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Installation & Operation Manual

list

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1 Brief Introduction

1.1 Preface

This manual will provide the users who use the Growatt SPH 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

Growatt SPH 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 Growatt SPH 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 and leave some message. Or you can call our 24-hour service hotline +86 0755 2747 1942/400-931-3122.

1.3 Product Description

Growatt 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 back up power.

SPH series has six kinds of type:

- Growatt SPH3000
- Growatt SPH3600
- Growatt SPH4000
- Growatt SPH4600
- Growatt SPH5000
- Growatt SPH5600

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

Note: In different country,we provide different power.Such as in Germany,we can provide SPH3000~SPH4600,but we don't provide SPH5000 and SPH6000.

Overview:

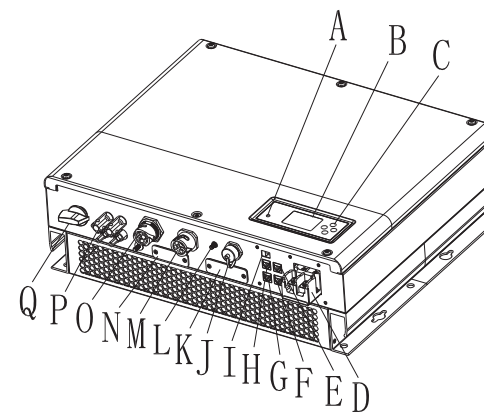


Chart 1.1

| Position | Description |
|----------|--|
| A | LED of status display |
| B | LCD screen |
| C | Function button |
| D | Battery terminal |
| E | NTC:Lead-acid temperature sensor terminal |
| F | RJ45 interface of DRMs(used only in Australia) |
| G | CT/meter input terminal |
| H | RS485 communication interface of Lithium battery |
| I | DIP switch(set safety standard) |
| J | USB interface |
| K | RS232/Wi-Fi cover board |
| L | Ground point |
| M | AC Grid (on grid connection) |
| N | RSD(do not open except by Professional staff) |
| O | EPS output(off grid connection) |
| P | PV input |
| Q | PV switch |

1.4 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.

2.1 Purpose Use

The system chart of SPH:

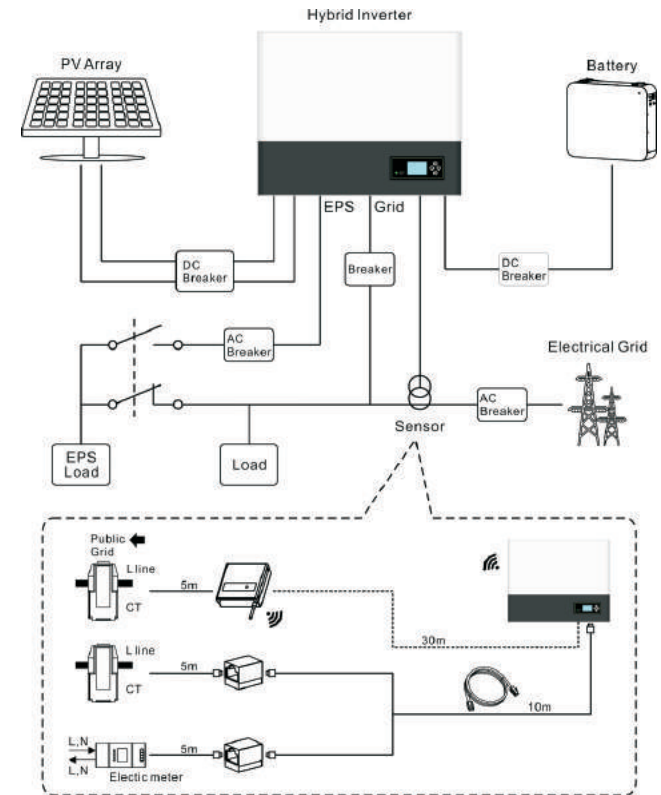


Chart 2.1

As shown above, a complete grid-connected system of SPH consists of PV modules, SPH 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 in 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



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



Risk of burns on the parts shell of SPH inverter !

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



SPH inverter exists radiation maybe affect health !

Don't stay a long time within 20cm 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 |
| | Danger to life due to high voltage in SPH There is residual voltage in SPH, SPH requires 5 minutes to discharge. Please wait 5 minutes before you open the upper lid or the DC lid. |
| | Protective conductor terminal |
| | Direct Current(DC) |
| | Alternating Current(AC) |
| | The inverter complies with the requirements of the applicable CE guidelines |
| | Refer to the operating instructions. |

3 Product Description

3.1 Growatt SPH series inverter

Marks of SPH

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

3.2 Label Explanation

Label contains the following information: for example SPH6000 shows as below:

Growatt

Model Name:
Growatt SPH6000

PV input data:

Max. input power:
4000W/4000W

PV input voltage range:
120V~550Vdc

Number of input strings:
2/1

Max. input current per string:
12A

AC output data:

Max. AC apparent power:
6000VA

Max. AC output current:
27A

AC Nominal voltage:
230V , 50 / 60Hz

Power Factor:
0.8leading~0.8lagging

Stand alone:

Rated AC output power:
3000W

Rated AC output voltage:
230V , 50 / 60Hz

Battery data:

Battery voltage range:
42~59Vdc

Max. charging and discharging current:
66A

Max. charging and discharging power:
3000W



Type of battery:
Lithium / Lead-acid

Environment:

Operating temperature range:
-25°C ~ +60°C

Degree of protection:
IP65

Certificates and approvals
**G83,G59,AS4777,CEI 0-21
CE,IEC62109,AS/NZS 3100
VDE0126-1-1,VDE-AR-N4105**

Description of label:

| | |
|---|--|
| the type of product | Growatt SPH6000 |
| PV input data | |
| Max input power | 4000W/4000W |
| PV input range | 120-550Vdc |
| Number of input strings | 2/1 |
| Max input current per string | 12A |
| AC output data | |
| Max AC apparent power | 6000VA |
| Max AC output current | 27A |
| AC nominal voltage | 230V,50/60Hz |
| Power factor | 0.8 leading~0.8 lagging |
| Stand alone | |
| Rated AC output power | 3000W |
| Rated output voltage | 230V,50/60Hz |
| Battery data | |
| Battery voltage range | 42-59Vdc |
| Max charge and discharge current of battery | 66A |
| type of battery | Lead battery and lithium battery |
| Environment | |
| Operating temperature range | -25°C~+60°C |
| Degree of protection | IP 65 |
| Certificates and approvals | G83,G59,AS4777,CEI 0-21,CE,IEC62109,AS/NZS 3100,VDE 0126-1-1,VDE-AR-N4105 |

3.3 Size and weight

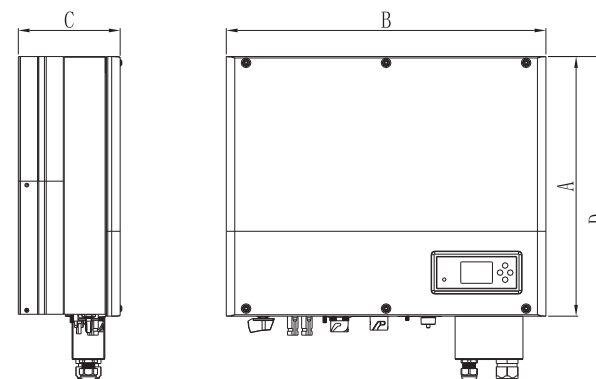


Chart 3. 1

| | A(mm) | B(mm) | C(mm) | weight (kg) |
|-------------|-------|-------|-------|---------------|
| Growatt SPH | 450 | 565 | 180 | 27 |

3.4 The advantage of the unit of Growatt 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.
- Max efficiency 97.5%.
- Two mpp tracker input.

