 Label Explanation


Label contains the following information: for example SPH 6000TL BL-UP shows as below:

<b>GROWATT</b> Hybrid Inverter	
Model name	SPH 6000TL BL-UP
<b>PV Input data</b>	
Max. PV voltage	550 d.c.V
PV voltage range	120-550 d.c.V
PV Isc	16.9 d.c.A*2
Max. input current	13.5 d.c.A*2
<b>AC output/Input data</b>	
Rated input/output power	6000/6000 W
Rated. output apparent power	6000 VA
Nominal voltage	230 a.c.V
Rated. input/output current	27/27 a.c.A
Nominal Frequency	50 Hz
Power factor range	0.8leading-0.8lagging
<b>Stand alone data</b>	
Rated AC output power	4000 VA
Rated AC output voltage	230 a.c.V
Rated output current	17.5 a.c.A
Rated AC output Frequency	50 Hz
Power factor range	0.8leading-0.8lagging
<b>Battery data</b>	
Battery voltage range	42-59 d.c.V
Rated. charging and discharging current	85 d.c.A
Type of battery	Lithium / Lead-acid
<b>Others</b>	
Safety level	Class I
Overvoltage category	PV:II AC:III Others:I
Ingress Protection	IP65
Operation Ambient Temperature	-25°C - +60°C
Inverter topology	Non-isolated
Certificate No.	SAAXXX
	
x <b>Made in China</b>	

Description of label:

Hybrid Inverter	
Model name	SPH 6000TL BL-UP
PV input data	
Max. PV voltage	550V d. c. V
PV voltage range	120-550 d. c. V
PV Isc	16.9 d. c. A*2
Max. input current	13.5d. c. A*2

AC output/input data	
Rated output/input power	6000/6000W
Rated output apparent power	6000VA
Nominal voltage	230 a. c. V
Rated input / output current	27/27 a. c. A
Nominal Frequency	50Hz
Power factor range	0.8leading~0.8lagging
Stand alone data	
Rated output apparent power	4000VA
Nominal voltage	230 a. c. V
Rated output current	17.5 a. c. A
Nominal Frequency	50 Hz
Power factor range	0.8leading~0.8lagging
Battery data	
Battery voltage range	42~59 d. c. V
Rated charging and discharging current	85 d. c. A
Type of Battery	Lithium/Lead-acid
other	
Safety level	Class I
Overvoltage category	PV:II AC:III Others:I
Ingress protection	IP65
Operation Ambient Temperature	-25°C~+60°C
Inverter topology	Non-isolated
Certificate No	SAAXXX

<b>GROWATT</b> Hybrid Inverter	
Model name	Growatt SPH6000
<b>PV input data</b>	
Max. PV voltage	550 d.c.V
PV voltage range	120-550 d.c.V
PV Isc	16.9 d.c.A*2
Max. input current	13.5 d.c.A*2
<b>AC output/input data</b>	
Rated input/output power	3000/6000 W
Rated. output apparent power	6000 VA
Nominal voltage	230 a.c.V
Rated. input/output current	13.5/27 a.c.A
Nominal Frequency	50 Hz
Power factor range	0.8leading~0.8lagging
<b>EPS output data</b>	
Rated AC output power	3000 VA
Rated AC output voltage	230 a.c.V
Rated output current	13.5 a.c.A
Rated AC output Frequency	50 Hz
Power factor range	0.8leading~0.8lagging
<b>Battery data</b>	
Battery voltage range	42-59 d.c.V
Rated. charging and discharging current	66 d.c.A
Type of battery	Lithium / Lead-acid
<b>Others</b>	
Safety level	Class I
Overvoltage category	PV:II AC:III Others:I
Ingress Protection	IP65
Operation Ambient Temperature	-25°C - +60°C
Inverter topology	Non-isolated
Certificate No.	SAAXXX
	
x <b>Made in China</b>	

Hybrid Inverter	
Model name	GrowattSPH6000
PV input data	
Max. PV voltage	550V d. c. V

PV voltage range	120-550 d. c. V
PV I <sub>sc</sub>	16.9 d. c. A*2
Max. input current	13.5d. c. A*2
AC input / output data	
Rated input / output power	3000/6000 W
Rated output apparent power	6000VA
Nominal voltage	230 a. c. V
Rated input / output current	13.5/27 a. c. A
Nominal Frequency	50 Hz
Power factor range	0.8leading~0.8lagging
EPS output data	
Rated output apparent power	3000VA
Nominal voltage	230 a. c. V
Rated output current	13.5 a. c. A
Nominal Frequency	50 Hz
Power factor range	0.8leading~0.8lagging
Battery data	
Battery voltage range	42~59 d. c. V
Rated charging and discharging current	66 d. c. A
Type of Battery	Lithium/Lead-acid
other	
Safety level	Class I
Overvoltage category	PV:II AC:III Others:I
Ingress protection	IP65
Operation Ambient Temperature	-25°C ~+60°C

Inverter topology	Non-isolated
Certificate No	SAAXXX

### 3.3 Size and weight

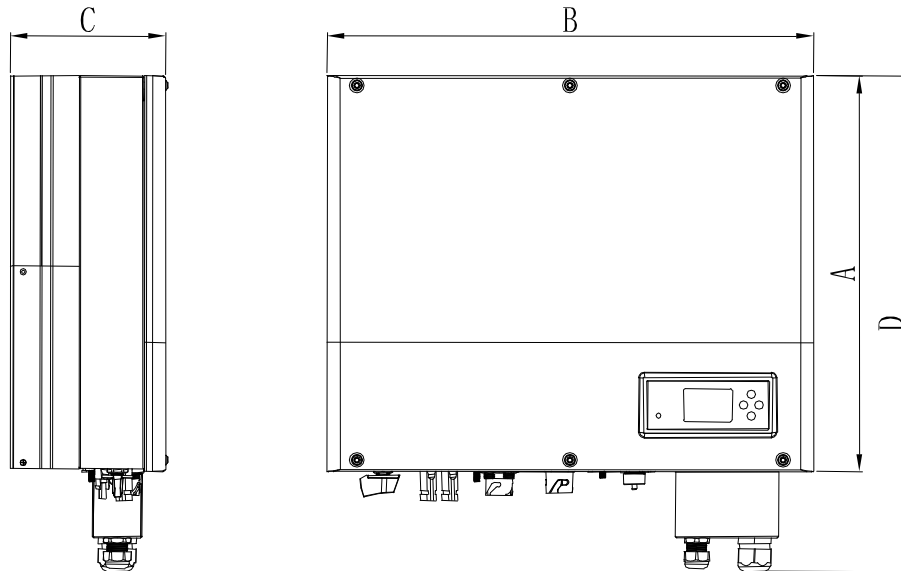


Chart 3.1

	A(mm)	B(mm)	C(mm)	weight(kg)
SPH TL BL-UP	450	565	188	27

### 3.4 The advantage of the unit of SPH

Features below:

- All in one design. Can improve self consumption, back up and also Pinch the valley
- Smart management, work mode can be set
- Safe battery used
- Easy installation
- Two mpp tracker input

## 4 Unpacking

Please check whether external damage to the goods before unpacking.

After unpacking, please check whether the unit damage or missing parts, if it is happen, please contact with supplier.

Growatt SPH series and accessories as follows:

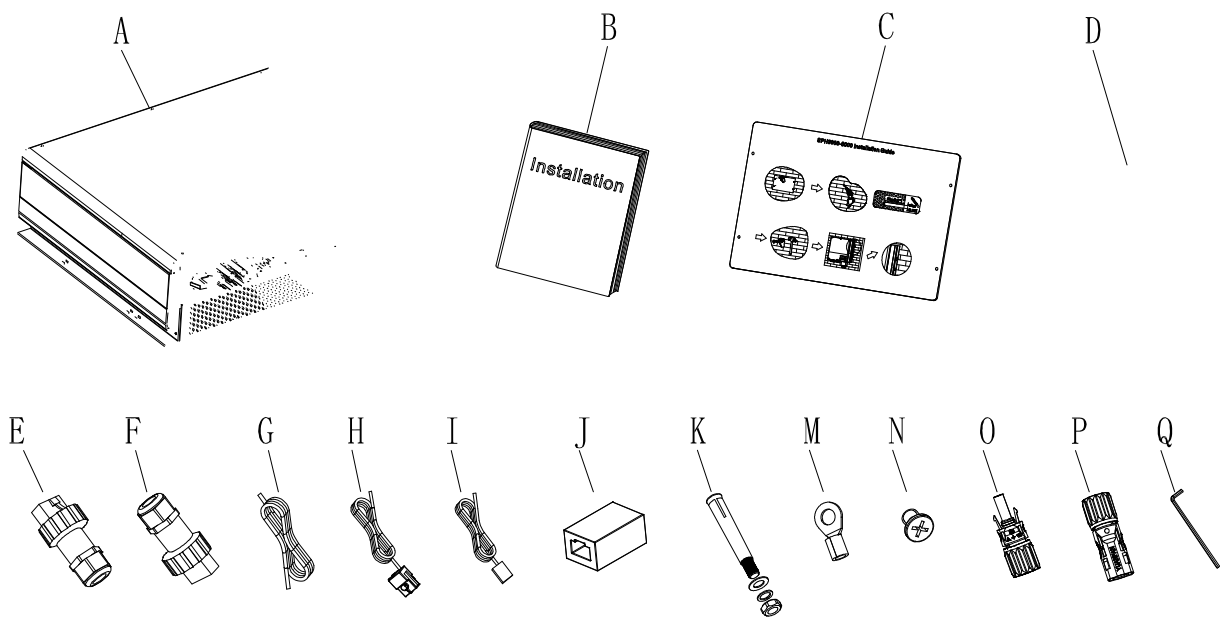


Chart 4.1

Item	Number	Description
A	1	SPH inverter
B	1	User Manual
C	1	Paper board(installation guide)
D	1	Waterproof cover
E	1	AC Grid connector
F	1	EPS output connector
G	1	Communication cable
H	1	Current sensor
I	1	Lead-acid battery temperature sensor
J	1	RJ45 connector
K	4	M6 setscrew
M	2	Battery power terminal
N	6	screw
O/P	2/2	MC4 connector
Q	1	Hex screwdriver

## 5 Installation

### 5.1 Basic installation requirements

- A. The installation location must be suitable for SPH's weight for a long period time
- B. The installation location must conform with dimension of SPH
- C. Do not install the unit on structures constructed of flammable or thermo labile materials
- D. The ingress Protection rate is IP65 and the pollution degree is PD2. Please refer to the below:



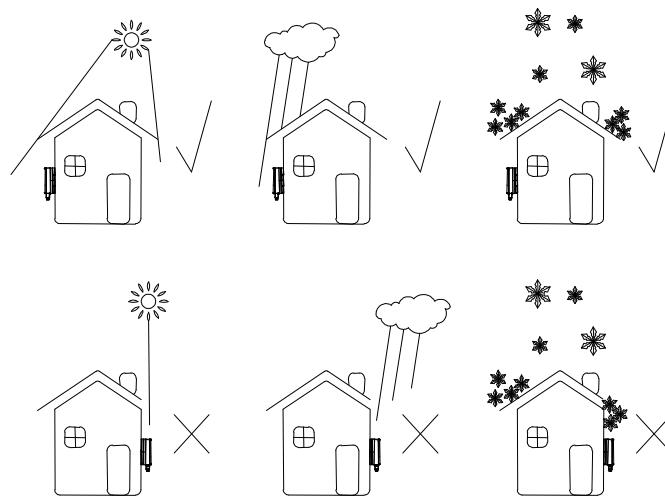


Chart 5.1

E. Battery installation option is not far away from the position of SPH, the length between SPH and battery should not be more than 1.5m.

F. The ambient temperature should be  $-25^{\circ}\text{C} \sim 60^{\circ}\text{C}$ .

G. SPH can be installed in vertical or lean back on plane, please refer to the below:

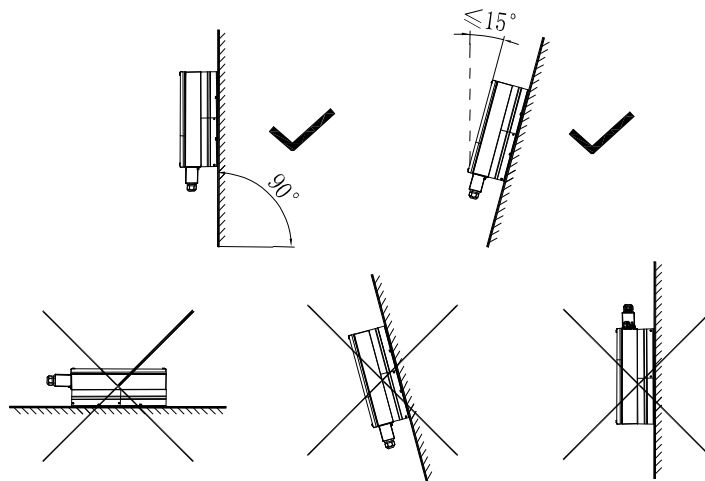


Chart 5.2

H. Installation position shall not prevent access to the disconnection means.

I. In order to ensure machine can run normally and easy to operate, please pay attention to provide adequate space for SPH, please refer to below:

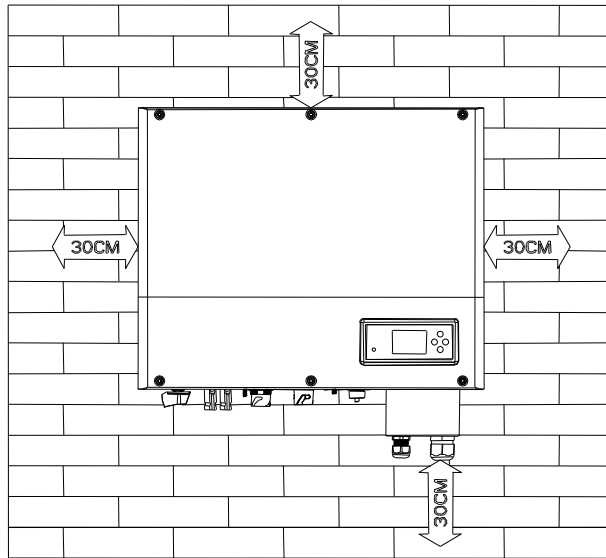


Chart 5.3

- J. Do not install the machine near television antenna or any other antennas and antenna cables
- K. Don't install the machine in the living area
- L. Be sure that the machine is out of the children's reach
- M. Taking the battery fixing space into account, about the dimensions please reference user manual
- N. The inflammable and explosive dangerous goods must not be placed around battery in case of cause serious danger.

**5.2 Installation requires tools and RJ 45 terminal sequence of the LAN line.**

When installing, we need to use tools as follow, prepare the follow tools before installing:



Chart 5.4

No.	Description
1	Press the RJ45 terminal
2	Press battery terminal connector
3	Disconnect PV terminal
4	Unscrew nut
5	Unscrew screw
6	Knock explosion bolt
7	Drill holes on the wall

LAN line RJ45 sequence as follow:

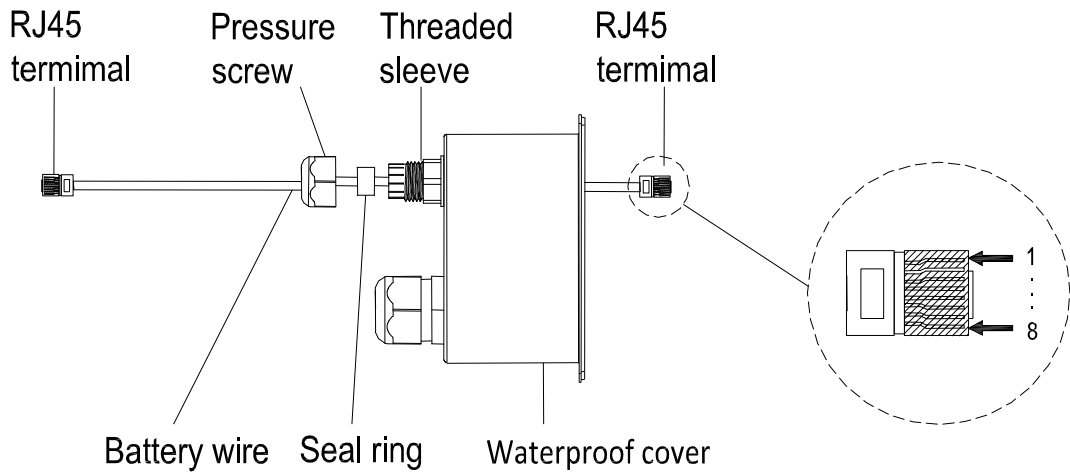


Chart 5.5

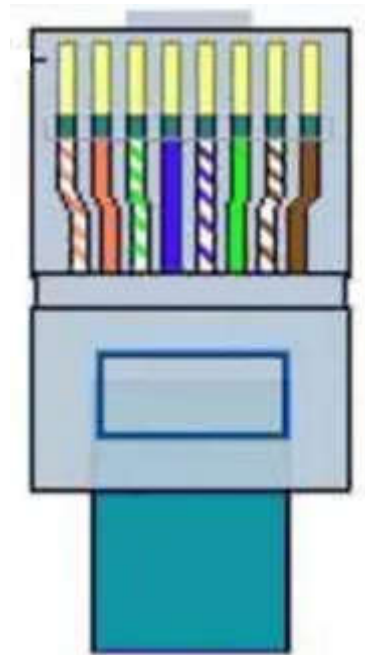


Chart 5.6

LAN line 1-8 colors as below:

PIN	1	2	3	4	5	6	7	8
Color	White orange	Orange	White green	Blue	White blue	Green	White brown	Brown

## 5.3 Installation Instructions

### 5.3.1 Attention Layout (length of sensors consider)

There're three types of sensors for use with SPH. One is wired current sensor, one is meter sensor, or SP-CT, if you choose wired sensor or meter. Before installing you should know something that as below:

The cable of wired sensor and meter is suggested not longer than 15m. So you need to consider the length between SPH with combiner box for the sensor should be installed in the live line. And if you installed SP-CT for sensor, distance recommended not more than 30 meters.