4 Unpacking

Installation 5

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:

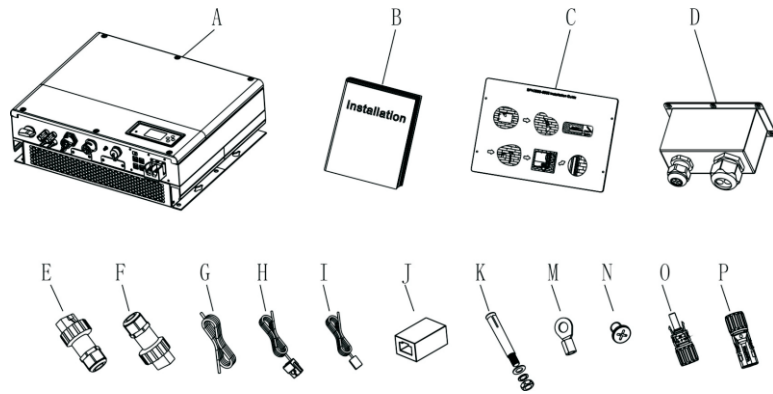


Chart 4.1

| 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 |

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 conforms 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:

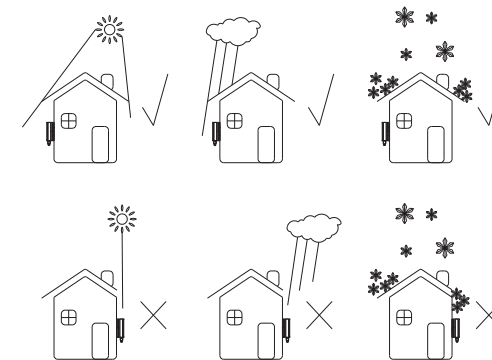


Chart 5.1

- 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℃ ~ 60℃
- G. SPH can be installed in vertical or lean back on plane, Please refer to the below

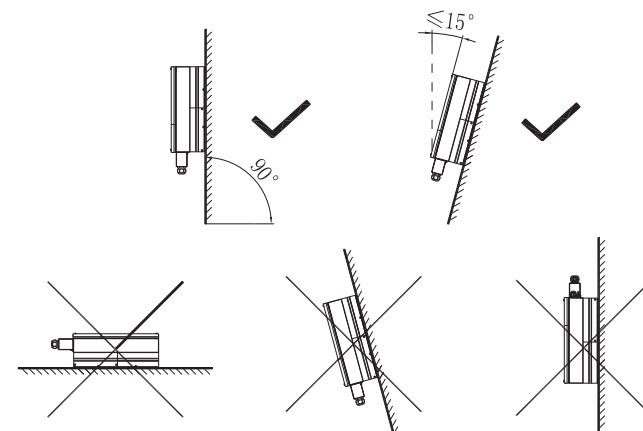


Chart 5.2

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:

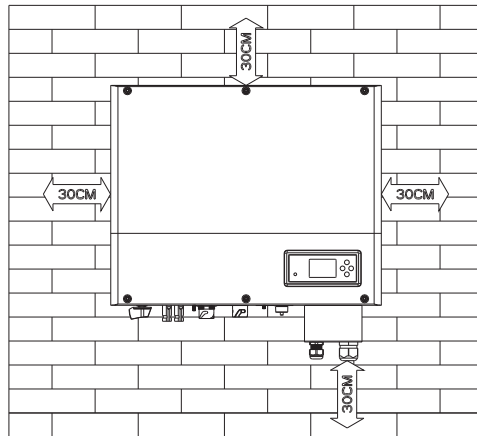


Chart 5.3

- 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 :

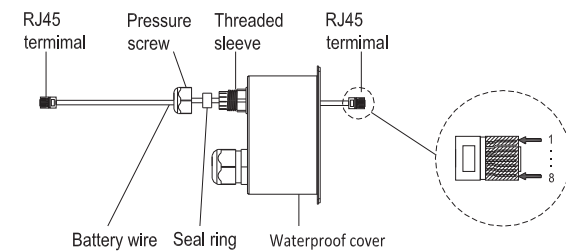


Chart 5.5



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 |

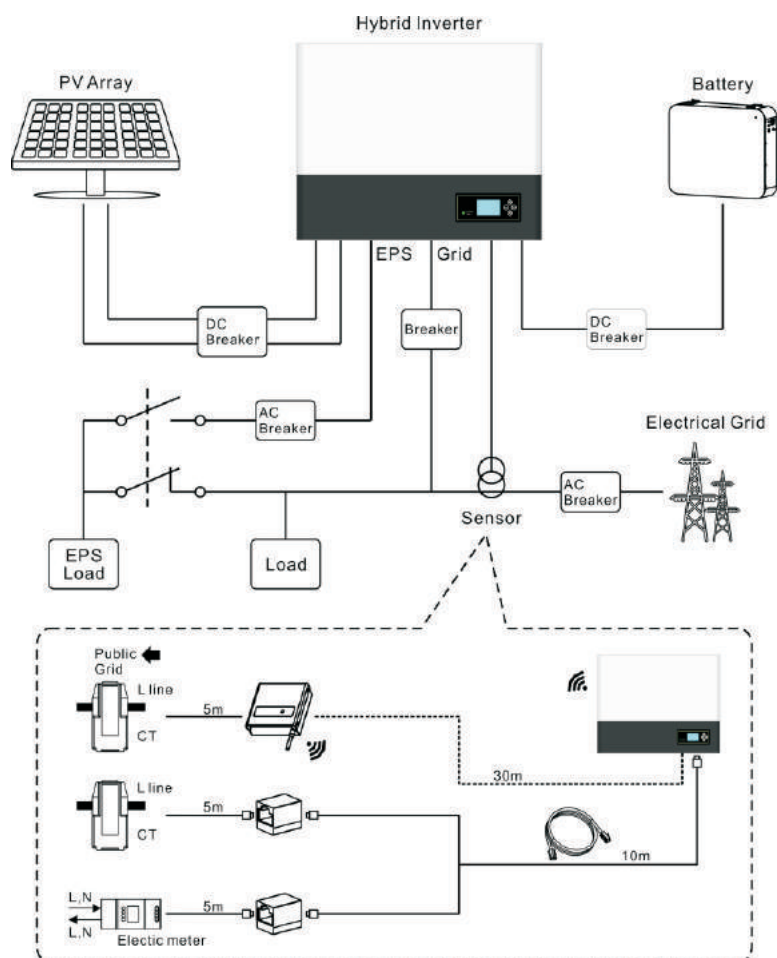
5.3 Installation Instructions

5.3.1 Attention Layout (length of sensors consider)

There're three types of sensors for use with Growatt 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:

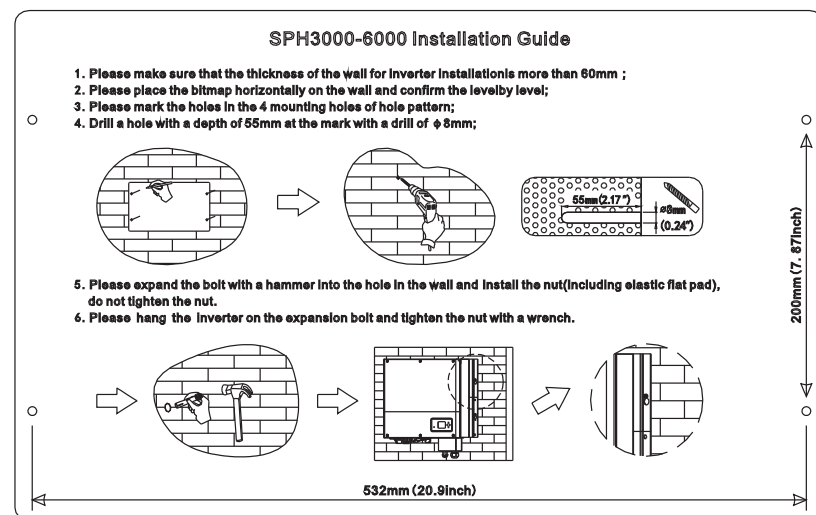
The cable of wired sensor and meter is suggested not longer than 15m. so you need to consider the length between SPH with combiner box for the sensor should be installed in the live line. And if you installed SP-CT for sensor, Distance recommended not more than 30 meters.

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

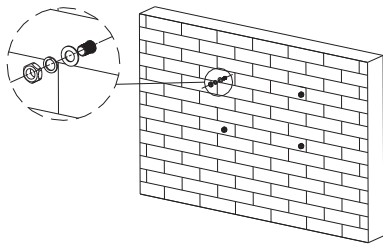


5.3.2 Installation of SPH

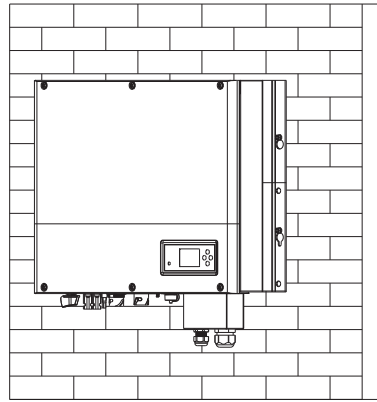
1. Project the machine's probably size on the wall; the thickness of wall for SPH must be not less than 60mm.
2. Make sure the drill position, use paper board (installation guide), put the paper board cling to the wall, make sure the top edge of paper board is level (As the chart 5.8a below) .
3. Mark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



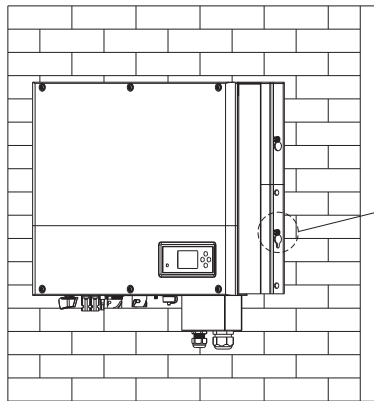
a)



b)



c)



d)

Chart 5.8

5.4 SPH System Connection Mode

5.4.1 Connection of PV terminal

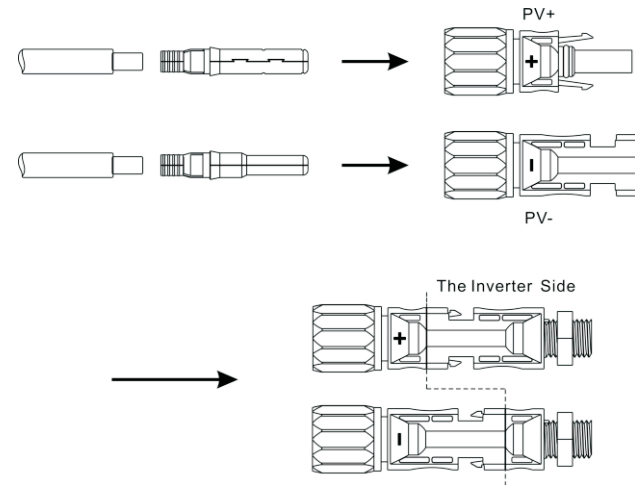


Chart 5.9

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

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.

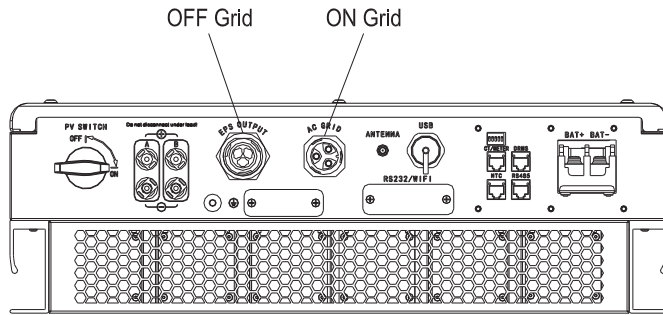


Chart 5.10

wire suggest length:

| conductor cross section | max cable length | | | | | |
|--------------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | Growatt SPH3000 | Growatt SPH3600 | Growatt SPH4000 | Growatt SPH4600 | Growatt SPH5000 | Growatt SPH6000 |
| 5.2mm ² 10AWG | 40m | 33m | 28m | 26m | 25m | 23m |
| 6.6mm ² 9AWG | 50m | 42m | 36m | 33m | 32m | 29m |

AC output terminal connection steps as follow :

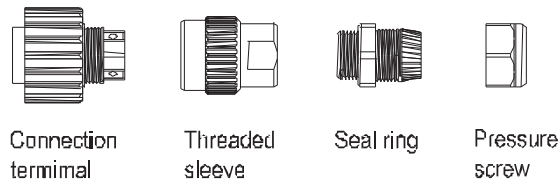


Chart 5.11

Step 1: Uninstall the AC terminal as above chart.

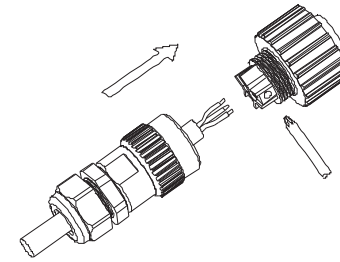


Chart 5.12

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.

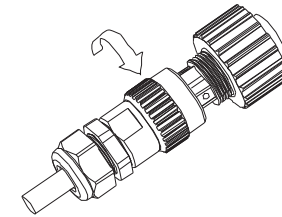
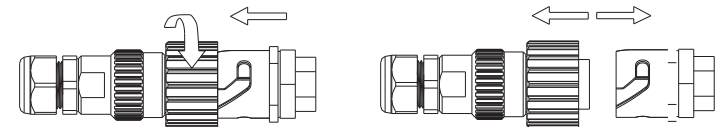


Chart 5.13

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



Screw up AC connector

Release AC connector

Chart 5.14

Step4: Plug the socket into AC output terminal, clockwise rotation to tighten the socket, counterclockwise rotation to loosen the socket.

The recommended wiring diagram is as follows:

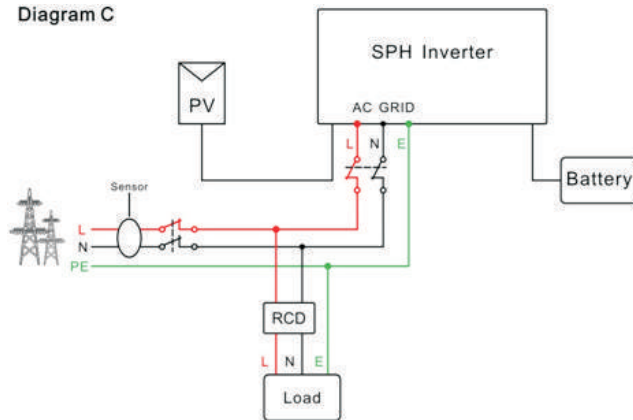


Chart 5.15

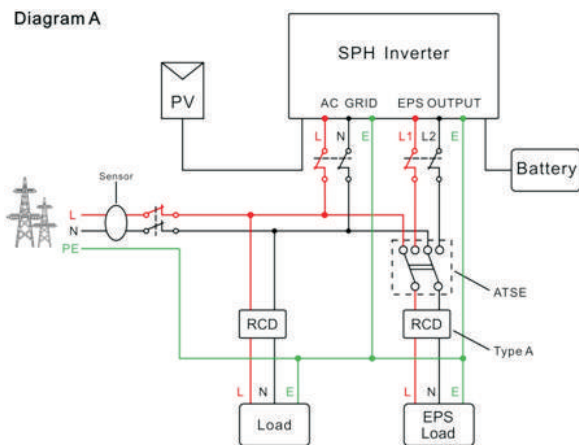


Chart 5.16



Notice:

- 1.If you want to use on grid only, please refer to chart 5.15. connect with AC grid and float EPS OUTPUT.
- 2.If you want to use both on grid power and back up power ,please refer to chart 5.16. connect with AC grid and EPS OUTPUT like the chart show.
- 3.On grid terminal and off grid terminal can't directly connect together, if directly connected together, it will cause damage to inverter!
- 4.Off Grid terminal can't connect to grid. If there is grid power, it will cause damage to inverter!
- 5.If you want to use on grid and off grid, you can use ATS (automatic transfer switch) like before or ask Growatt for help to connect them.

5.4.3 Connection of battery terminal

Install battery steps are as follows:

- 1.Open cover.
- 2.Thread cables through pressure screw, seal ring, threaded sleeve, waterproof cover.
- 3.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).
- 4.Connect positive pole (+) of battery cable to battery positive terminal (+) of the inverter, connect negative pole (-) of battery cable to battery negative terminal (-).