The installation layout of energy storage machine at home as following:

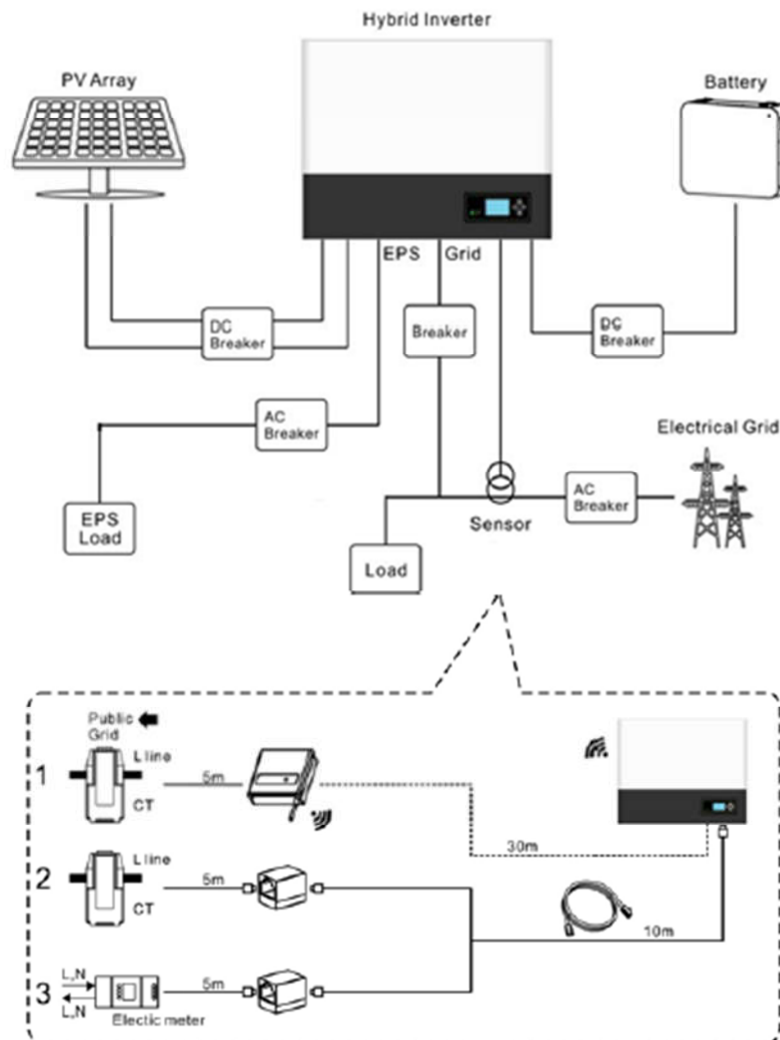


Chart 5.7-1 SPH 3000-6000TL BL-UP

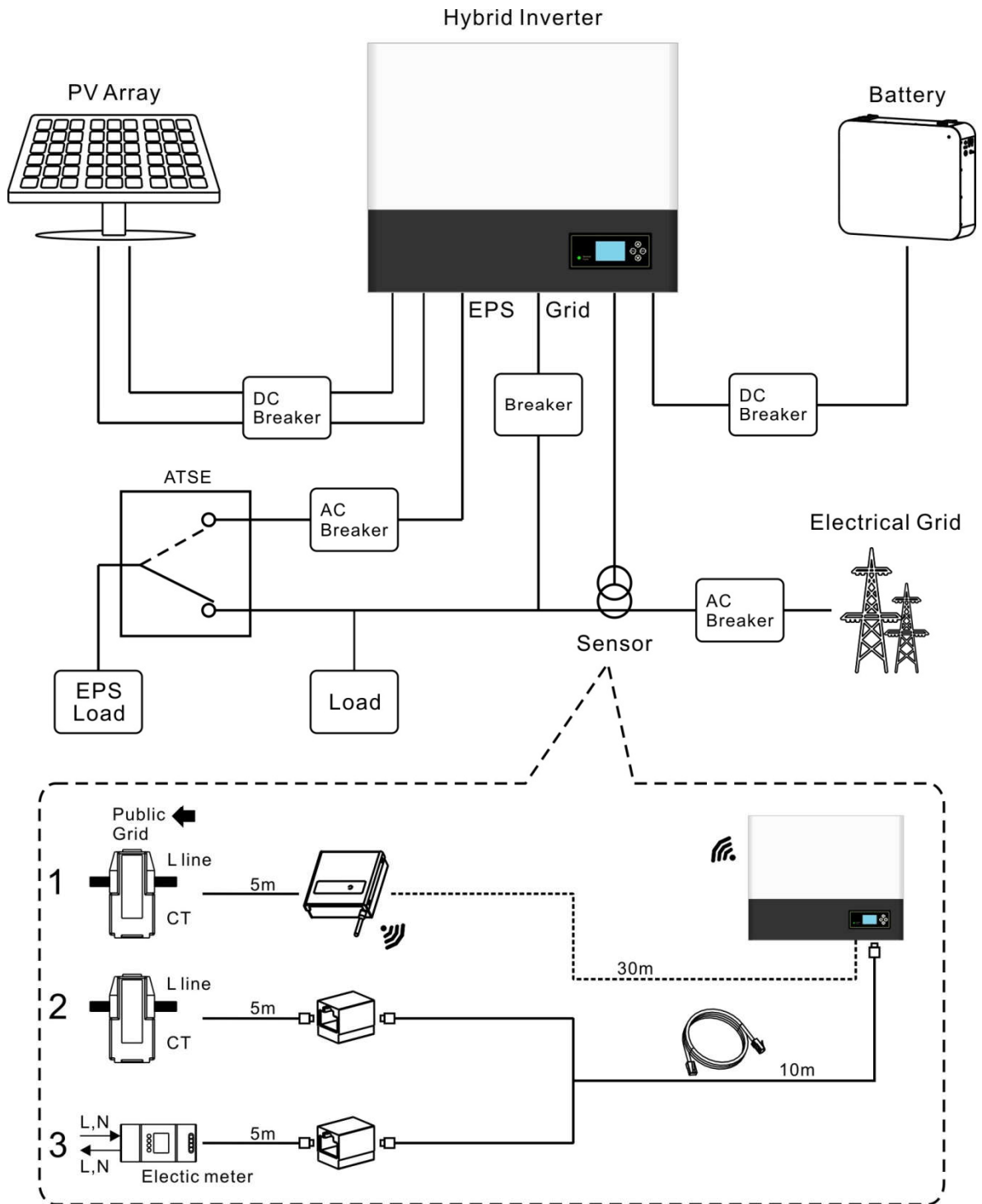
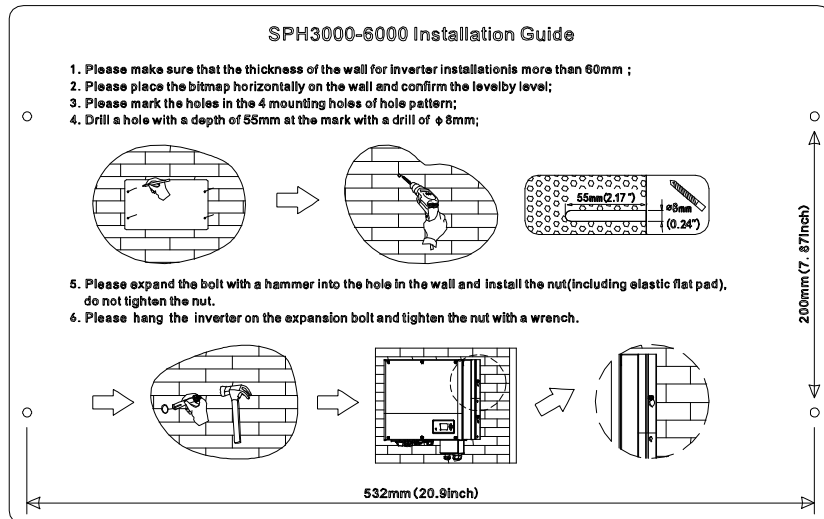


Chart 5.7-2 Growatt SPH 3000-6000

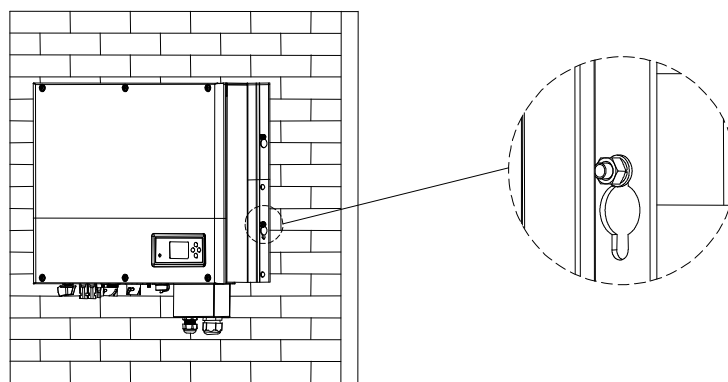
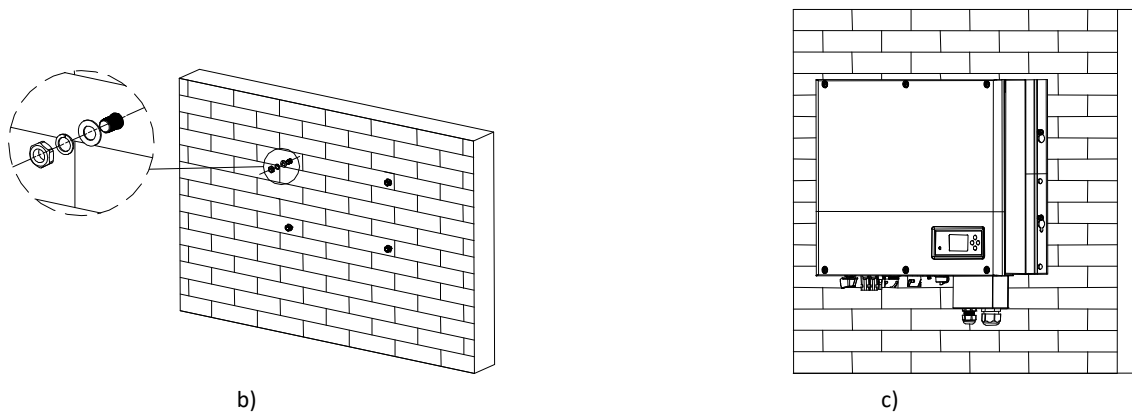
### 5.3.2 Installation of SPH

1. Project the machine's probably sizes on the wall, the thickness of wall for SPH must be not less than 60mm.
2. Make sure the drill position, use paper board(installation guide), put the paper board cling to the wall, make sure the top edge of paper board is level (As the chart 5.8a below).
3. Mark four points at the wall via the hole of the paper board, then remove the paper board.

4. Drill four  $\Phi 8$  holes at the mark point, the depth is not less than 55mm.
5. Knock four explosion bolt into  $\Phi 8$  holes (As the chart 5.8b below).
6. Hang the energy storage machine on the four setscrews (As the chart 5.8c below).
7. Lock the nut of setscrew (As the chart 5.8d below).
8. The whole installation has finished.




a)



d)  
Chart 5.8


## 5.4 SPH System Connection Mode

### 5.4.1 Conditions for DC Connection



 <b>WARNING</b>	<p>The solar modules connected to the inverter must conform to the Class A requirements of the IEC 61730 standard.</p> <p>Please use the same brand male and female PV connectors.</p>
---	--

SPH single-phase inverter has 2 independent input : MPPT1& MPP

Notice that the connectors are in paired (male and female connectors).

 <b>CAUTION</b>	<p>If the inverter is not equipped with a DC switch but this is mandatory in the country of installation, install an external DC switch.</p> <p>The following limit values at the DC input of the inverter must not be exceeded:</p>		
	Types	Max current MPPT1	Max current MPPT2
	SPH 3000-6000TL BL-UP	13.5A	13.5A
	Growatt SPH3000-6000	13.5A	13.5A

### 5.4.2 Connecting the PV Array (DC input)

 <b>DANGER</b>	<p><b>Danger to life due to lethal voltages!</b></p> <p>PV array supplies d.c voltage to inverter when exposed to light, before connecting the PV array , Cover some light screens above PV arrays, ensure that the DC switch and AC breaker are disconnect from the inverter. NEVER connect or disconnect the DC connectors under load.</p> <p>Make sure the maximum open circuit voltage(Voc) of each PV string is less than the maximum input voltage of the inverter.</p> <p>Check the design of the PV plant. The Max. open circuit voltage, which can occur at solar panels temperature of -15°C, must not exceed the Max. input voltage of the inverter.</p>
 <b>WARNING</b>	<p>Improper operation during the wiring process can cause fatal injury to operator or unrecoverable damage to the inverter. Only qualified personnel can perform the wiring work.</p> <p>Please don't connect PV array positive or negative pole to the ground, it could cause serious damages to the inverter.</p> <p>Check the connection cables of the PV modules for correct polarity and</p>

make sure that the maximum input voltage of the inverter is not exceeded.

## Connection of PV terminal

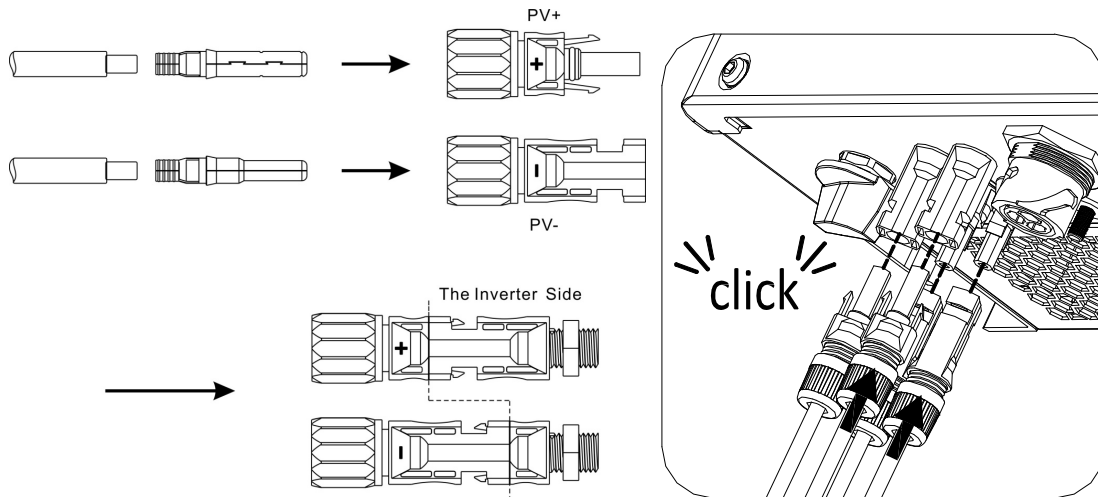


Chart 5.9

Similar to the traditional inverter connecting, the input of PV panel energy can be realized by using MC4 PV terminal, the detail steps are as follows:

1. Turn off PV switch.

2. Insert PV panel positive and negative cables into MC4 terminal, then connect positive pole(+) of connection cable to positive pole(+) of PV input connector, connect negative pole(-) of connection cable to negative pole(-) of PV input connector, please pay attention to PV input voltage and current within permission

### Limit:

Max PV voltage: 550V (consider the lowest temperature)

Max PV input current: 12A

Max PV input power per string: 4000W

### Remark:

1. We suggest you use the cable  $\geq 4\text{mm}^2/12\text{ AWG}$  to connect.

2. Please do not connect to DC source!

## 5.4.2 Connection of AC terminal and off grid terminal

SPH has a grid output terminal and off grid out terminal, look down on the SPH from the front, the terminal on the left (on grid) is grid outlet for connecting grid, the terminal on the right is an emergency power outlet for connecting critical load.



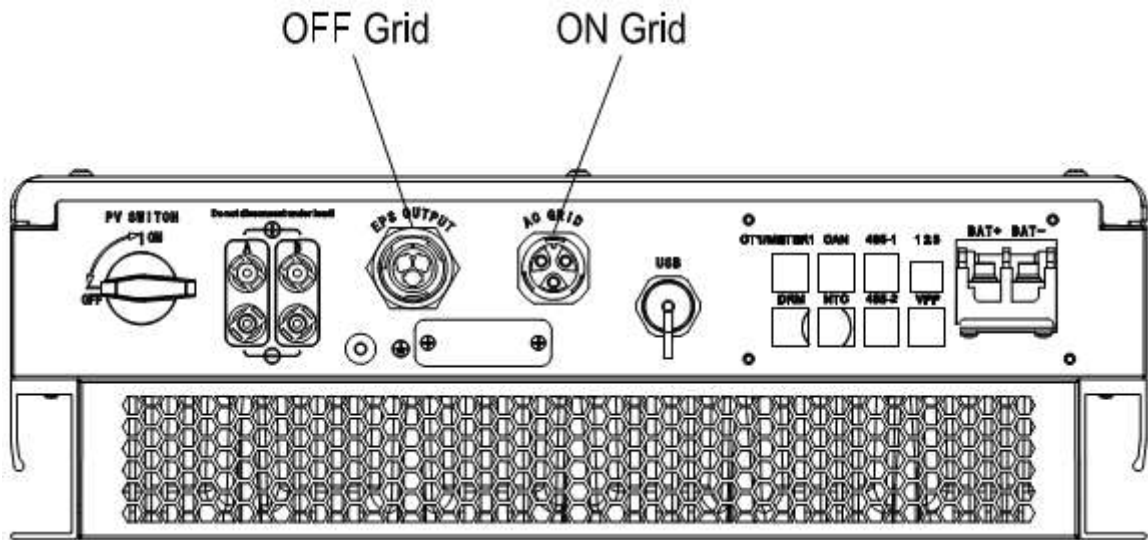


Chart 5.10.1 SPH3000-6000TL BL-UP

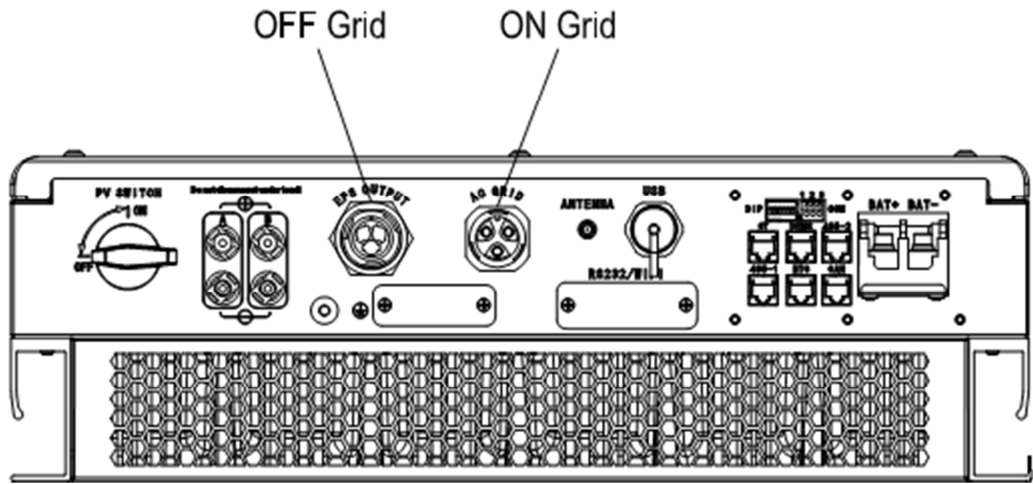
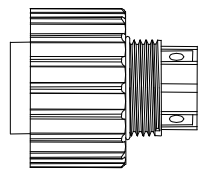


Chart 5.10.1 Growatt SPH3000-6000

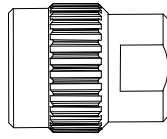
Wire suggest length

Conductor section	cross	Max cable length					
		Growatt SPH3000 & SPH 3000TL UP	Growatt SPH3600&S PH 3600 TL UP	Growatt SPH4000&S PH 4000 TL UP	Growatt SPH4600&S PH 4600 TL UP	Growatt SPH5000&S PH 5000 TL UP	Growatt SPH6000&S PH 6000 TL UP
5.2mm <sup>2</sup> 10AWG		40m	33m	28m	26m	25m	23m
6.6mm <sup>2</sup> 9AWG		50m	42m	36m	33m	32m	29m

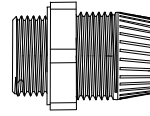
AC output terminal connection steps as follow:



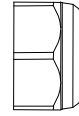
Connection terminal



Threaded sleeve



Seal ring



Pressure screw

Chart5.11

Step 1: Uninstall the AC terminal as above chart.