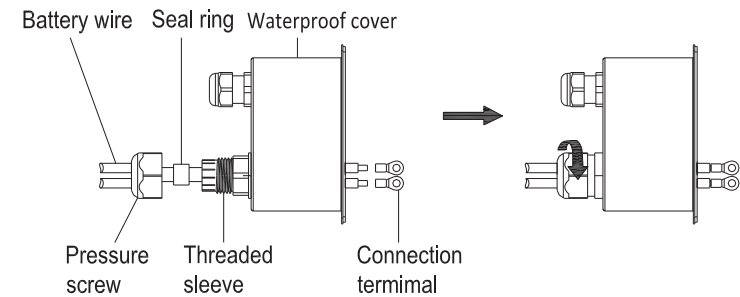
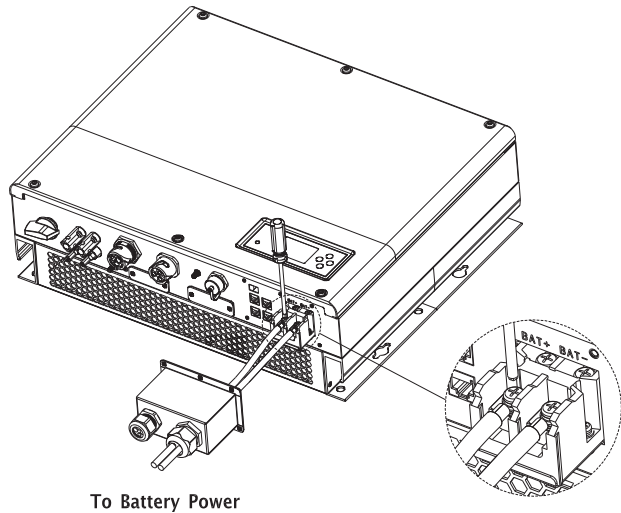


Chart 5.17



To Battery Power

Chart 5.18

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 communication terminal for lithium battery

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 for the "RS485" (lithium battery communication) cable and "NTC" (lead-acid battery temperature sensor) cable and "DRMs" (only used in Australia) cable and the "CT/Meter" (connection of sensor or meter communication) cable at the connection cap.
2. Insert LAN cables into RJ45 terminal, the order of the cables as follow, then press the RJ45 terminal with suitable tools and make sure all of cables are firmly.
3. Connect pressed RJ45 terminal into corresponding port of the inverter.
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" pin connector on the inverter until it snaps into place.

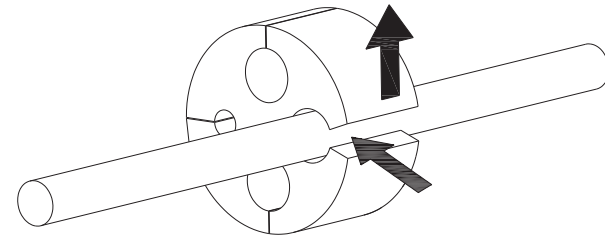
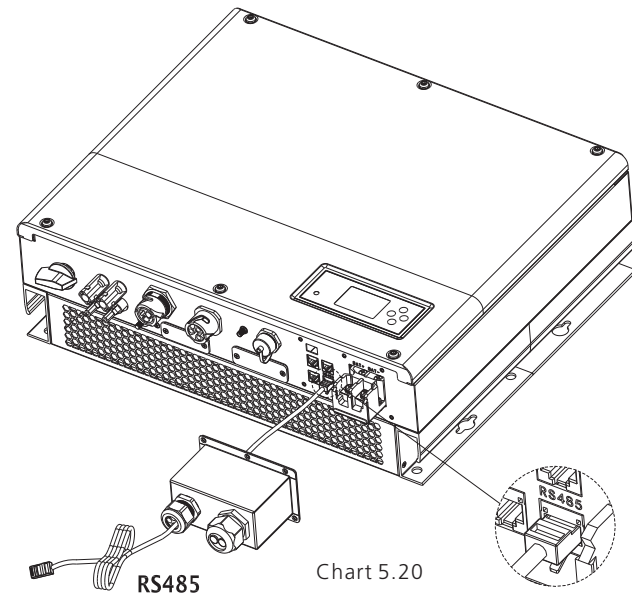


Chart 5.19



RS485

Chart 5.20

Note : If you are using a lead-acid battery, you do not need to install this communication cable, please skip this step to 5.3.5.

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

Note : 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.

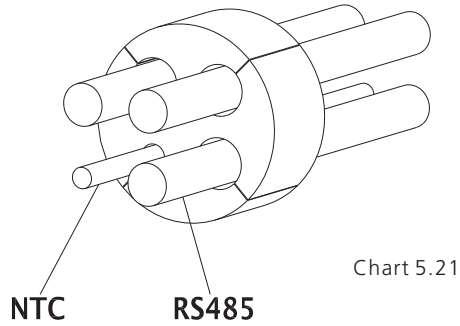


Chart 5.21

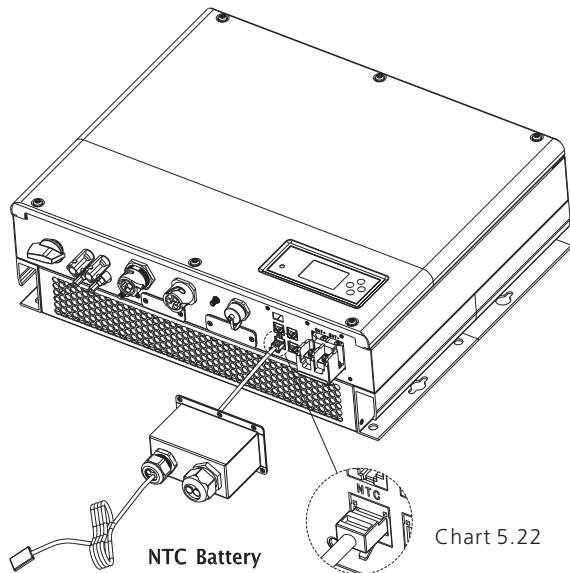


Chart 5.22

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

6. Insert the RJ45 plug of the network cable into the "CT/METER" pin connector on the inverter until it snaps into place.

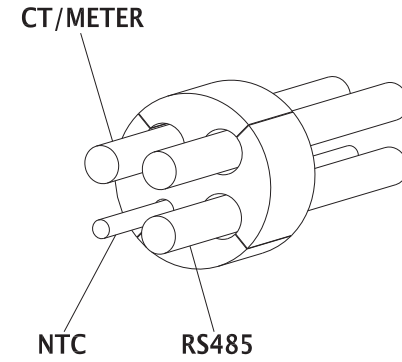


Chart 5.23

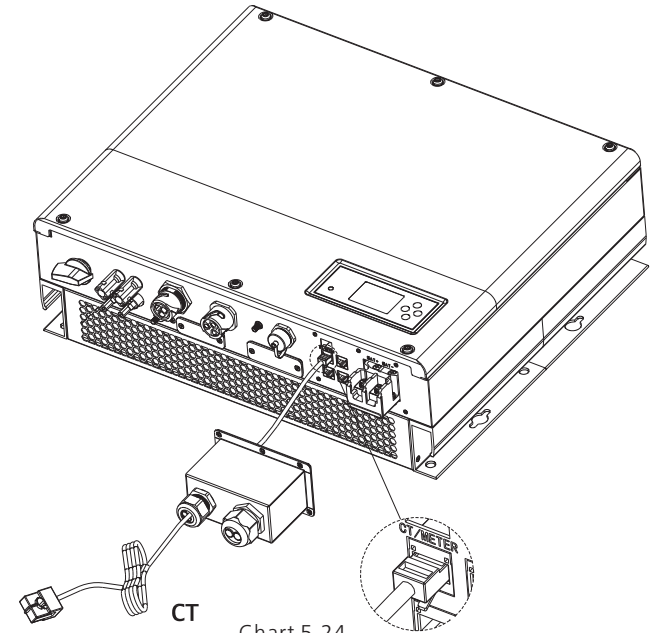


Chart 5.24

Note : The meter and CT cannot 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.

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:

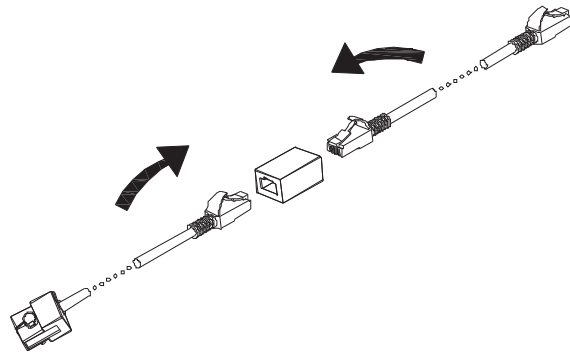


Chart 5.25

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

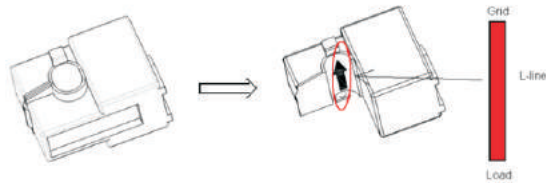


Chart 5.26

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 load to the grid. Sensor needs to be placed in the power distribution cabinet.

5.4.7 Connection of meter terminal

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

- 1.Thread cables through pressure screw, seal ring, threaded sleeve, waterproof cover.
- 2.Insert LAN cables into RJ45 terminal, the order of the cables as follow, then press the RJ45 terminal with suitable tools and make sure all of cables are firmly.
- 3.Connect pressed RJ45 terminal into corresponding port of the inverter.

Note:The meter and CT cannot 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.

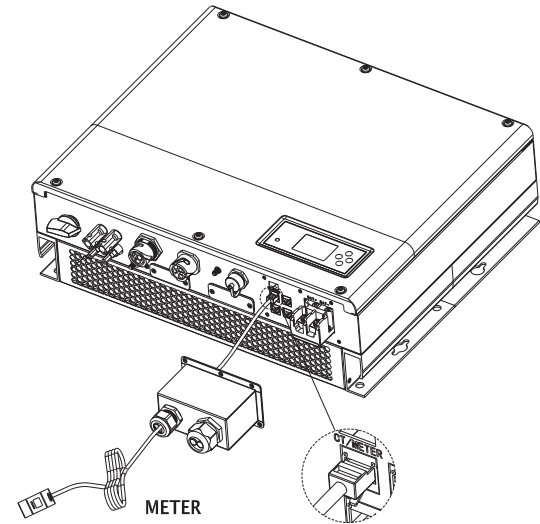


Chart 5.27

5.4.8 Connection of DRM's terminal

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

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

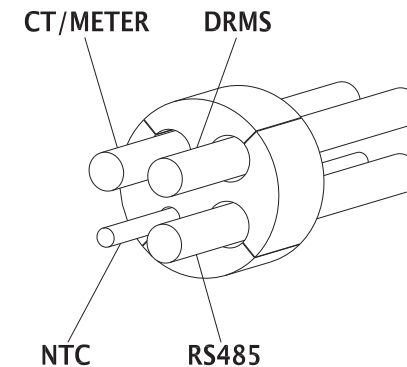


Chart 5.28

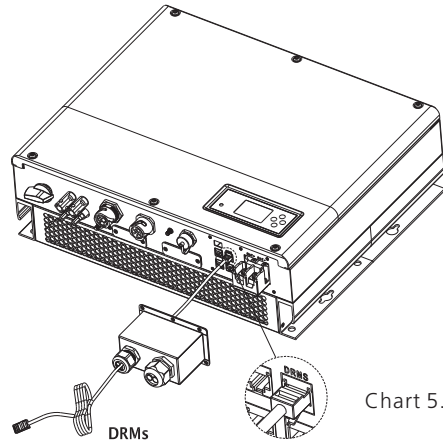


Chart 5.29

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 | RJ 45 socket asserted by shorting pins | | Requirement |
|------|--|---|----------------------------------|
| DRM0 | 5 | 6 | Operate the disconnection device |

| | | | |
|------|---|---|--|
| DRM5 | 1 | 5 | Do not generate power |
| DRM6 | 2 | 5 | Do no 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) |

5.4.9 Grounding connection

grounding

SPH must be grounded by cable, the grounding point is showed as follow, and the minimum grounding cable wire diameter is 10.0mm².

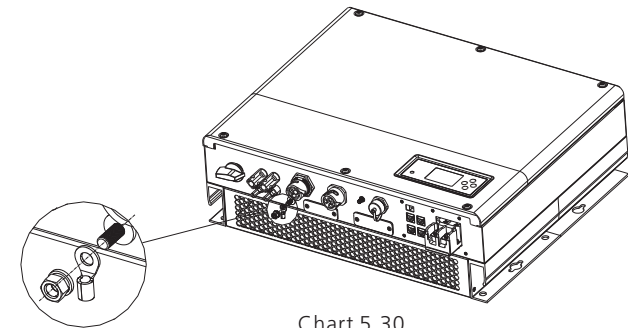


Chart 5.30

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.

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 need 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:

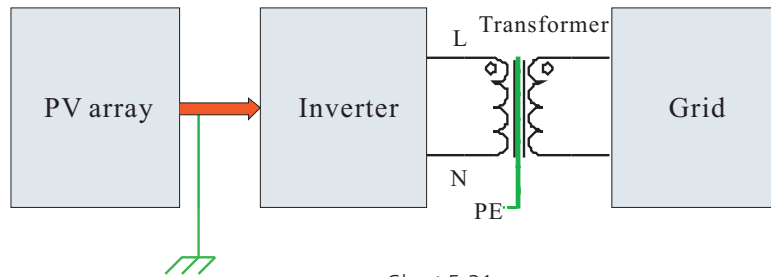


Chart 5.31

6.1 Commissioning of SPH

1) electrify SPH after all installation of Part5 be finished, here are the steps :

- connect AC.
- connect PV.
- turn on battery.

if PV、Grid and battery are available, system would work on the "normal" mode. when the SPH enter the normal mode ,the screen showing "normal ", LED is green, if SPH not enter normal mode successful.

2) especially the LCD is red, you need to check below:

- make sure all the connection are correct.
- all the external switches are on.
- inverter built -in switch is on.
- make sure the lithium battery is on.
- refer to Part 9.1 for correction.

3) you can refer to Part 6.3.4 for work mode setting.

4) configure monitor.

5) Finish commissioning.

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 use 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. user can set power rate which less than the battery maximum output power. If the customer don't enable the AC CHG (AC grid charging function). Inverter will charge battery by PV power as large as it can do. If the customer enable the AC CHG (AC grid charging function). 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 chose 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. user only can set one period for battery first and Grid first on the LCD,, if user need set more please login shineserver.
2. if user need Grid charge battery, user 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:

- a)The detail's fault information please refer to 9.1
- b)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 indicate 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 haven't fault 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 various regulations of the machine, after customers receive the machine, according to their country, by dialing DIP switch to set the corresponding regulations. Following is the DIP switch introduction.