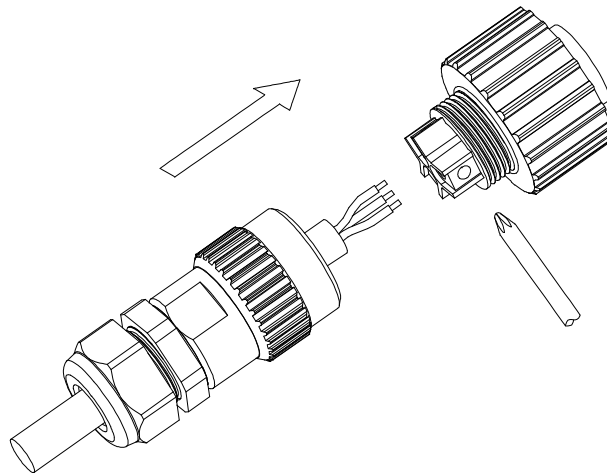


Chart5.12

Step 2: Thread cables through pressure screw, seal ring, threaded sleeve in sequence, insert cables into connection terminal according to polarities indicates on it and tighten the screws.

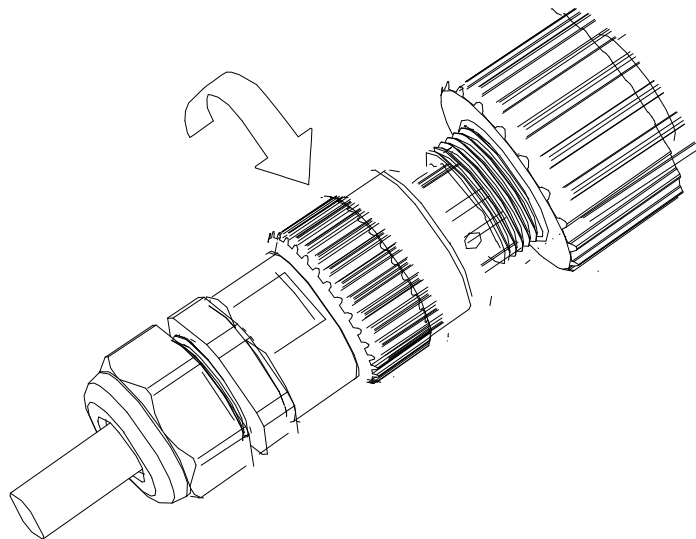
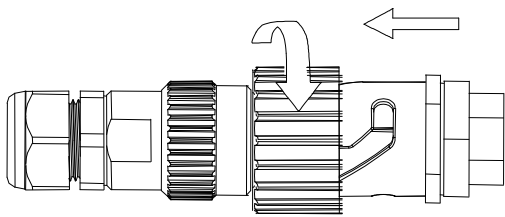
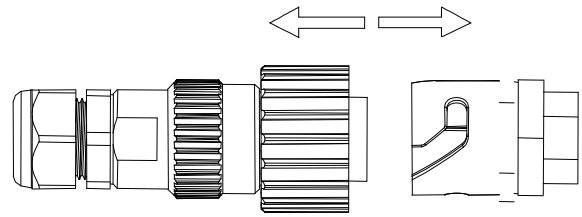


Chart 5.13

Step 3: Push threaded sleeve on to connection terminal until both are locked tightly.



Screw up AC connector



Release AC connector

Chart 5.14

Step 4: Plug the socket into AC output terminal, clockwise rotation to tighten the socket, counterclockwise rotation to loosen the socket.

Recommended wiring diagram in Australia is as follows::

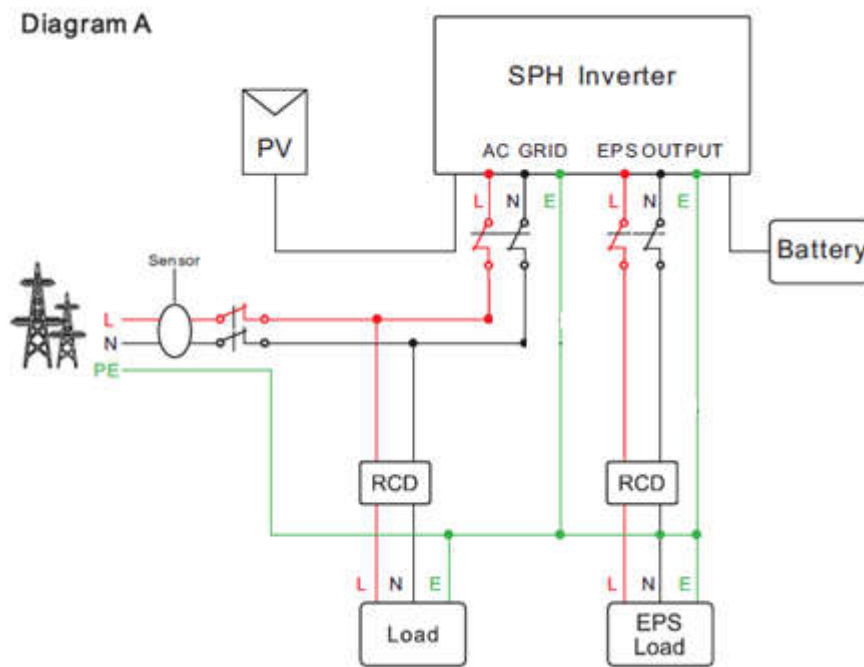


Chart 5.15 SPH3000-6000TL BL-UP

**Note:**

This diagram is an example for grid system without special requirement on electrical wiring connection.

Diagram B

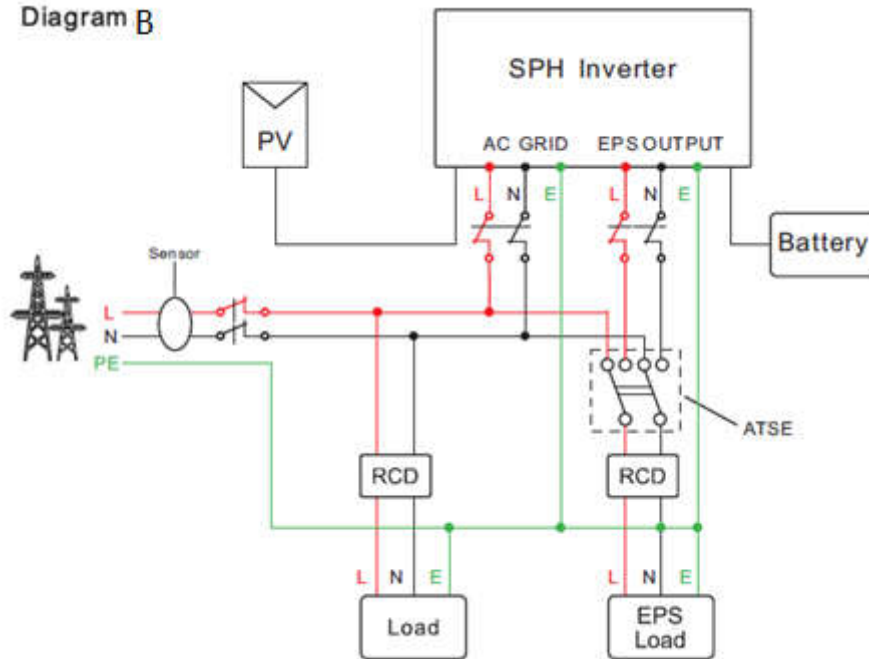


Chart 5.16

**Note:**

This diagram is an example for Australian and New Zealand grid system where neutral line can't be switched.

Diagram C

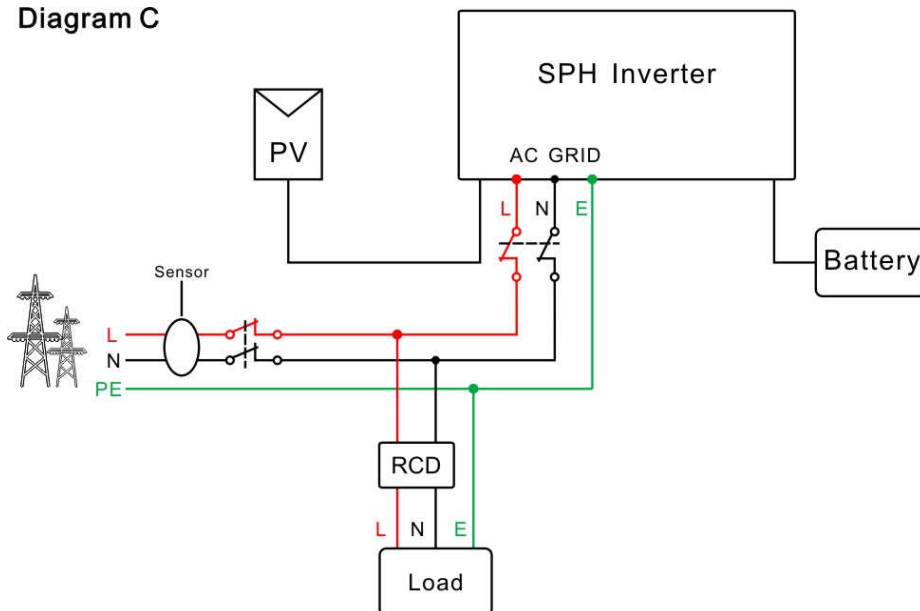


Chart 5.17 Growatt SPH3000-6000

**Note:**

This diagram is an example for customer who only wants to use the on grid storage system.



**Notice:**

- 1.If you want to use on grid only, please refer to chart 5.17 connect with AC grid and float EPS OUTPUT.
- 2.If you have no battery now, you can also float BAT terminal, and this hybrid inverter will only work like a PV inverter.
- 3.If you want to use both on grid power and backup power, please refer to chart 5.15 and 5.16 connect with AC grid and EPS OUTPUT like the chart show.
- 4.On grid terminal and off grid terminal can't directly connect together.
- 5.Off Grid terminal can't connect to grid.
- 6.If you want to use on grid and off grid, you can use ATS (automatic transfer switch) like chart 5.15 and 5.16 before or ask Growatt for help to connect them.
- 7.The first start of system needs Grid power.

### 5.4.3 Connection of battery terminal

Install battery cable steps are as follows:

- 1.Unscrew the swivel nut from the cable gland.
- 2.Thread the swivel nut over the battery cable.
- 3.Press the cable support sleeve out of the cable gland.
- 4.Remove the filler plug from the cable support sleeve.
- 5.Route the network cable through an opening in the cable support sleeve.
- 6.Thread the network cable through the cable gland.
- 7.Thread cables into connection terminal, then press the terminal by relevant tools and make sure battery cables are firmly (Growatt lithium battery contains a battery cable in the original packing).
- 8.Connect positive pole (+) of battery cable to battery positive terminal (+) of the inverter, connect negative pole (-) of battery cable to battery negative terminal (-).
- 9.Continue to install other cables.

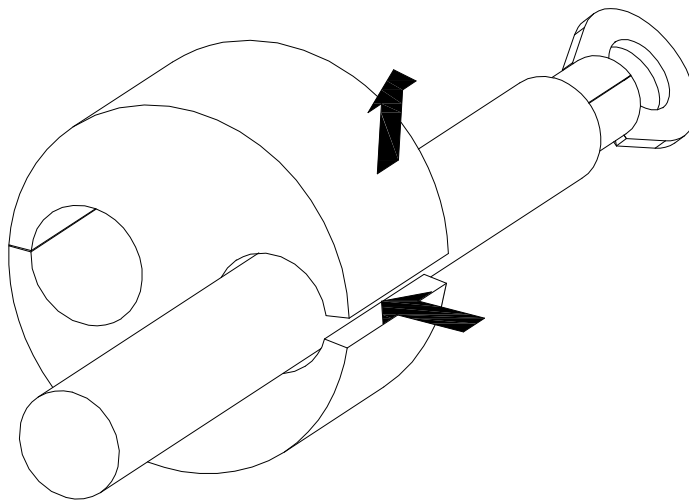


Chart 5.18

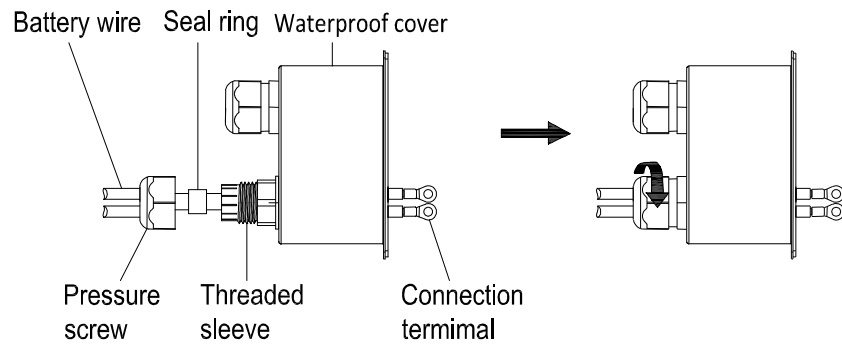


Chart 5.19

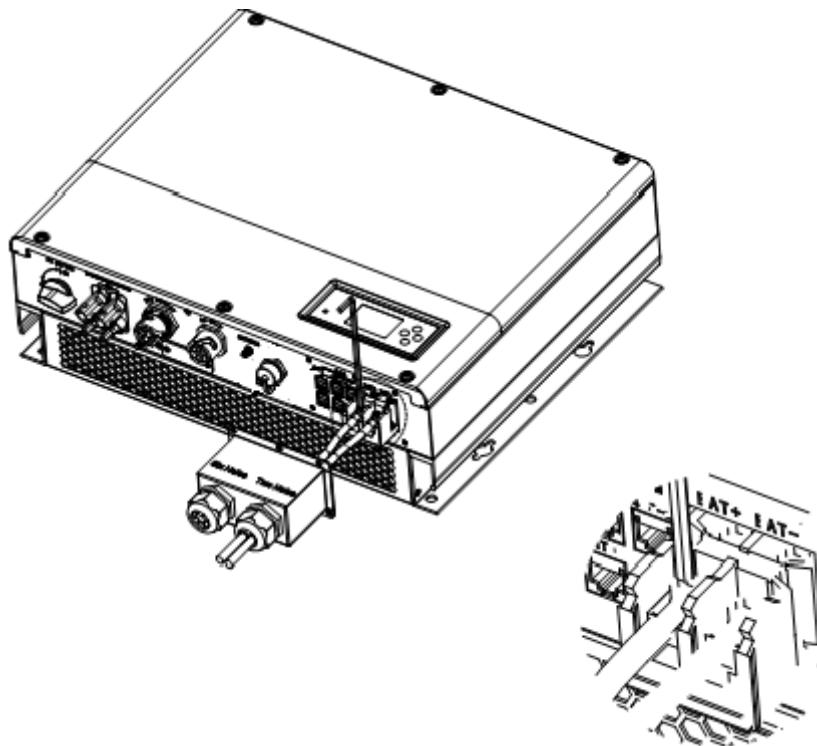


Chart 5.20

**Note:**

We suggest the distance between battery and SPH no longer than 1.5m, and the power line area must be larger than 5 AWG.

**5.4.4 Connection of CT terminal**

There is a CT in SPH inverter monitoring the power consumption situation of residential users, the CT terminal connection steps are as follows:

1. Unscrew the swivel nut from the cable gland.
2. Thread the swivel nut over the "CT" cable.
3. Press the cable support sleeve out of the cable gland.
4. Remove the filler plug from the cable support sleeve.
5. Route the "CT" cable through an opening in the cable support sleeve.
6. Thread the "CT" cable through the cable gland.
7. Insert the RJ45 plug of the network cable into the "CT" pin connector on the inverter until it snaps into place.

- 8.If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
- 9.Screw the swivel nut onto the waterproof cover.