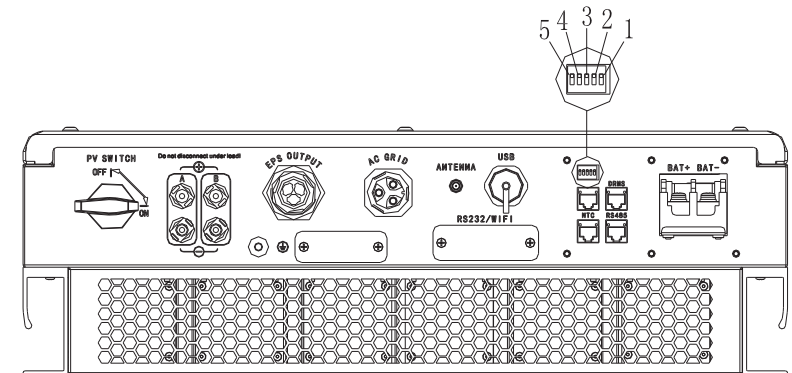


Chart 6.1

| | |
|--|---|
| | <p>Caution : 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: 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. 2. You need to calibrate the time that the machine is showing after inverter starts up. If the country is set incorrectly, please shut down the inverter and set again.</p> |

The DIP switch is composed of five-digit binary number PINS. The different combination of the five 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:

6.3.1 Switch to country table

| DIP switch status | Country/region / regulations | Model display |
|-------------------|------------------------------|---------------|
| | VDE 0126 | GT4XXXXXX1 |
| | Queensland | GT4XXXXXX2 |
| | As4777 | GT4XXXXXX3 |
| | CEI 0-21 | GT4XXXXXX4 |
| | G59 | GT4XXXXXX5 |
| | XINA1 | GT4XXXXXX6 |
| | VDE-AR-N 4105 | GT4XXXXXX7 |
| | G83 | GT4XXXXXX8 |
| | Norway-EN50438 | GT4XXXXXX9 |
| | CQC | GT4XXXXXXA |

| | | |
|--|-------------------|------------|
| | Danmark-EN50438-1 | GT4XXXXXXB |
| | Hungary | GT4XXXXXXC |
| | Belgium | GT4XXXXXXD |
| | Thailand MEA | GT4XXXXXXE |
| | Thailand PEA | GT4XXXXXXF |
| | Sp1663 | GT5XXXXXX0 |
| | CQC-1 | GT5XXXXXX1 |
| | TAIWAN | GT5XXXXXX2 |
| | EN50438-Ireland | GT5XXXXXX3 |
| | TUV000 | GT5XXXXXX4 |

6.4 Display and button

6.4.1 LCD display area

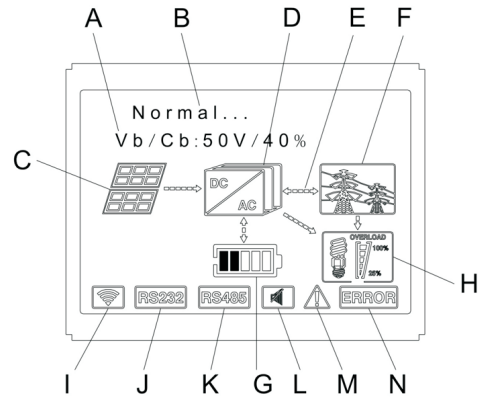


Chart 6.2

| location | Description |
|----------|--|
| A | information |
| B | state |
| 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

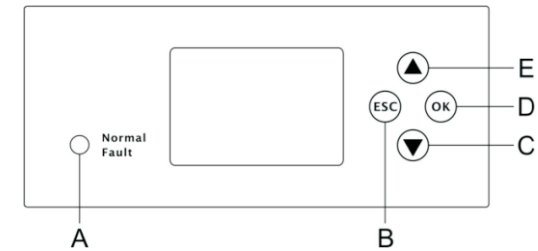


Chart 6.3

| 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 color, one is green and another is red. Please turn to 3.1 and read the detail of LED.

6.4.3 LCD display column

LCD display column is used to show the current state, basic information and fault information. Also include language setting, program charging/discharging priority and system time. On default condition will take turns to display the information.

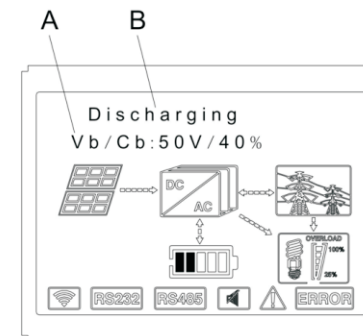


Chart 6.4

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 "down", the order of the paging information as follow:

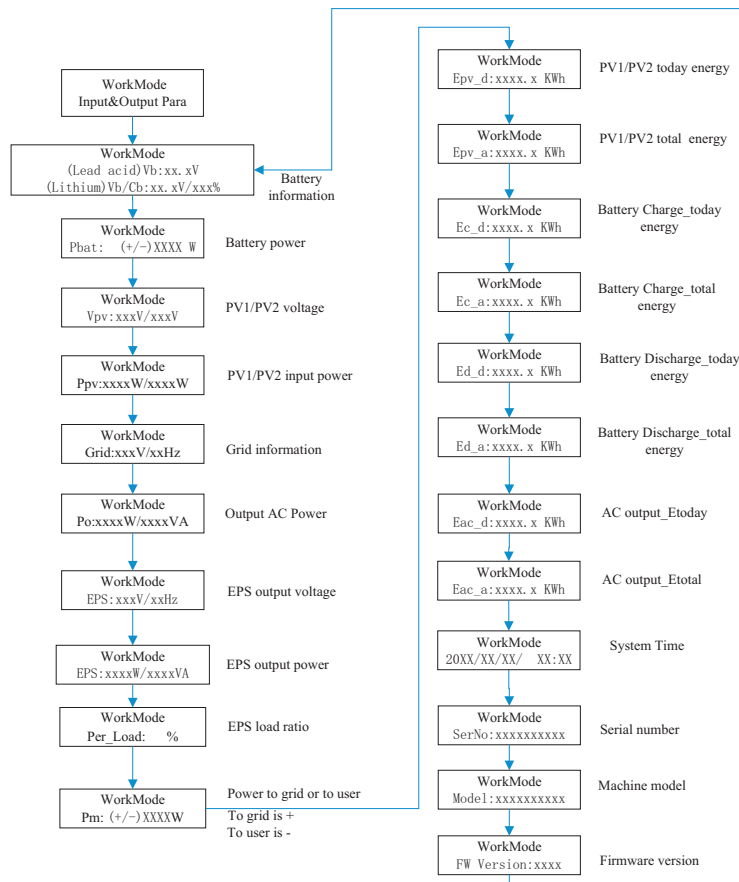


Chart 6.5

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 show 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.

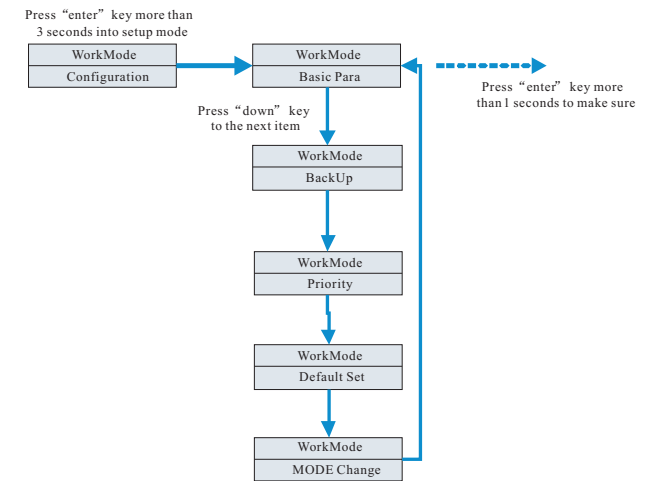


Chart 6.6

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

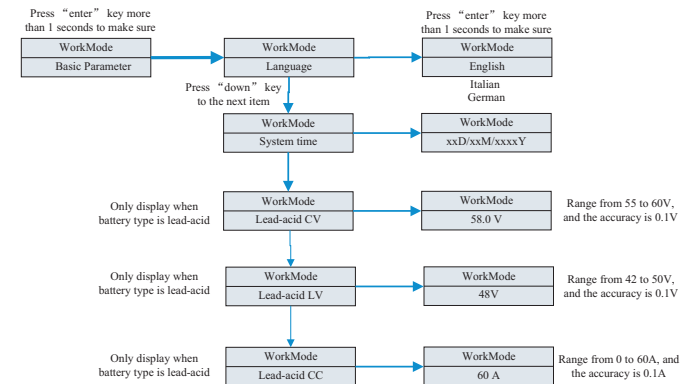
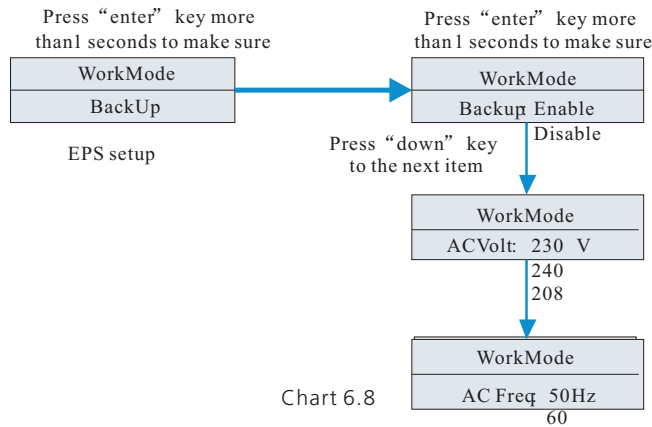