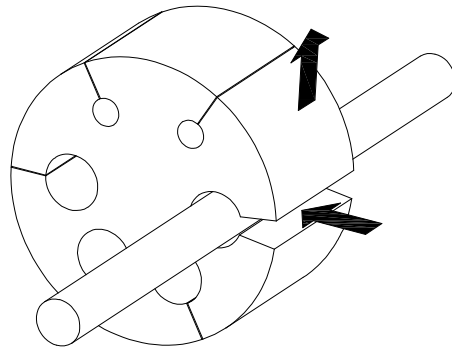


Chart 5.21

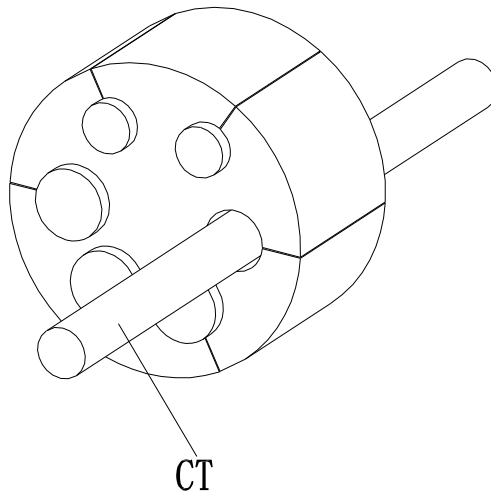


Chart 5.22

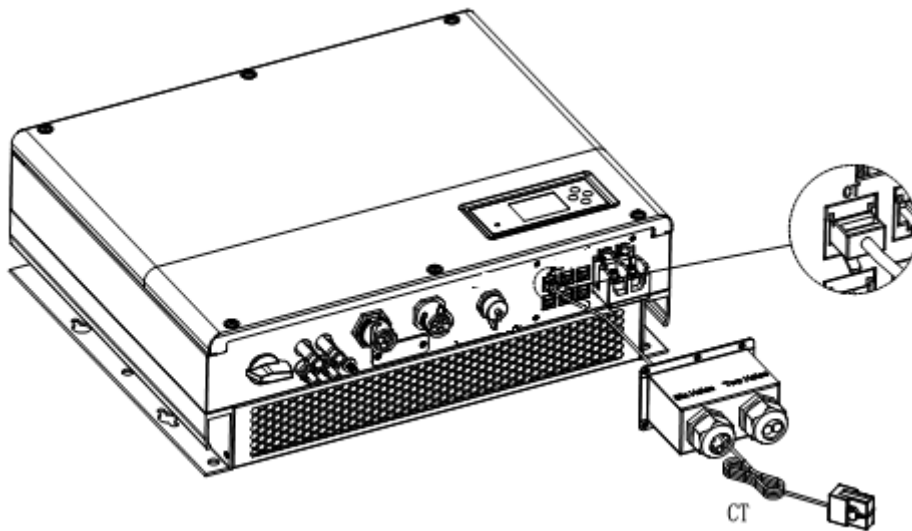


Chart 5.23

**Note:**

- 1.The meter and CT can't be installed at same time, please set the sensor model when selecting CT or

electricity meter, please refer to section 6.3.3 for details.

2.If the cable such as "CT" cable is not used, please do not remove the filler plug from the cable support sleeve.

**Remark:**

CT wire (5m in length) specification: RJ45, standard LAN line (one end with 8P modular plug, the other connected with transformer). But if the length is not enough, customer can add cable, so the length can be increased to 15m max, the operation is as follow chart:

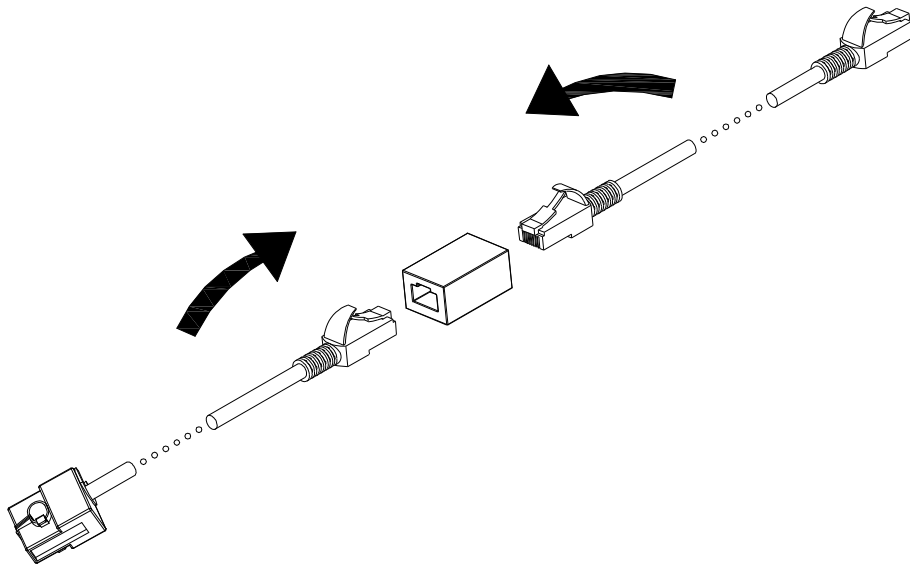


Chart 5.24

During the actual operation, please pay attention to the installation of current transformer as the diagram shows below:

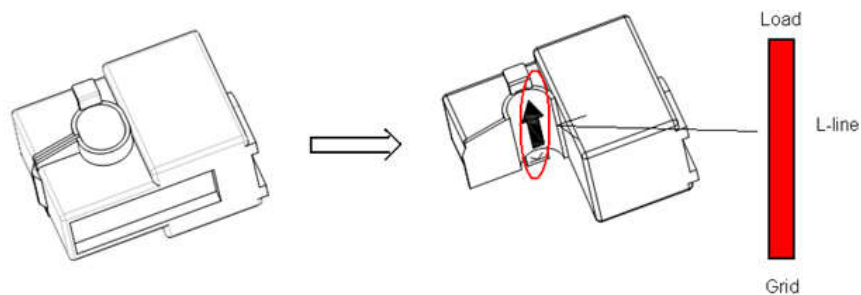


Chart 5.25

As illustrated above, open the current transformer and you can see an arrow labeled on it indicating the direction of current. Put the live wire among the under-detection wires onto the current transformer. After latching the current transformer, the installation has been finished

**Notice:**

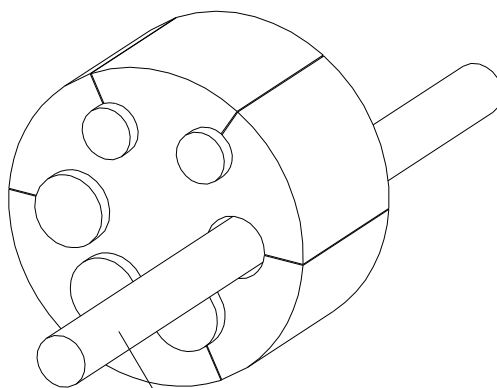
The direction (from K to L) of the arrow on the current transformer is corresponding to the direction of the current in live wire from Grid to Load. Sensor needs to be placed in the power distribution cabinet.



### 5.4.5 Connection of meter terminal

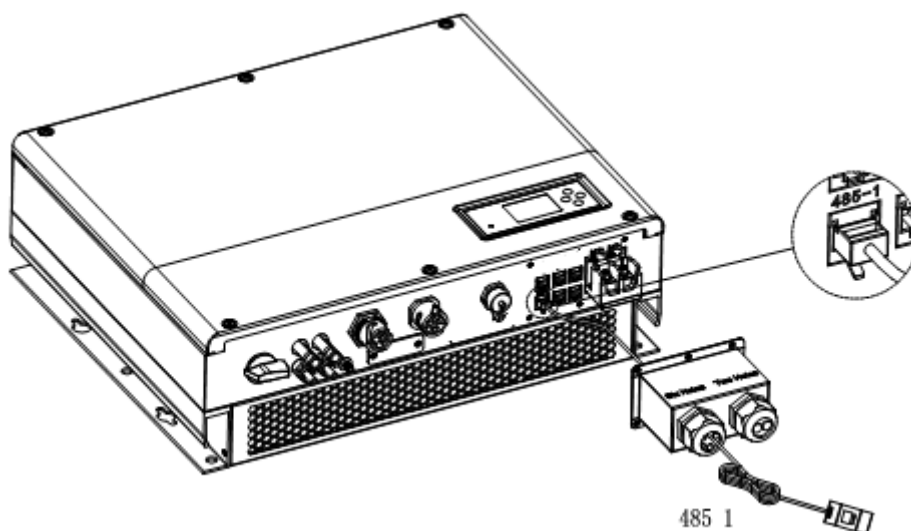
When customer needs to use meter to monitor the energy flow, the meter terminal connection steps are as follows:

1. Reference 5.2, make LAN cables with RJ45 terminal.
2. Thread the swivel nut over the LAN cable.
3. Press the cable support sleeve out of the cable gland.
4. Remove the filler plug from the cable support sleeve.
5. Route the LAN cable through an opening in the cable support sleeve.
6. Thread the LAN cable through the cable gland.
7. Insert the RJ45 plug of the network cable into the "485-1" pin connector on the inverter until it snaps into place.
8. If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
9. Screw the swivel nut onto the waterproof cover.



485-1

Chart 5.26



485 1

Chart 5.27

**Note:**

- 1.Meter and CT can't be installed at same time, please set the sensor model when selecting CT or electricity meter, please refer to section 6.3.3 for details.
- 2.Meter must be provided by Growatt. If not, maybe meter can't communicate with SPH inverter.
- 3.The more detail describe of meter installation, please turn to meter user manual.

#### 5.4.6 Connection of communication terminal for lithium battery (CAN)

When using CAN communication with lithium batteries (for example PYLON US2000B), connect lithium battery terminal (RJ45) steps as follows:

- 1.Unscrew the swivel nut from the cable gland.
- 2.Thread the swivel nut over the "CAN" cable.
- 3.Press the cable support sleeve out of the cable gland.
- 4.Remove the filler plug from the cable support sleeve.
- 5.Route the "CAN" cable through an opening in the cable support sleeve.
- 6.Thread the "CAN" cable through the cable gland.
- 7.Insert the RJ45 plug of the network cable into the "CAN" pin connector on the inverter until it snaps into place.
- 8.If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
- 9.Screw the swivel nut onto the waterproof cover.

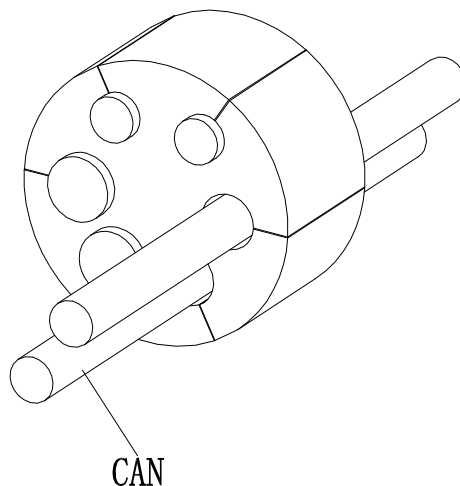


Chart 5.28

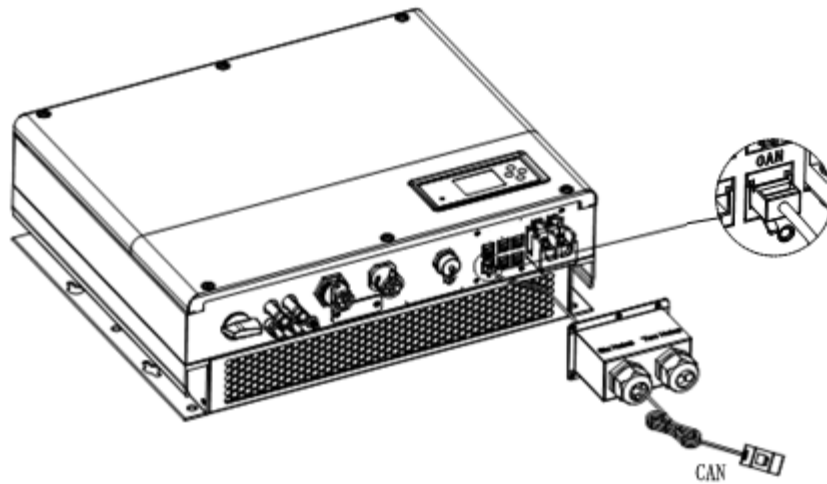


Chart 5.29

**Note:**

- 1.If you are using a lead-acid battery, you do not need to install this communication cable.
- 2.The CAN battery communication and 485-2 battery communication can't be installed at same time, please select the correct communication method according to the battery manual.
- 3.If the cable such as "485-2" cable or "CAN" cable is not used, please do not remove the filler plug from the cable support sleeve.

**5.4.7 Connection of communication terminal for lithium battery (RS485)**

When using lithium batteries which need to connect BMS system of the battery, connect lithium battery terminal (RJ45) steps as follows:

- 1.Unscrew the swivel nut from the cable gland.
- 2.Thread the swivel nut over the "RS485" cable.
- 3.Press the cable support sleeve out of the cable gland.
- 4.Remove the filler plug from the cable support sleeve.
- 5.Route the "RS485" cable through an opening in the cable support sleeve.
- 6.Thread the "RS485" cable through the cable gland.
- 7.Insert the RJ45 plug of the network cable into the "RS485-2" pin connector on the inverter until it snaps into place.
- 8.If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
- 9.Screw the swivel nut onto the waterproof cover.

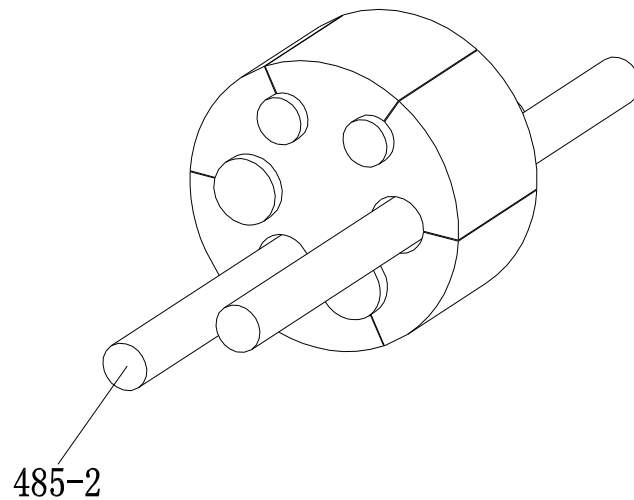


Chart 5.30

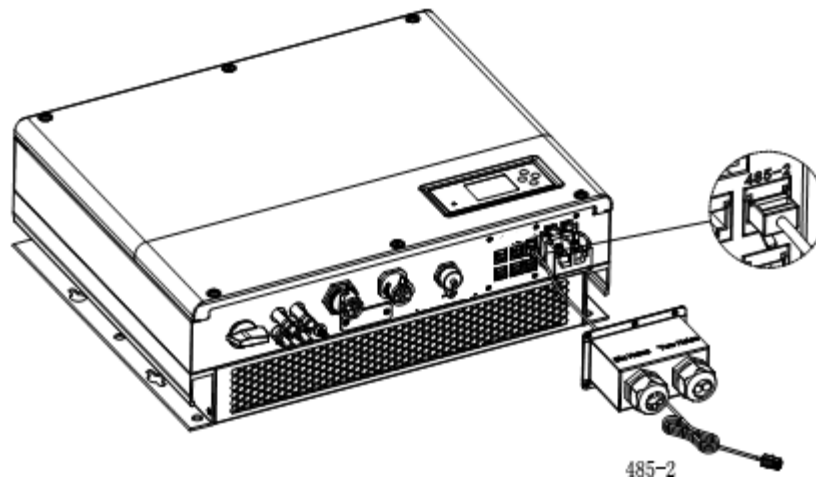


Chart 5.31

**Note:**

1. If you are using a lead-acid battery, you do not need to install this communication cable.
2. The CAN battery communication and 485-2 battery communication can't be installed at the same time, please select the correct communication method according to the battery manual.
3. If the cable such as "485-2" cable or "CAN" cable is not used, please do not remove the filler plug from the cable support sleeve.

**5.4.8 Connection of DRMS terminal (Australia only)**

When SPH is applied to Australia, the DRMS terminals need to be connected, the connection way appears as follows:

1. Unscrew the swivel nut from the cable gland.
2. Thread the swivel nut over the "DRMS" cable.
3. Press the cable support sleeve out of the cable gland.
4. Remove the filler plug from the cable support sleeve.
5. Route the "DRMS" cable through an opening in the cable support sleeve.
6. Thread the "DRMS" cable through the cable gland.

7. Insert the RJ45 plug of the network cable into the “DRMS” pin connector on the inverter until it snaps into place.

8. If no other cables need to be installed, lock the waterproof cover to the inverter with screws.

9. Screw the swivel nut onto the waterproof cover.

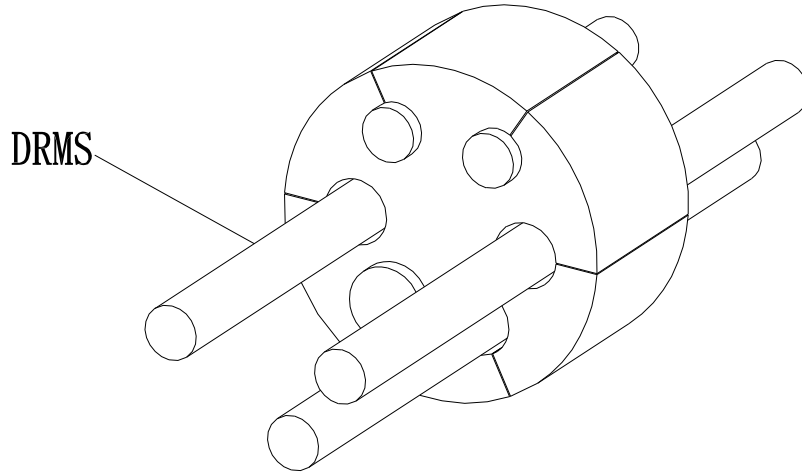


Chart 5.32

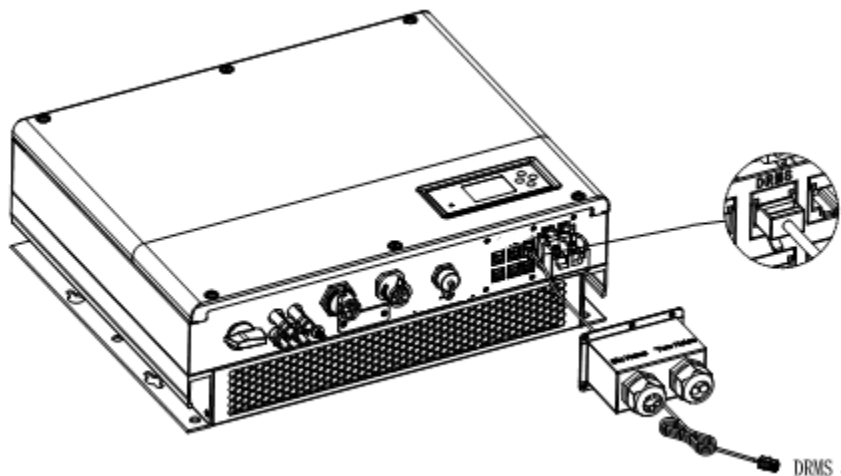


Chart 5.33

RJ45 terminal pin assignment

PIN	assignment for inverter scapable of both charging and discharging
1	DRM5
2	DRM6
3	DRM7
4	DRM8
5	RefGen
6	COM/DRM0
7	/
8	/

Method of asserting demand response modes

MODE	RJ45 socket asserted by shorting pins		Requirement
DRM0	5	6	operate the disconnection device
DRM5	1	5	Do not generate power
DRM6	2	5	Do not generate at more than 50% of rated power
DRM7	3	5	Do not generate at more than 75% of rated power and sink reactive power if capable
DRM8	4	5	Increase power generation (subject to constraints from other active DRMs)

**Note:**

If the cable such as “NTC” (lead-acid battery temperature sensor) cable is not used, please do not remove the filler plug from the cable support sleeve.

**5.4.9 Connection of temperature probe for lead-acid battery**

When customer using lead-acid battery, the temperature probe of the lead-acid battery is used to detect the ambient temperature of the lead-acid battery, the battery temperature cable of the SPH side connection steps are as follows:

1. Unscrew the swivel nut from the cable gland.
2. Thread the swivel nut over the “NTC” cable.
3. Press the cable support sleeve out of the cable gland.
4. Remove the filler plug from the cable support sleeve.
5. Route the “NTC” cable through a min opening in the cable support sleeve.
6. Thread the “NTC” cable through the cable gland.
7. Insert the RJ45 plug of the network cable into the “NTC” pin connector on the inverter until it snaps into place.
8. If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
9. Screw the swivel nut onto the waterproof cover.

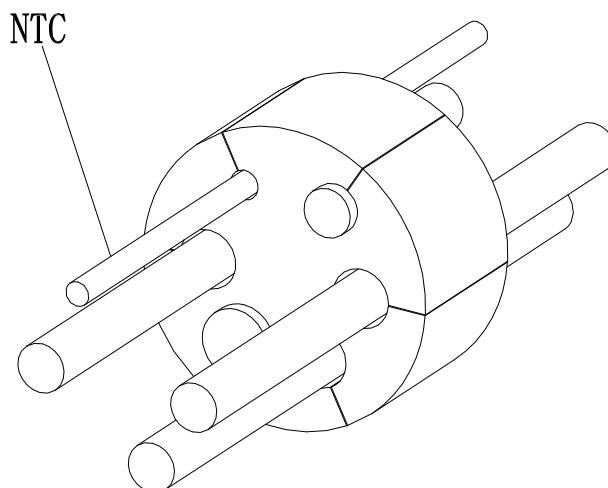


Chart 5.34

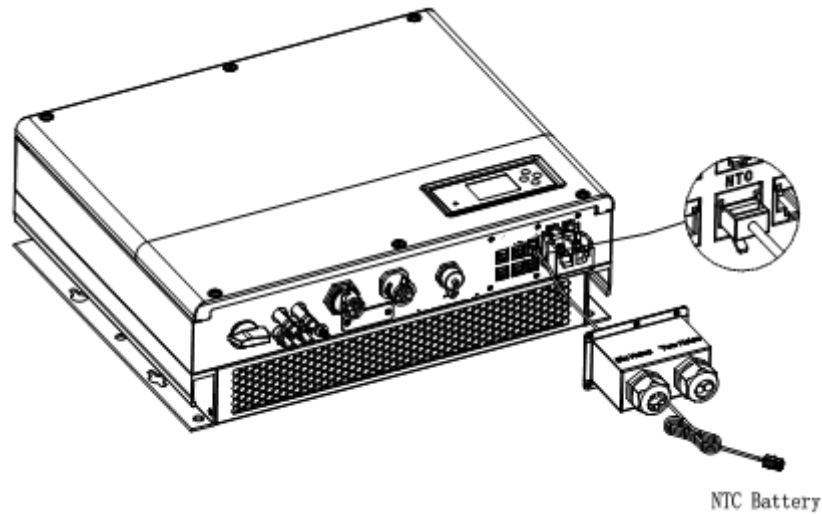


Chart 5.35

**Note:**

1.If you are using a lithium battery, you do not need to install this temperature probe, the probe of the temperature cable should be attached to the surrounding environment of the lead-acid battery, and the length of this cable is 1.5m, so pay attention to the distance of battery and SPH.

2.If the cable such as “NTC” (lead-acid battery temperature sensor) cable is not used, please do not remove the filler plug from the cable support sleeve.

#### 5.4.10 Connection of Dry contact

The dry contact is used to communicate with external devices (such as remote start hot water heater). The wiring steps are as follows:

- 1.Unscrew the swivel nut from the cable gland.
- 2.Thread the swivel nut over the cable.
- 3.Press the cable support sleeve out of the cable gland.
- 4.Remove the filler plug from the cable support sleeve.
- 5.Route the network cable through an opening in the cable support sleeve.
- 6.Thread the network cable through the cable gland.
- 7.Thread cables into connection terminal of the inverter, then press the terminal by relevant tools and make sure cables are firmly.
- 8.If no other cables need to be installed, lock the waterproof cover to the inverter with screws.
- 9.Screw the swivel nut onto the waterproof cover.

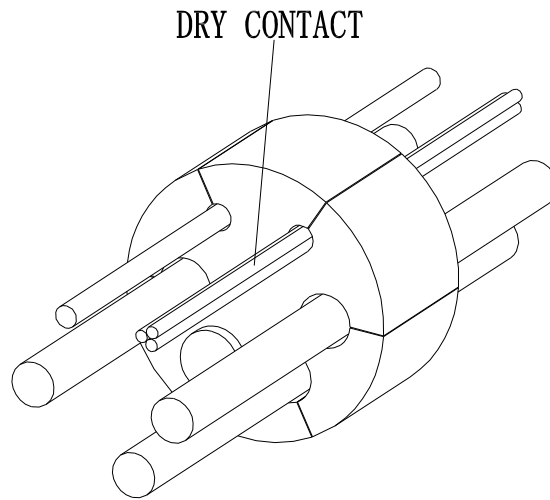


Chart 5.36

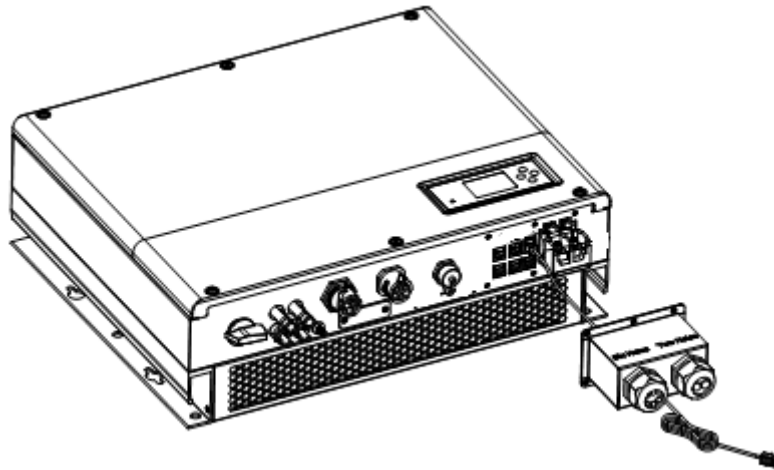


Chart 5.37

**Note:**

If the cable such as "Dry contact" cable is not used, please do not remove the filler plug from the cable support sleeve.

**5.4.11 Grounding connection**

SPH must be grounded by cable, the grounding point is showed as follow, and the minimum grounding cable wire diameter is 10.0mm<sup>2</sup>.



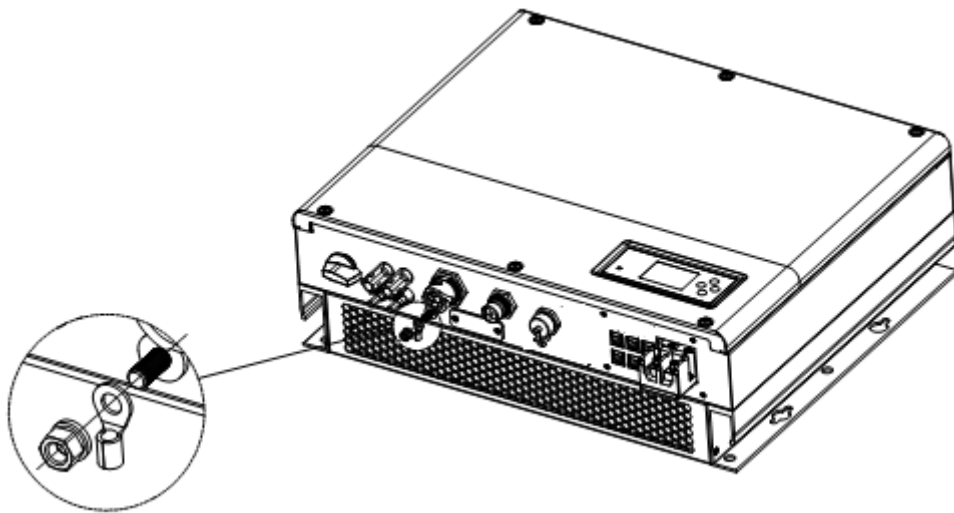


Chart 5.38

**PV Array Grounding**

Grounding conductor of PV panel brackets must be firmly connected to earth at PV array side and inverter side and SP side. The sectional area of grounding conductor should be equal to the sectional area of DC grounding conductor. The minimum wire diameter is 10.0mm<sup>2</sup>.

**DC Grounding**

Select the DC Grounding mode according to the local standard and use the PV grounding terminal box and DC Grounding wires of the same specification.

**Grounding Device**

If the positive pole or the negative pole of PV array needs to be grounded in the PV system, the inverter output should be insulated by Isolation Transformer. Isolation transformer must conform to IEC62109-1,-2 standard.

Connection as below:

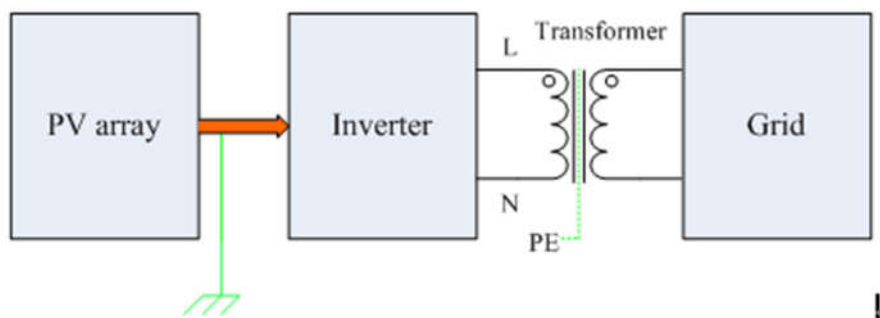


Chart 5.39

## 6 Commissioning

### 6.1 Commissioning of SPH

Electrify SPH after all installation of Part5 be finished, here are the steps:

- 1.Connect PV
- 2.Connect AC
- 3.Connect battery
- 4.Turn on AC first
- 5.Then turn on battery
- 6.Last turn on PV

If PV Grid and battery are available, system would work on the “normal” mode. When the SPH on the normal mode, the screen showing “Normal”, LED is green. If SPH not enter normal mode successful, especially the LCD is red, you need to check below:

- 1.Make sure all the connection is correct.
- 2.All the external switches are on.
- 3.Inverter built -in switch is on.
- 4.Make sure the lithium battery is on.
- 5.Refer to Part 9.1 for correction.

You can refer to Part 6.3.4 for work mode setting, then configure monitor, finish commissioning lastly.

### 6.2 Operation modes

#### 6.2.1 Normal mode

Normal mode is working state which including online mode and backup mode.

##### Online mode

User can set an appropriate priority mode according to request when SPH working on the online mode. If customer uses the LCD and key settings, you can only set one period, but if you use website settings, you can set up to three periods of the priority mode.

(refer to 6.3.4)

1. Load first: Load first is the default mode, when it's working in this mode, PV energy would offer to load and battery prior; when PV is Insufficient, battery would discharge; when PV is sufficient for load, the excess energy would feed to battery. If there is no battery or battery is full, the excess energy would feed to Grid (except anti-reflux).
2. Battery first: When SPH working in this mode, battery would be charged first, it's suitable working on the period when the electric charge is low. user need to set the mode ON and OFF time, and the end time of battery SOC. Users can set power rate which less than the battery maximum output power. If the customer doesn't enable the AC CHG (AC grid charging functions). Inverter will charge battery by PV power as large as it can do. If the customer enables the AC CHG (AC grid charging functions). Inverter will charge battery by PV power and AC power from grid as large as it can do.
3. Grid first: When SPH working in Grid-first mode, the PV energy would feed to Grid first. User can choose the period when electric charge is high. User need to set the mode ON and OFF time, and the end time of battery SOC. User can set power rate which less than the battery maximum output power.

### **Backup mode**

If Grid lost, system would turn to backup mode (user can disable it, refer to 6.3.4) and AC output from EPS LOAD port, all the energy from PV and battery, if the battery also lost, then only battery discharge. Mind you, SPH maximum output power is 3000W in this mode, the load which connect with EPS LOAD should less than 3000W.

#### **Notice:**

- 1.Users only can set one period for battery first and Grid first on the LCD, if users need set more please login shineserver.
- 2.If users need Grid charge battery, users need input password on the SC surface and set the AC CHG to enable.

### **6.2.2 Fault mode**

The SPH's intelligent control system could monitor and adjustment system's status continuously, when SPH inverter monitoring anything unexpected happen, such as system fault or machine fault ,the LCD will display the fault information, in fault mode, the LED light will be lighten.

#### **Notice:**

- 1.The detail's fault information please refer to 9.1
- 2.Some fault information is in order to remind users that might have some faults occurred in inverter side.

### **6.2.3 Programming mode**

Programming mode indicates the SPH is updating, don't cut out power when it's updating until the processing is finish, SPH inverter would log out automatically when the updating finish and turn to other mode.

### **6.2.4 Checking mode**

Before SPH work in normal mode, it will go to self-check mode. If all are ok, system will go to normal mode, otherwise, it will go to fault mode.

### **6.2.5 Standby mode**

If the system hasn't faults while the condition is not qualified, SPH would stay at standby mode.

### **6.2.6 Shutdown mode**

If customer need SPH inverter stop working, customer must disconnect all the energy source, then SPH inverter will turn into shutdown mode automatically.

The following is the shutdown procedure:

- 1.Shutdown the PV side
- 2.Turn off battery switch.
- 3.Shut down AC power of SPH. Then you can see the both LED and LCD of SP are off.

#### **Notice:**

After all the actions are done, you still have to wait for more than 5 minutes.

### 6.3 Country setting

Growatt can provide machines of various specifications. After receiving the machines, customers can set the corresponding specifications by dialing the LCD according to their national safety regulations.

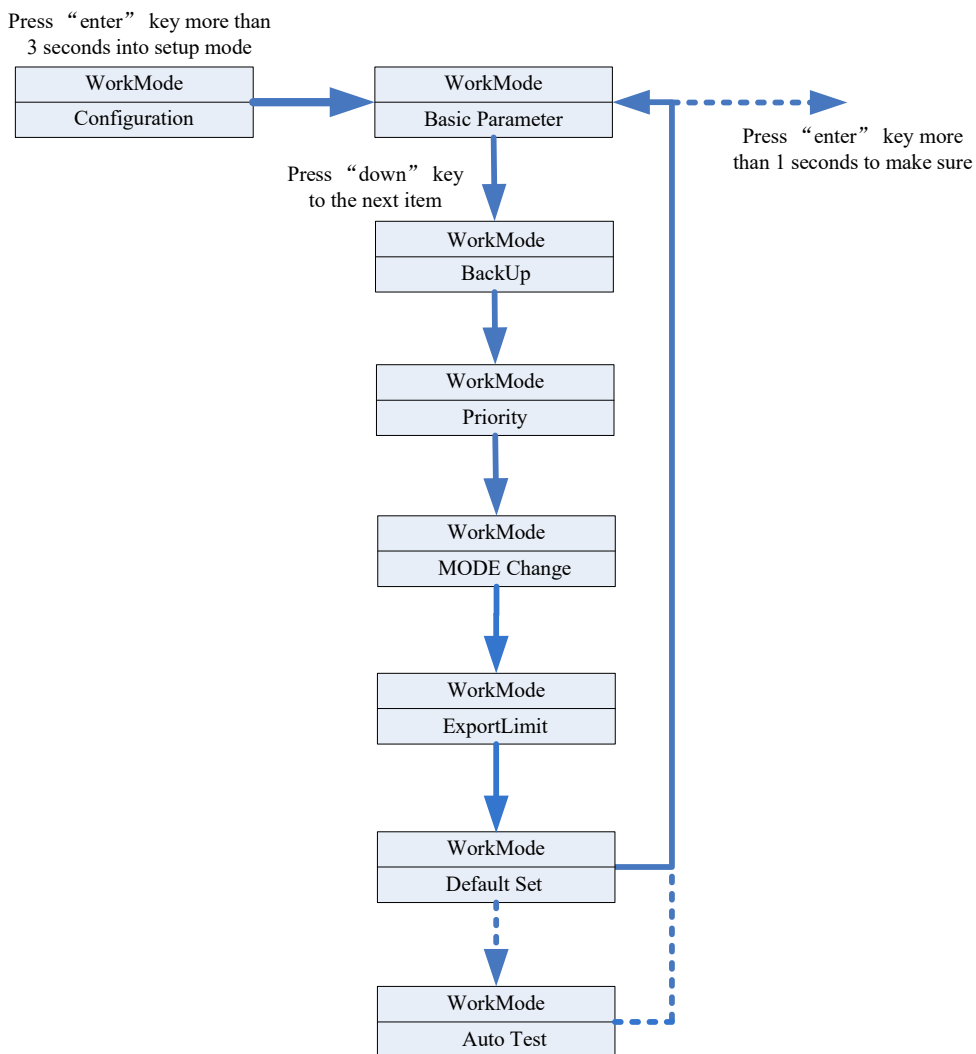




Chart 6.1

	<p>Caution :</p> <p>When you setting the DIP, you must turn off PV switch, AC breaker and Battery to make sure all of the power are off.</p>
	<p>Caution:</p> <ol style="list-style-type: none"> <li>1. After setting the DIP, please power on the inverter and check the model display (show as 6.3.1). If the model display is match what you want, it means your setting is successful.</li> <li>2. You need to calibrate the time that the machine is showing after inverter starts up.</li> </ol> <p>If the country is set incorrectly, please shut down the inverter</p>

and set again.