Chart 6.7

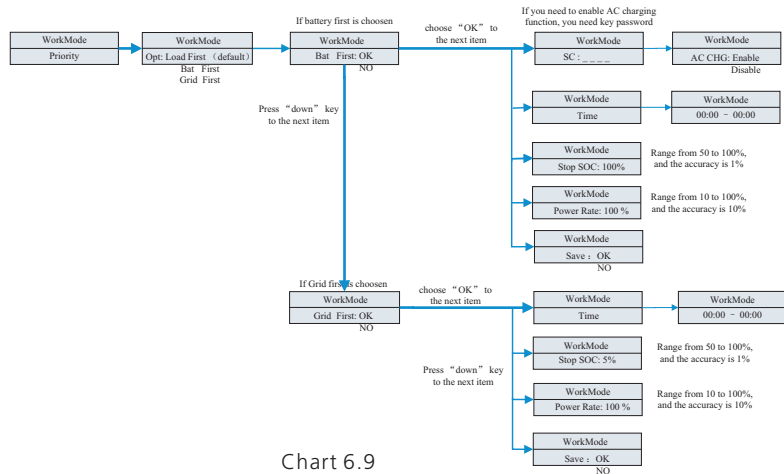
In the basic Parameter, you can set language (English, Italian, German), system time, lead-acid cell charging voltage (default is 58V), discharge low voltage (default is 48V) and lead-acid constant current (default is 60A).

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



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).

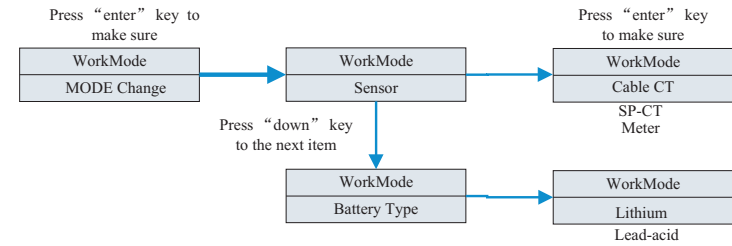
3. Under the Priority, you can see the setup options below after pressing Enter :



Note :

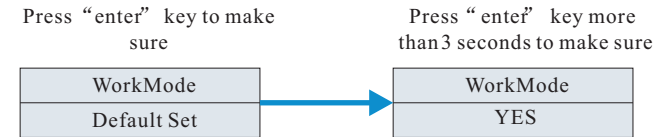
1. "Power Rate" is used to set up power of battery. So different battery may has the different power, customer need to check the max power of battery.
2. Time setting is 24-hour. If the end time is less than beginning time, it defaults to spanning days.

4. Under the MODE Change, you can see the setup options below after pressing Enter :



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

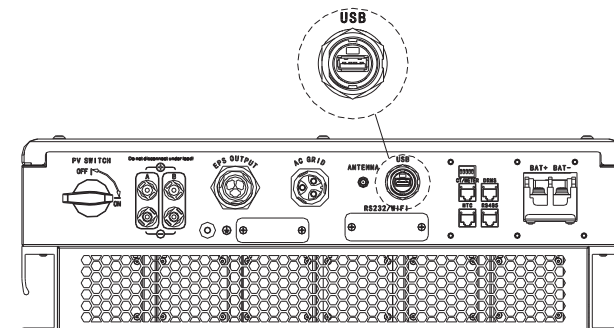


Default set is "resume to default setting", please don't use it unless it's necessary.

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,



6.5.2 Use of RS232 port

RS232 port is mainly used for monitoring connection with PC, users can monitor ,set parameters and update the software of the machine through RS232 connection with machine and PC, using the shinebus software developed by Growatt. About ShineBus software, when you needed, please download from official website of Growatt. About ShineBus software, when you needed, please download from official website of Growatt.



Chart 6.13

Before use RS232 communication, you should make sure the follow PIN1 and PIN2 are OFF:

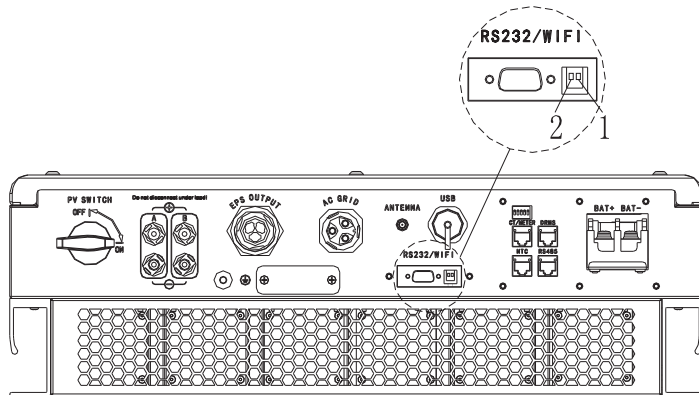


Chart 6.14

The wiring diagram is as follows:

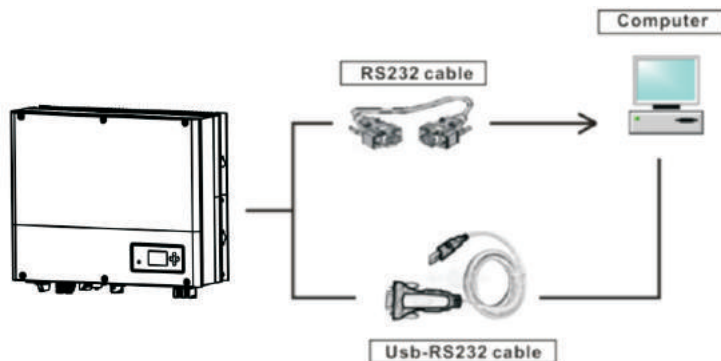


Chart 6.15

6.5.3 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 Shine server software provided by the company.

Through RS232 interface connect to WIFI/3G, use computer terminal for data monitoring.

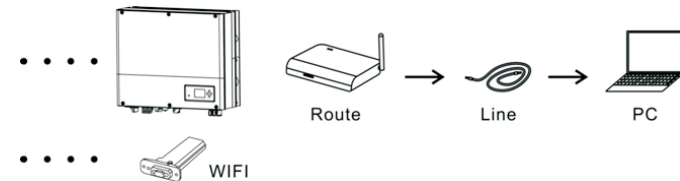


Chart 6.16

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

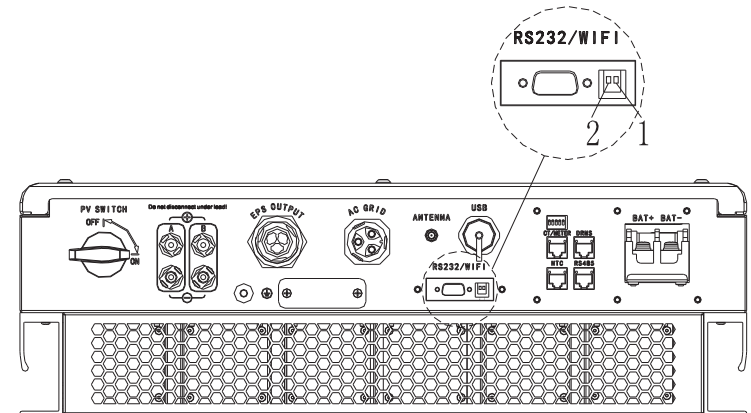


Chart 6.17

7 Start-up and shut down SP 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. Open the switch on the cable in turn
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