The DIP switch is composed of six-digit binary number PINS. The different combination of the six PINS can represent different inverter’s model, which is corresponding to the local grid standard. Each small white PIN has two statuses, when set upward to “ON”, its value turns to “1”, when set downward, its value turns to “0”. Concerning the matching of the PIN status and the country safety standard, please refer to the table below:

**6.4 Display and button**

**6.4.1 LCD display area**

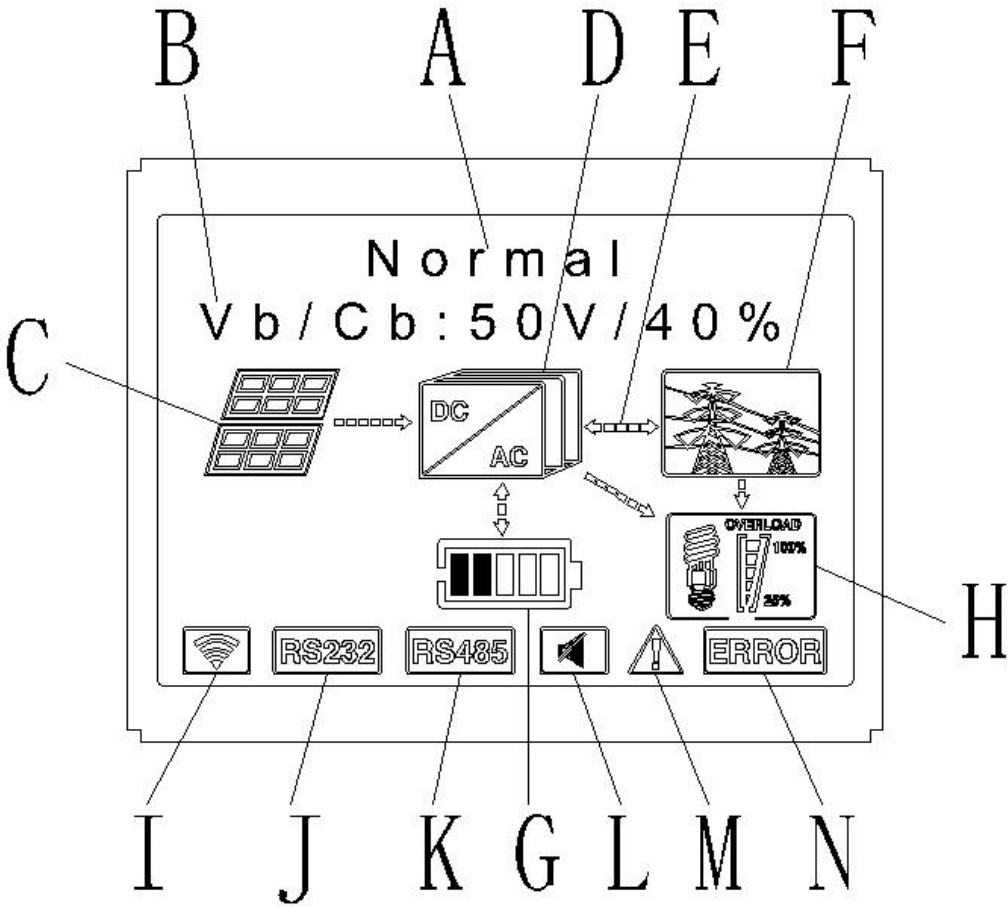


Chart 6.2

Location	Description
A	State
B	Information
C	PV input (If you connect two tracks, it will show two. Otherwise show one)
D	SPH inverter
E	Power flow line
F	Grid
G	Battery (Show the SOC in five grid, Every grid represents 20%)
H	Local load

I	Wireless communication
J	RS232
K	RS485
L	Buzzer(Reserved)
M	Warning
N	Fault

#### 6.4.2 LED and button instruction

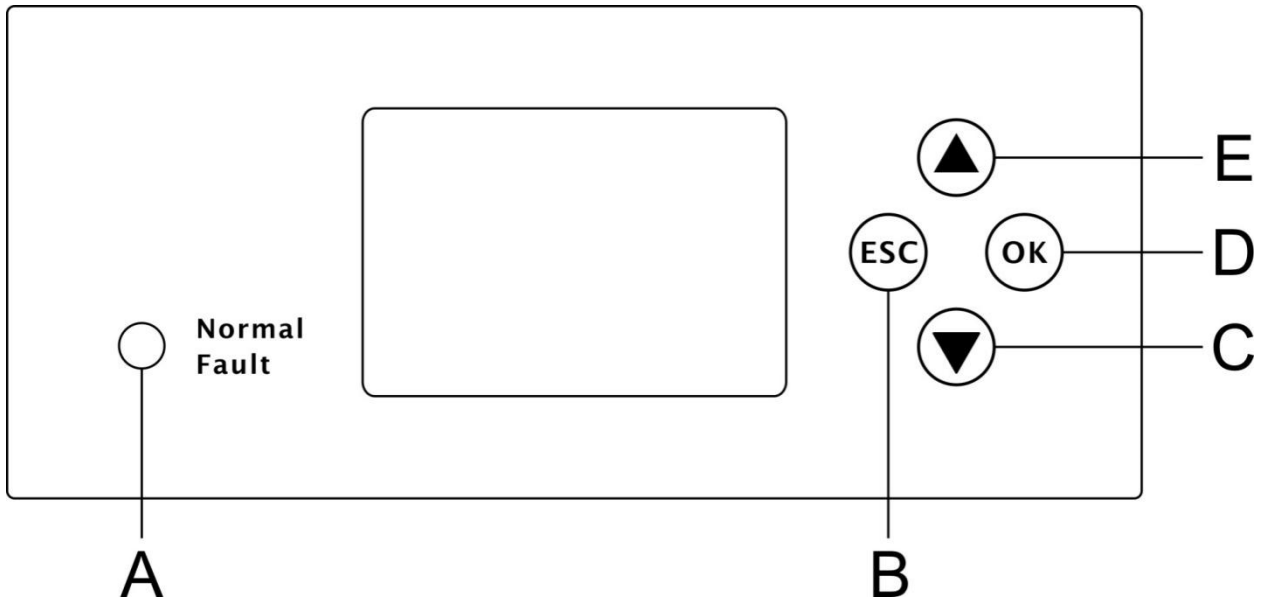


Chart 6.3

Location	Description
A	Status
B	ESC- button(cancel control)
C	Down-button
D	Enter-button
E	UP-button

**Notice:**

LED showing status of SPH, it has two colors, one is green and another is red. Please turn to 3.1 and read the detail of LED

#### 6.4.3 LCD display column

Grovet can provide a variety of rules and regulations of the machine, the customer received the machine, according to their country, through the LCD selection to set the corresponding rules and regulations.

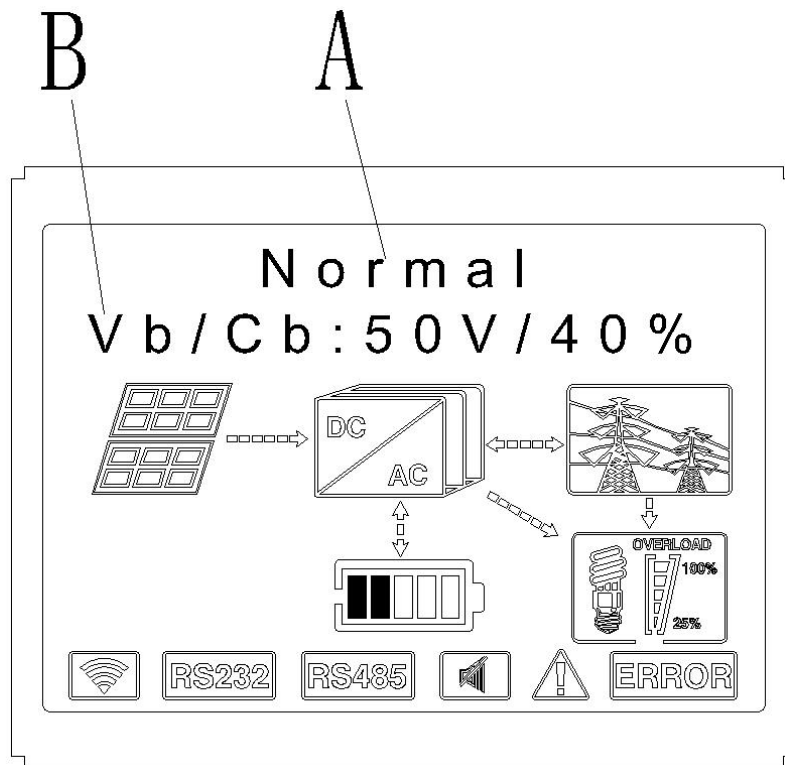


Chart 6.4

The A line's concluding information as follow:

1. Standby state: SPH is in standby state. No error in this state, but for other reasons, make it in a wait state.
2. Normal state: SPH is normal working state.
3. Checking state: SPH is in self-check state, if there is no error or warning, SPH will go to normal state or standby state. Otherwise it will go to fault state.
4. Programming state: SPH is in updating firmware state.
5. Fault state: SPH has fault information, it will be in stopped operational protection state.

The B line's information as follow:

In normal, it will turn on page automatically, when pushing the button "UP", the order of the paging information as follow:

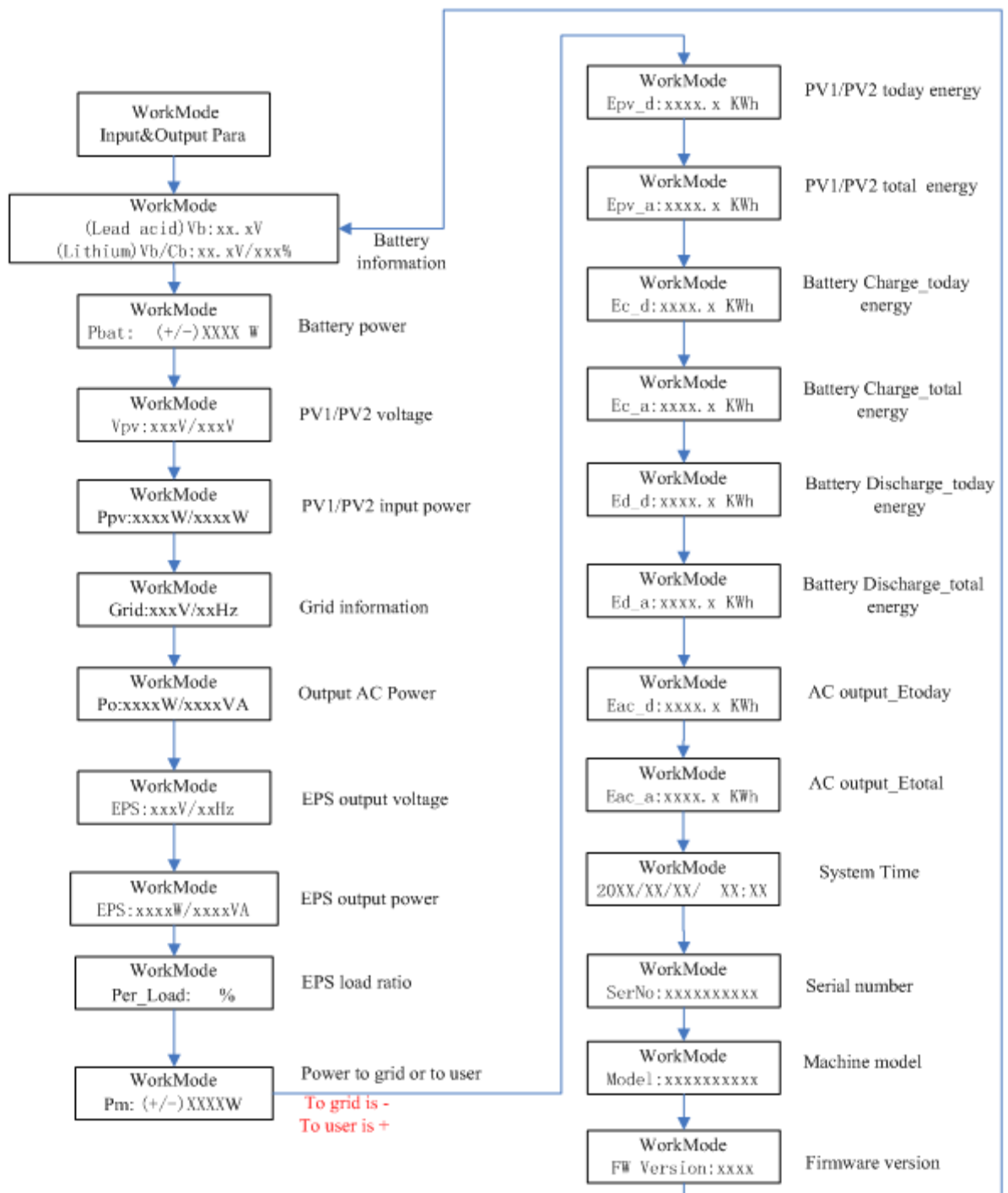


Chart 6.5

**Note:**

1. “Down” control command (if pushing “up” button, command will go back).
2. Workmode depend on the situation. If SPH is normal state, it will show “normal”. If SPH is standby state, it will show as “standby” etc.
3. Some special definitions are explained, for example: Vb means the voltage of battery. Cb means the capacity of lithium battery (only lithium battery shows this data). Pm means the monitor power of user.



#### 6.4.4 Work mode set up

Keep pressing “enter” for 3S, you can enter set up surface, in the set up surface you need hold button Enter or ESC 1S for selection, you can see the surface as showing below.

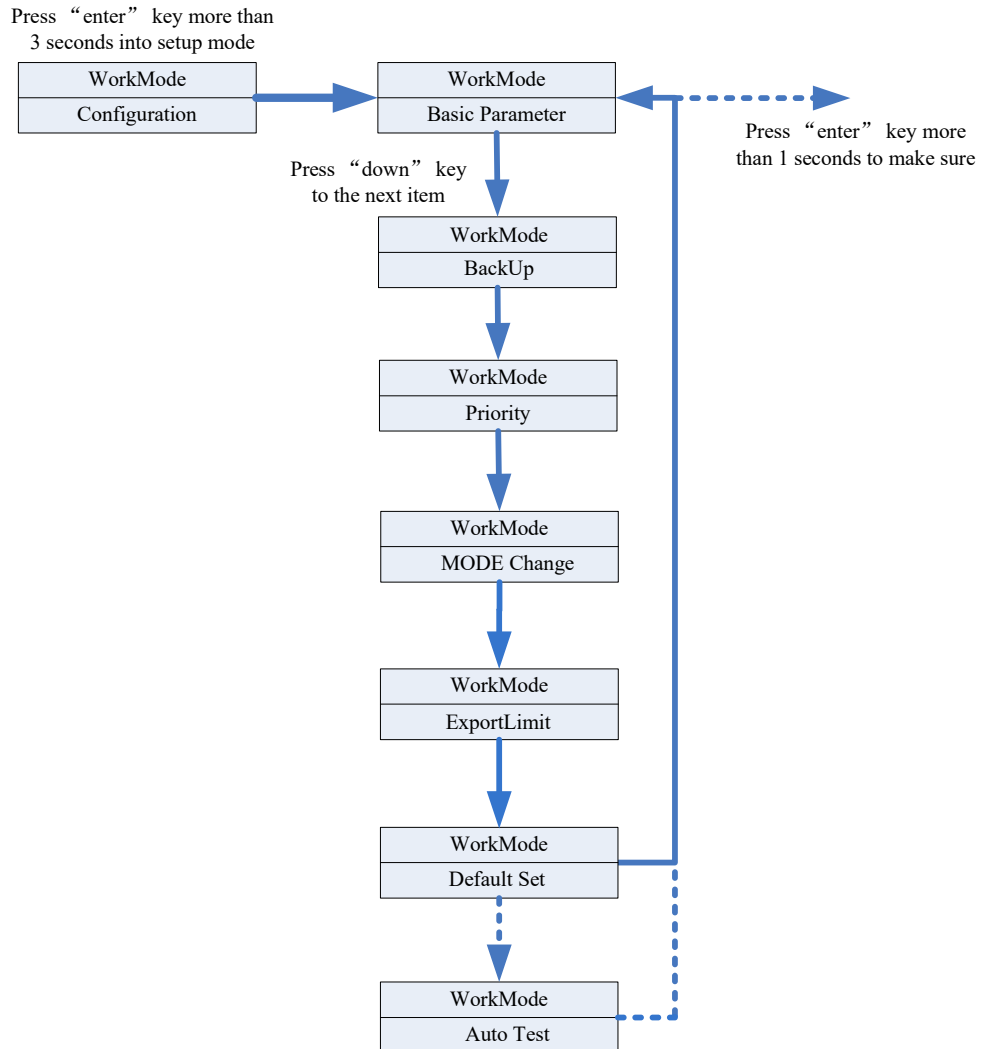


Chart 6.6

If you choose CEI and used SPH inverter in Italy, SPH inverter have Auto Test function. How to use the Autotest functions. Please see the annex.

1. Under the Basic Para, you can see the setup options below after pressing Enter for 1S:

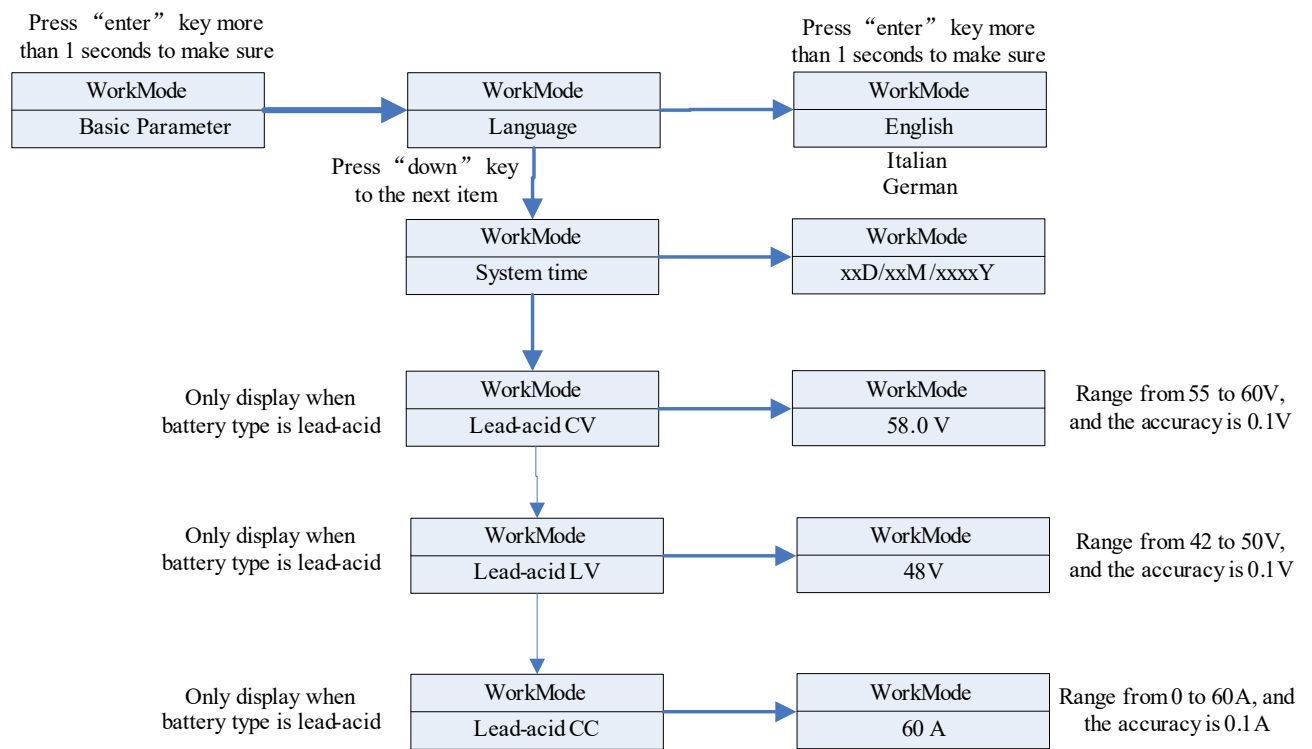


Chart 6.7

In the basic Parameter, you can set language (English, Italian, German), system time, lead-acid cell charging voltage (default is 58V), discharge low voltage (default is 48V) and lead-acid constant current (default is 60A).

2. Under the Back Up, you can see the setup options below after pressing Enter for 1S:

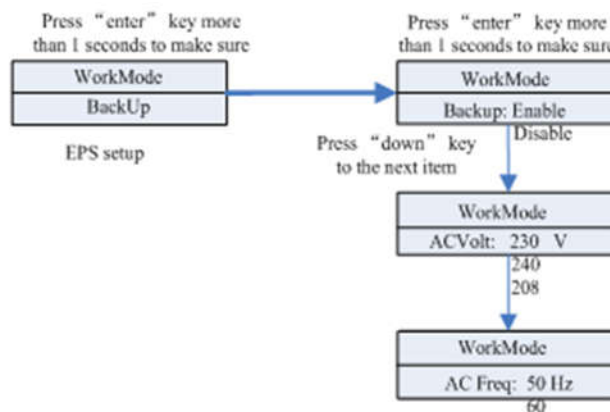


Chart 6.8

In the back up you can set EPS, including enable or disable (default is enable), AC voltage (default is 230V) and frequency (default site 50HZ).

3. Under the Priority, you can see the setup options below after pressing Enter:

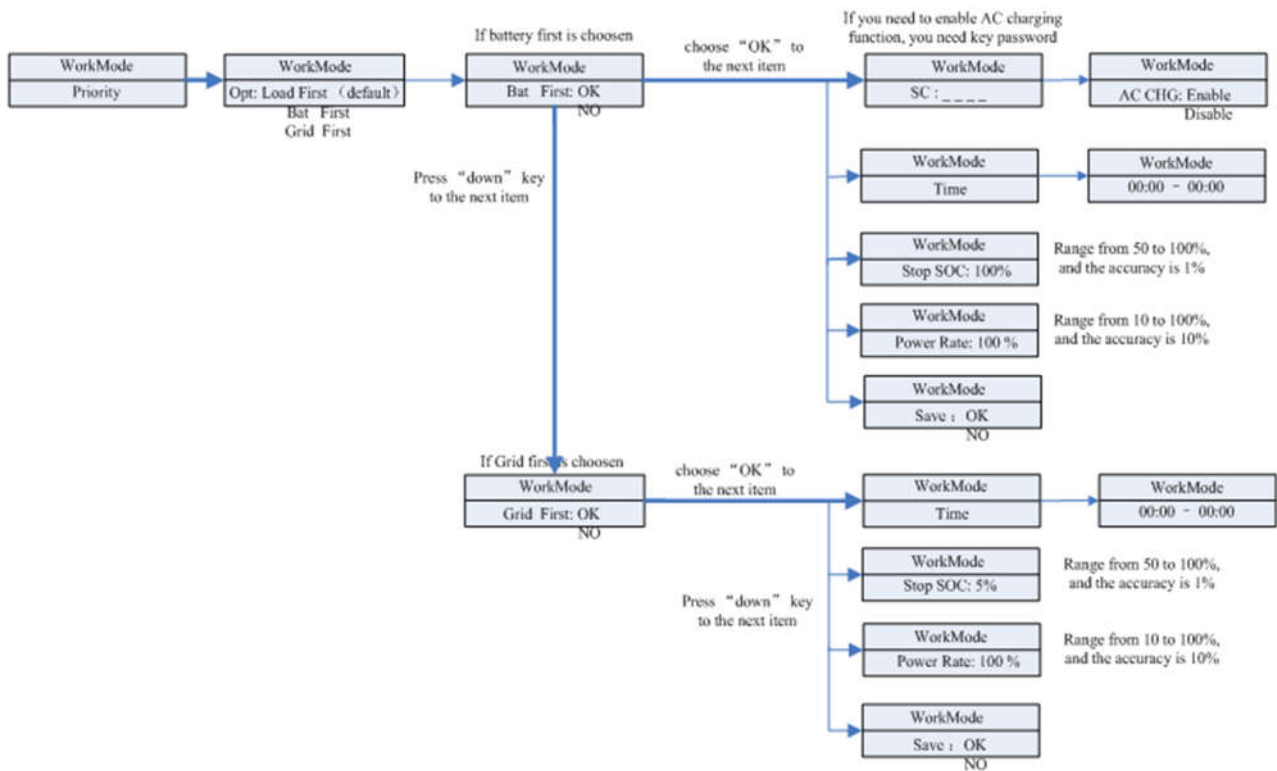


Chart 6.9

**Note:**

1. "Power Rate" is used to set up power of battery. So different battery may have the different power, customer need to check the max power of battery.
2. Time setting is 24-hour. If the end time is less than beginning time, it defaults to spanning days.
4. Under the MODE Change, you can see the setup options below after pressing Enter:

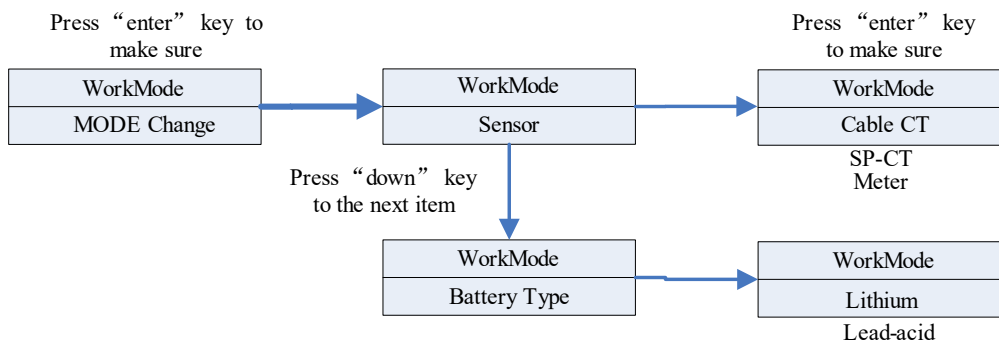


Chart 6.10

The MODE change has two options what are sensor and battery type, sensor is cable CT (default), meter and SP-CT(wireless RF transfer). In the battery type, you can choose lithium battery or lead-acid battery.

5. Under the ExportLimit, you can see the setup options below after pressing Enter:

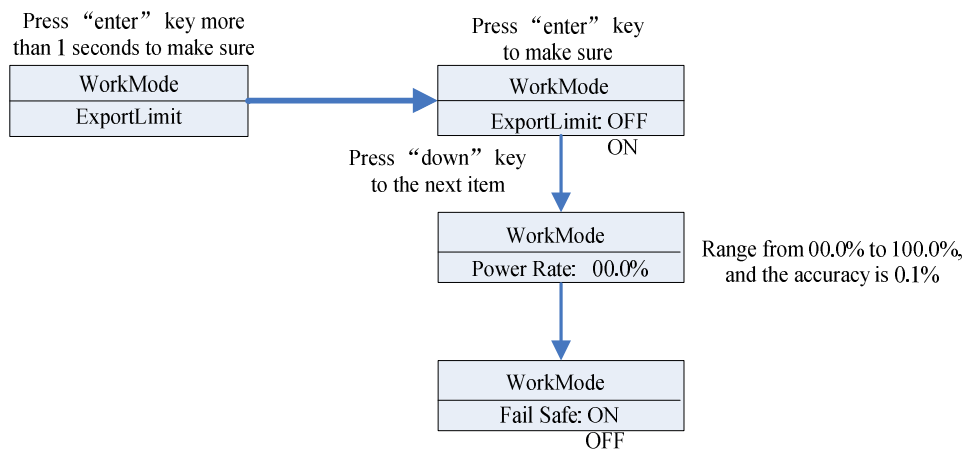


Chart 6.11

Exportlimit is used for users to control the energy flowing to the grid. If this function is enabled, the feeding power to grid will be equal or less than the setup value.

The purpose of the Fail Safe function is to ensure that should any part of the ELS fail, the Active Power exported across the Connection Point will drop to the Agreed Export Capacity or less within the specified time.

Note: 1.Default value is 00.0%

2.Fail safe works only in meter mode

6.Under the default set, you can see the setup options below after pressing Enter:



Chart 6.12

Default set is "resume to default setting", please don't use it unless it's necessary.

## 6.5 Communication

### 6.5.1 Use of USB-A port

USB-A port is mainly for firmware update. Through USB connection, we can quickly update the software of machine. You can see USB-A as below:

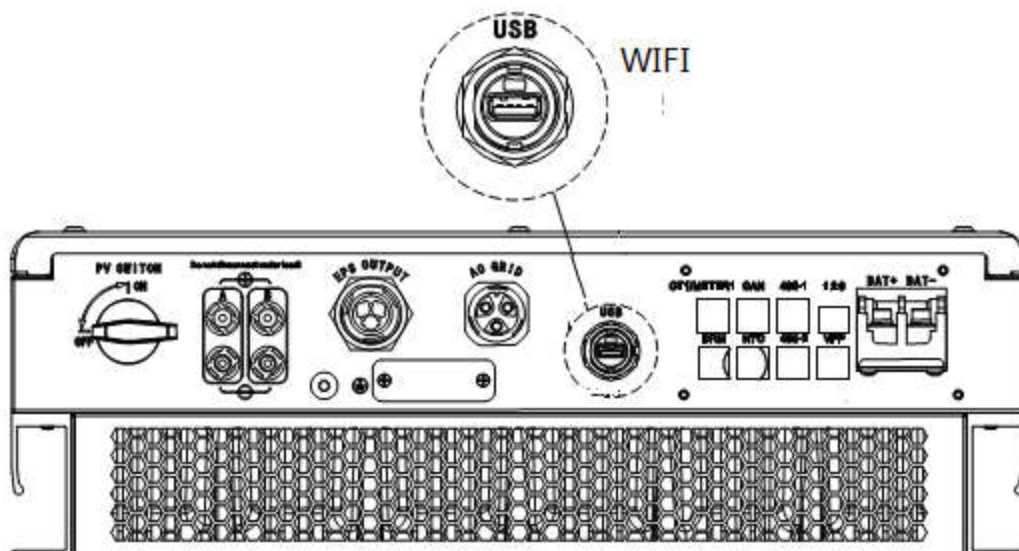


Chart 6.13

**Note:**

USB is only used for firmware update. Customer can't use it for charging.

**6.5.2 The SPH's monitoring**

The SPH provide RS232 interface. Users can through the following communication solution to monitor the SPH.

**Note:**

This kind of monitoring can only be used by the monitor of Growatt's Shineserver /shine phone provided by the company. Through RS232 interface connect to Wi-Fi-S/shinelinek, use computer terminal/or mobile phone for data monitoring.

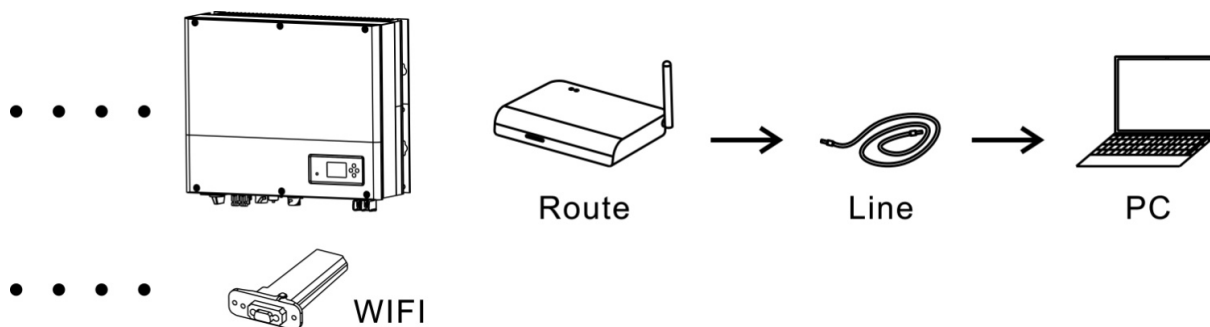


Chart 6.17

Before use WIFI communication, you should make sure the follow PIN1 and PIN2 are ON:

## 7 Start-up and shut down SPH system

### 7.1 Start-up the SPH system

Users can start-up SPH inverters through following steps:

- 1.Connect to PV
- 2.Connect to Grid
- 3.Connect to Battery
- 4.Turn the switch on in turn of Grid, battery and PV
- 5.When the LED turns green, the working information on LCD indicates the successful start-up of SPH inverter

### 7.2 Disconnect the SPH system

- 1.Turn off all the circuit breaker and switch
- 2.Disconnect PV
- 3.Disconnect the inverter
- 4.Disconnect the battery
- 5.Pull up AC PLUG connection
- 6.Waiting until LED, LCD display have gone out, the SPH is shut down completely

## 8 Attention of the installation environment, maintenance and cleaning

Heat dissipation performance is very important when SPH inverter work under the environment of high temperature, better heat dissipation can reduce the possibility of SPH inverter stops working. Growatt SPH series inverter without fan so belongs to natural cooling, hot air from the top of the radiator, tie-in battery, use environment for IP65, please pay attention to the temperature of the installation environment, to ensure that the battery's safety and the normal work of the machine.

When use battery, please pay attention to the follow information:

Caution: Do not dispose of batteries in a fire. The batteries may explode.

Caution: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

Caution: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:

- Remove watches, rings or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.
- Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

If SPH inverter doesn't work for overheating or too cold, solve it according to the following methods

- Confirm whether the radiator air duct installation is reasonable, choose the appropriate position before installation.
- If lead-acid batteries are connected, confirming the NTC battery is in a good installation

- Confirm whether the battery temperature is too high, too high temperature of battery can also lead to SPH fail to work, at this point, to ventilation, cooling or still handle to the battery, please.
- If temperature is low, also can appear the battery low temperature protection, the battery will start with small load in low temperature output, after temperature back to normal system can work normally, please be patient at this time
- If the temperature is too low, it is possible that battery will be low temperature protection, at this time, please pay attention to the working temperature range listed in the specifications of the book.
- Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions.
- When replacing batteries, replace with the same type and number of batteries or battery packs.
- General instructions regarding removal and installation of batteries.

**Remark:**

All of above action should be operated by professional person, if you want to do these works, you must make sure the whole system are off.

## 9 Fault removal

Our products are carried out with strict tests before they take out, if the operation difficulties in the process of installation, please log on to [www.ginverter.com](http://www.ginverter.com) website, view the Q&A program.

When SPH inverter fault happens, please inform our company, and to provide SPH related information, we will have a professional after-sales service personnel to answer you.

What you need to provide the information about the SPH including:

- Serial number
- Model
- Information about the LCD display
- Brief description of problems
- The battery voltage
- The PV input voltage and power per string.
- The grid voltage and frequency
- Can you retell the failure problem? If you can, what kind of a situation
- Did the problem happen in the past?
- When did this fault happen? First installation?
- About the battery
- The manufacturer name and model of battery
- Capacity of battery
- Output voltage of the battery
- The time you buy Battery and frequency you use it

### 9.1 System fault information list and troubleshooting suggestions

Warning Message		
Error Message	Description	Suggestion
Warning401	SP-CT/Meter Communication fault	Check the wire connection between meter and inverter is good or not. Check the distance of SP-CT and inverter is in the

		range of specification or not. Restart inverter and SP-CT, reconnect.
Warning203	PV1 or PV2 Circuit short	Check the positive and negative of PV input is reversed or not. Reinserted the PV terminal, please contact Growatt service center if restart can't solve the problem.
Warning506	Battery temperature out of specified range for charge or discharge	Check the environment temperature of battery is in the range of specification or not.
AC V Outrange	Grid voltage fault. Please refer to the local grid standard for more details of the grid frequency.	Check the AC voltage is in the range of standard voltage in specification. Check the grid connection is good or not.
AC F Outrange	Grid frequency fault. Please refer to the local grid standard for more details for the grid voltage.	Check the frequency is in the range of specification or not. Restart inverter. Please contact Growatt service center if restart can't solve the problem.
PairingTimeOut	Communication fault	Check the distance of SP-CT and inverter is in the range of specification or not. Restart inverter and SP-CT, reconnect.
CT LN Reversed	LN Reversed	Check the L line and N line of SP-CT is reversed or not. Check the PE of SP-CT is connected well or not.
BMS COM Fault	Communication fault	Check the lithium Battery is open or not. Check the connection of lithium Battery and inverter is good or not.
Battery reversed	Battery terminals reversed	Check the positive and negative of battery is reversed or not.
BAT NTC Open	NTC open (only for lead-acid battery)	Check the temperature of lead-acid battery is installed or not. Check the temperature of lead-acid battery is connected well or not.
Battery Open	Battery terminal open (only for lithium battery)	Check the battery connection is good or not. Check the switches between the battery and inverter are all on or not.
Over Load	EPS output overload warning. If this warning occurred three time. Off-grid function will be locked one hour and output power again.	Please reduce the load of EPS output.



No AC Connection	No Utility	Please confirm grid is lost or not. Check the grid connection is good or not. Check the switches on the cable are on or not.
Output High DCI	Output DC current too high. Please refer to the local grid standard for disconnection time when the output DC current is too high.	Restart inverter. Please contact Growatt service center if restart can't solve the problem.
Bat Voltage High	Battery Voltage higher than 60V	Check the voltage of battery is in the range of specification or not. Check the battery connection is right or not If battery is really higher than 60V. Please disconnect the connection of battery and check inverter.
Bat Voltage Low	Battery Voltage Lower than 42 V	Check the real voltage of battery. Check the wire of battery and inverter is good or not.
BMS Warning:XXX	BMS report warning	Check the warning information from lithium battery user manual. Please contact Growatt service center if restart can't solve the problem.
BMS error:XXX	BMS report error	Check the warning information from lithium battery user manual. Please contact Growatt service center if restart can't solve the problem.
EPS Volt Low	EPS output voltage low	Check the load of EPS. If overload occurred, reduce load. Restart inverter again.

Error Message		
Error Message	Description	Suggestion
Error 411	Internal communication failed	Restart inverter. Please contact Growatt service center if restart can't solve the problem.
Error 417	Sample fault	Restart inverter Please contact Growatt service center if restart can't solve the problem
Error 418	DSP and COM firmware version unmatch, system fault.	Read DSP and COM firmware version from LCD or shinebus. Check if the firmware is correct.
Error 303	Inverter L N reversed or ground failed	Check the L line and N line is reversed or not. Check the PE s connected well or not.

Error 405	Relay fault	Restart inverter. Please contact Growatt service center if restart can't solve the problem.
Error 123	Autotest failed (only in Italy)	Restart inverter. Please contact Growatt service center if restart can't solve the problem.
PV Isolation Low	PV isolation too low	Check the connection of PV panels and inverter is good or not. Check the PE of inverter is good or not.
OP Short Fault!	EPS Output Short Fault	Check the load of EPS. Check the output of EPS. Especial not connect to grid
NTC Open	Internal temperature failed	Please contact Growatt service center
Error 406	Model set up not meet with certification	Please check model set or check the DIP setting
Residual I High	Leakage current too high	Check the cable of inverter. Restart inverter. Please contact Growatt service center if restart can't solve the problem
Error 408	Temperature over range	Please check the temperature is in the range of specification or not.
PV Voltage High	PV voltage higher than datasheet	Please check the voltage of PV input is in the range of specification or not.

## 10 Manufacturer Warranty

This certificate represents a 5 year warranty for the Growatt products listed below. Possession of this certificate validates a standard factory warranty of 5 years from the date of purchase.

### Warranted products

This warranty is applicable solely to the following products:

- Growatt SPH3000.
- Growatt SPH3600.
- Growatt SPH4000.
- Growatt SPH4600.
- Growatt SPH5000.
- Growatt SPH6000.
- SPH 3000TL BL-UP
- SPH 3600TL BL-UP
- SPH 4000TL BL-UP
- SPH 4600TL BL-UP
- SPH 5000TL BL-UP
- SPH 6000TL BL-UP

### Limited Product Warranty

(Applicable under normal application, installation, use and service conditions) Growatt warrants the above

listed products to be free from defects and/or failure specified for a period not exceeding five (5) years from the date of sale as shown in the Proof of Purchase to the Original purchaser.

The warranties described in these "Limited Warranty" are exclusive and are expressly in lieu of and exclude all other warranties, whether written, oral, expresser implied, including but not limited to, warranties of merchantability and of fitness for a particular purpose, use, or application, and all other obligations or liabilities on the part of GROWATT , unless such other obligations or liabilities are expressly agreed to it in writing signed and approved by GROWATT , GROWATT shall have no responsibility or liability whatsoever for damage or injury to persons or property, or for other loss or injury resulting from any cause whatsoever arising out of or related to the modules, including, without limitation, any defects in the modules or from use or installation. Under no circumstances shall GROWATT be liable for incidental, consequential or special damages howsoever caused; loss of use, loss of production, loss of revenues are therefore specifically and without limitation excluded to the extent legally permissible, GROWATT's aggregate liability, if any, in damages or otherwise, shall not exceed the invoice as paid by the customer.

The "**Limited Product Warranty**" described above shall not apply to, and Growatt shall have no obligation of any kind whatsoever with respect to, any machine which has been subjected to:

- Misuse, abuse, neglect or accident;
- Alteration, improper installation or application;
- Unauthorized modification or attempted repairs;
- Insufficient ventilation of the product;
- Transport damage;
- Breaking of the original manufacturers seal;
- Non-observance of Growatt installation and maintenance instruction;
- Failure to observe the applicable safety regulations
- Power failure surges, lighting, flood, fire, exposure to incorrect use, negligence, accident, force majeure, explosion, terrorist act, vandalism or damage caused by incorrect installation, modification or extreme weather conditions or other circumstances not reasonably attributable to Growatt.

The warranty shall also cease to apply if the product cannot be correctly identified as the product of Growatt. Warranty claims will not be honored if the type of serial number on the machines have been altered, removed or rendered illegible.

#### **Liability**

The liability of Growatt in respect of any defects in its machines shall be limited to compliance with the obligations as stated in these terms and conditions of warranty. Maximum liability shall be limited to the sale price of the product. Growatt shall accept no liability for loss of profit, resultant of indirect damage, any loss of electrical power and / or compensation of energy suppliers within the express meaning of that term.

The warranty rights as meant herein are not transferable or assignable to any third party excepting the named warranty holder.

#### **Warranty Conditions**

If a device becomes defective during the agreed Growatt factory warranty period and provided that it will not be impossible or unreasonable, the device will be, as selected by Growatt:

1. Shipped to a Growatt service center for repair.
2. Repaired on-site.
3. Exchanged for a replacement device of equivalent value according to model and age.



The warranty shall not cover transportation costs in connection with the return of defective modules. The cost of the installation or reinstallation of the modules shall also be expressly excluded as are all other related

logistical and process costs incurred by all parties in relation to this warranty claim.

## 11 Decommissioning

### 11.1 Dismantling the energy storage

1. Disconnect the storage machine such as mentioned in section 7.
2. Disconnect the upper cable of SPH inverter

Watch out the SPH's shell heat and prevent to scald  
Wait 20 minutes until the SPH cooling and then to disassembly!

3. Unscrew all the connecting cable
4. Unscrew the radiator and wall-mounted anchor screw and then take down the machine from wall.

### 11.2 Packing the SPH inverter

Usually placed SPH inverter in the packing box with tape sealing, if the SPH inverter cannot reoccupy, you can choose a cheap carton for packaging. Carton requirements must meet the size of the inverter and can support energy storage machine overall weight.

### 11.3 Storing SPH inverter

Store SPH inverter in a dry place where ambient temperatures are always between -25°C and +60°C

### 11.4 Disposing of the SPH inverter



Do not dispose of SPH inverter together with household waste. Please accordance with the disposal regulations for electronic waste which apply at the installation site at that time. Ensure that the old unit and, where applicable, any accessories are disposed of in a proper manner

## 12 Product specification

### 12.1 SPH series energy storage machine product specification

Model	Growatt SPH3000&SP H 3000TL BL-UP	Growatt SPH3600&SPH 3600TL BL-UP	Growatt SPH4000&SPH 4000TL BL-UP	Growatt SPH4600&SPH 4600TL BL-UP	Growatt SPH5000&SPH 5000TL BL-UP	Growatt SPH6000&SPH 6000TL BL-UP	备注
Specifications							
<b>Input data(DC)</b>							
Max.	6000W	7200W	7200W	8000W	8000W	9000W	

recommended PV power(for module STC)							
Max. DC voltage	550V	550V	550V	550V	550V	550V	
Start voltage	120V	120V	120V	120V	120V	120V	
Nominal voltage	370V	370V	370V	370V	370V	370V	
MPP work voltage range	120V-550V	120V-550V	120V-550V	120V-550V	120V-550V	120V-550V	
Full load dc voltage range	275V-440V	275V-440V	275V-440V	340V-440V	340V-440V	340V-440V	
Number of independent MPP trackers	2						
No. of PV strings per MPP trackers	1						
Max. input current per MPP trackers	13.5A						
Max. short-circuit current per MPP trackers	16.9A						
Backfeed current to the array	0A						
<b>AC output/input data</b>							
Gowatt SPH&SPH TL BL-UP Rated input / output power	3000/3000W&3000/3000W	3000/3680W&3680/3680W	3000/4000W & 4000/4000W	3000/4600W&4600/4600W	3000/5000W&5000/5000W	3000/6000W&6000/6000W	
Rated output apparent power	3000VA	3680VA	4000VA	4600VA	5000VA	6000VA	
Nominal AC voltage/range	230V ; 180Vac-260Vac	230V ; 180Vac-260Vac	230V ; 180Vac-260Vac	230V ; 180Vac-260Vac	230V ; 180Vac-260Vac	230V ; 180Vac-260Vac	
Nominal Frequency	50Hz	50Hz	50Hz	50Hz	50Hz	50Hz	
SPH&SPH TL BL-UP Rated input / output current	13.5/13.5A&13.5/13.5A	13.5/16A&16/16A	13.5/17.5A&17.5/17.5A	13.5/20A&20/20A	13.5/22A&22/22A	13.5/27A&27/27A	
Max inrush peak current	10A(5mS)						

Maximum output fault peak current	65A(56uS)						
Maximum output over current protection	65A						
Phase factor at rate power	1						
Displacement power factor, configurable*	0.8leading... 0.8lagging	0.8leading... 0.8lagging	0.8leading... 0.8lagging	0.8leading... 0.8lagging	0.8leading... 0.8lagging	0.8leading... 0.8lagging	0.8leading... 0.8lagging
THDI	<3%	<3%	<3%	<3%	<3%	<3%	<3%
AC connection	Single phase	Single phase	Single phase	Single phase	Single phase	Single phase	
<b>EPS output data(AC power)</b>							
Growatt SPH &SPH TL BL-UP Rated output apparent power	3000VA&3000VA	3000VA&3680VA	3000VA&4000VA	3000VA&4000VA	3000VA&4000VA	3000VA&4000VA	
Nominal voltage	230V	230V	230V	230V	230V	230V	
Rated Frequency AC output	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	
Growatt SPH &SPH TL BL-UP Rated output current	13A/13A	13A/16A	13A/17.5A	13A/17.5	13A/17.5A	13A/17.5A	
THDv	3%	3%	3%	3%	3%	3%	
Switch time(SPH TL BL-UP))	≤10ms	≤10ms	≤10ms	≤10ms	≤10ms	≤10ms	
<b>BAT data (DC)</b>							
Battery voltage range	42~59V	42~59V	42~59V	42~59V	42~59V	42~59V	
Minimum full load voltage	46V	48V	48V	48V	48V	48V	
Growatt SPH&SPH TL BL-UP Rated charging and discharging current	66A& 66A	66A&75A	66A&85A	66A&85A	66A&85A	66A&85A	
Growatt SPH&SPH TL BL-UP Continuous charging /	3000W&3000W	3000W&3680W <sup>*1</sup>	3000W&4000W <sup>*1</sup>	3000W&4000W <sup>*1</sup>	3000W&4000W <sup>*1</sup>	3000W&4000W <sup>*1</sup>	

discharging power							
Type of Battery	lithium /Lead-acid	lithium /Lead-acid	lithium /Lead-acid	lithium /Lead-acid	lithium /Lead-acid	lithium /Lead-acid	
<b>Efficiency</b>							
Max. efficiency	97.2%	97.2%	97.3%	97.4%	97.5%	97.6%	
Euro weighted efficiency	97%	97%	97.1%	97.1%	97.2%	97.2%	
MPPT efficiency	≥99.5%	≥99.5%	≥99.5%	≥99.5%	≥99.5%	≥99.5%	
<b>Protection devices</b>							
Safety level	Class II						
Overvoltage category	PV:II AC:III Others:I						
Ingress protection	IP65						
Inverter topology	Non-isolated						
Operating temperature range	-25°C ... +60°C (-13...+140°F) with derating above 45°C /113°F						
Safety level	Class I						
Ingress protection	IP65						
DC switch	Integrated						
DC reverse-polarity protection	Integrated						
DC Surge protection	Type II						
Insulation resistance monitoring	Integrated						
AC surge protection	Type II						
AC short-circuit protection	Integrated						
Ground fault monitoring	Integrated						
Grid monitoring	Integrated						
Anti-islanding protection	Integrated(Active Frequency Drift)						
Residual-current monitoring unit	Integrated						
<b>General Data</b>							

Dimensions (W / H / D) in mm	461*565*188	
Weight	27KG	
Noise emission (typical)	≤ 25 dB(A)	
Altitude	2000m	
Self-Consumption	< 10 W	
Cooling concept	Natural	
Relative humidity	100%	
<b>Features</b>		
DC connection	MC4/H4(opt)	
AC connection	connector	
BAT connection	OT Terminal	
Display	LCD	
Interfaces: RS485/ USB /CAN/Wi-Fi/GPRS	yes /yes /yes/yes	
Warranty: 5 years / 10 years	yes /opt	
Certificates and approvals	CE, IEC62109, G98/G99, VDE0126-1-1, AS4777, CEI 0-21, VDE-AR-N4105, UTE C 15-712, EN50549, IEC 61727, IEC 62116, IEC 62040 „C10/11,NRS 097-2-1	

Note:

- <sup>\*\*1</sup> Continuous charging current: if there is PV and the PV power is large enough, the maximum continuous charging power can reach 4000W; If there is no PV, only AC is connected, the maximum continuous charging power is 3000W.

## 12.2 DC input terminal parameter

MC4 specification:

	2.5mm <sup>2</sup> /14AWG	4mm <sup>2</sup> /12 AWG	6mm <sup>2</sup> /10 AWG	10mm <sup>2</sup> /8AWG
Rated current (90°C environment)	32A	40A	44A	65A
Nominal system voltage	600V DC(UL) 600V DC(TUV)			
Contact resistance	0.25mΩ (model)			
Protection grade	IP68			

Socket contact materials	Copper, tin
Insulation materials	Thermoplastics UL94 V-0
Ambient temperature range	-40°C to +90°C
Wire stripping length	7.0mm(9/32)



Cable casing diameter	4.5 to 7.8mm(3/16: to 5/16")
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### 12.3 Torque

Upper cover screws	1.3Nm(10.8 1bf.in)
Dc connector	1.8Nm(16.0 1bf.in)
M6 screwdriver	2Nm(18 1bf.in)
Grounding screw	2Nm(18 1bf.in)

### 12.4 Appendix

The following chart is the energy storage machine optional appendix list, if there is a need please contact the Growatt New Energy Technology Co., Ltd or dealer orders (P/N is only for reference and it may be changed).

Name	Description	GROWATT P/N
Shine link	Used for data record in EU	MR00.0007200
	Used for data record in Australia	MR00.0006100
Shine Wi-Fi	COM interface	MR00.0004601
SP-CT	Wireless meter sensor	MR00.0006700
SPM(Single phase meter)	RS485 meter sensor	MR00.0008800
TPM(three phase meter)	RS485 meter sensor (standard)	MR00.0008300
	RS485 meter sensor (for Italy)	MR00.0008400

### 13 Certificate

Growatt SPH series inverter apply within the scope of the world, so the inverter have to satisfy different countries and regions of different safety standards

Model	Certificate
Growatt SPH3000 Growatt SPH6000 SPH 3000TL BL-UP SPH 6000 TL BL-UP	CE,IEC62109,G83,VDE0126-1-1,G59,AS4777,AS/NZS3100, CEI0-21,VDE-AR-N4105,EN50438,VFR,MEA,PEA,IEC61727,IEC62116
Growatt SPH3600 Growatt SPH4000 Growatt SPH4600 Growatt SPH5000 SPH 3600 TL BL-UP SPH 4000 TL BL-UP SPH 4600 TL BL-UP SPH 5000 TL BL-UP	CE,IEC62109,G83,VDE0126-1-1,G59,AS4777,AS/NZS3100, CEI0-21,VDE-AR-N4105,EN50438,VFR,IEC61727,IEC62116

## 14 Contact

If you have technical problems about our products, contact the Growatt Service line or dealer. We need the following information in order to provide you with the necessary assistance:

- 1.SPH inverter Serial number
- 2.SPH inverter module information
- 3.SPH inverter communication mode
- 4.SPH inverter fault information code
- 5.SPH inverter Display content
- 6.The manufacturer and model of the battery
7. Battery capacity and connection mode

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