Attention of the installation environment, maintenance and cleaning 8

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:

- a) Remove watches, rings or other metal objects.
- b) Use tools with insulated handles.
- c) Wear rubber gloves and boots.
- d) Do not lay tools or metal parts on top of batteries.
- e) Disconnect charging source prior to connecting or disconnecting battery terminals.
- f) 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 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 | | |
|-----------------|---|---|
| errormessage | Description | suggestion |
| warn101 | SP-CT/Meter Communication fault | 1.Check the wire connection between meter and inverter is good or not. 2.Check the distance of SP-CT and inverter is in the range of specification or not. 3.Restart inverter and SP-CT, reconnect. |
| Warn 108 | PV1 or PV2 Circuit short | 1.Check the positive and negative of PV input is reversed or not. 2.Reinserted the PV terminal , please contact Growatt service center if restart can't solve the problem. |
| warn210 | 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 gridfrequency. | 1.Check the AC voltage is in the range of standard voltage in specification. 2.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. | 1.Check the frequency is in the range of specification or not. 2.Restart inverter. 3.Please contact Growatt service center if restart can't solve the problem. |
| PairingTimeOut | Communication fault | 1.Check the distance of SP-CT and inverter is in the range of specification or not. 2.Restart inverter and SP- CT, reconnect. |
| CT LN Reversed | LN Reversed | 1.Check the L line and N line of SP-CT is reversed or not. 2.Check the PE of SP-CT is connected well or not. |
| BMS COM Fault | Communication fault | 1.Check the lithium Battery is open or not. 2.Check the connection of lithium Battery and inverter is good or not. |

| warning message | | |
|------------------|---|---|
| error message | Description | suggestion |
| 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) | 1.Check the temperature of lead-acid battery is installed or not. 2.Check the temperature of lead-acid battery is connected well or not. |
| Battery Open | Battery terminal open (only for lithium battery) | 1.Check the battery connection is good or not. 2.Check the switches between the battery and inverter are all on or not. |
| over load | EPS output overload warning | Please reduce the load of EPS output. |
| No AC Connection | No Utility | 1.Please confirm grid is lost or not. 2.Check the grid connection is good or not. 3.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. | 1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem. |
| Bat Voltage High | Battery Voltage higher than 60V | 1.Check the voltage of battery is in the range of specification or not. 2.Check the battery connection is right or not. |
| Bat Voltage Low | Battery Voltage Lower than 42 V | 1.Check the real voltage of battery. 2.Check the wire of battery and inverter is good or not. |
| EPS Volt Low | EPS output voltage low | 1.check the load of EPS.If overload occurred , reduce load. 2.Restart inverter again. |

| error message | | |
|------------------|--|---|
| Error : 101 | internal communication failed | 1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem. |
| Error : 104 | 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 : 105 | Bus sample fault | 1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem. |
| Error : 111 | Inverter L N reversed or ground failed | 1.Check the L line and N line is reversed or not. 2.Check the PE s connected well or not. |
| Error : 117 | Relay fault | 1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem. |
| Error : 123 | autotest failed(only in Italy) | 1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem. |
| PV Isolation Low | PV isolation too low | 1.Check the connection of PV panels and inverter is good or not. 2.Check the PE of inverter is good or not. |
| OP Short Fault ! | EPS output Short Fault | 1.check the load of EPS. 2.check the output of EPS.Especialnot connect to Grid |
| NTC Open | internal temperature failed | Please contact Growatt service center |
| Model Set Fault | Model set up not meet with certification | Please check model set or check the DIP setting |
| Residual I High | Leakage current too high | 1.check the cable of inverter. 2. Restart inverter. 3. Please contact Growatt service center if restart can't solve the problem |
| Over Temperature | 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.

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:

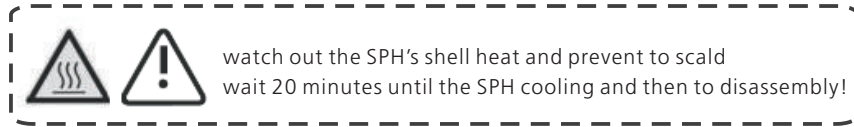
1. Shipped to a Growatt service center for repair;
2. Repaired on-site;
3. Exchanged for a replacement device of equivalent value according to model and age.

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.



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.

Product Specification 12

12.1 Growatt SPH series energy storage machine product specification

| Model | Growatt SPH3000 | Growatt SPH3600 | Growatt SPH4000 | Growatt SPH4600 | Growatt SPH5000 | Growatt SPH6000 |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Specifications | | | | | | |
| Input data (DC) | | | | | | |
| Max. recommended PV power(for module STC) | 3300W/ 3300W | 3300W/ 3300W | 3300W/ 3300W | 4000W/ 4000W | 4000W/ 4000W | 4000W/ 4000W |
| Max. DC voltage | 550V | 550V | 550V | 550V | 550V | 550V |
| Start voltage | 150V | 150V | 150V | 150V | 150V | 150V |
| PV voltage range | 120V-550V | 120V-550V | 120V-550V | 120V-550V | 120V-550V | 120V-550V |
| MPP work voltage range/ nominal voltage | 150V-550V /360V | 150V-550V /360V | 150V-550V /360V | 150V-550V /360V | 150V-550V /360V | 150V-550V /360V |
| Full load dc voltage range | 275V-440V | 275V-440V | 275V-440V | 340V-440V | 340V-440V | 340V-440V |
| Max. input current of tracker A/ tracker B | 12A/12A | 12A/12A | 12A/12A | 12A/12A | 12A/12A | 12A/12A |
| Number of independent MPP trackers / strings per MPP tracker | 2/1 | 2/1 | 2/1 | 2/1 | 2/1 | 2/1 |
| Output (AC) | | | | | | |
| Rated AC output power | 3000W | 3680W | 4000W | 4600W | 4999W | 6000W |
| Max. AC apparent power | 3000VA | 3680VA | 4000VA | 4600VA | 5000VA | 6000VA |
| Max. output current | 16A | 16A | 22A | 22A | 22A | 27A |
| AC nominal voltage; range | 230V ; 180Vac- 280Vac | 230V ; 180Vac- 280Vac | 230V ; 180Vac- 280Vac | 230V ; 180Vac- 280Vac | 230V ; 180Vac- 280Vac | 230V ; 180Vac- 280Vac |
| AC grid frequency; range | 50/60,±5Hz | | | | | |
| Phase factor at rate power | 1 | 1 | 1 | 1 | 1 | 1 |
| Displacement power factor, configurable* | 0.8leading ...0.8 lagging | 0.8leading ...0.8 lagging | 0.8leading ...0.8 lagging | 0.8leading ...0.8 lagging | 0.8leading ...0.8 lagging | 0.8leading ...0.8 lagging |

| Model Specifications | Growatt SPH3000 | Growatt SPH3600 | Growatt SPH4000 | Growatt SPH4600 | Growatt SPH5000 | Growatt SPH6000 |
|--------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| THDI | <3% | <3% | <3% | <3% | <3% | <3% |
| AC connection | Single phase | Single phase | Single phase | Single phase | Single phase | Single phase |
| Stand alone(AC power) | | | | | | |
| Rated AC output power | 3000W | 3000W | 3000W | 3000W | 3000W | 3000W |
| Rated AC output voltage | 230Vac | 230Vac | 230Vac | 230Vac | 230Vac | 230Vac |
| Rated AC output frequency | 50/60Hz | 50/60Hz | 50/60Hz | 50/60Hz | 50/60Hz | 50/60Hz |
| Starting mode | Setup | Setup | Setup | Setup | Setup | Setup |
| BAT data(DC) | | | | | | |
| Battery voltage range | 42~59V | 42~59V | 42~59V | 42~59V | 42~59V | 42~59V |
| Max charging voltage | 58V | 58V | 58V | 58V | 58V | 58V |
| Max charging and discharging current | 66A | 66A | 66A | 66A | 66A | 66A |
| Max charging and discharging power | 3000W | 3000W | 3000W | 3000W | 3000W | 3000W |
| Type of battery | lithium / Lead-acid | lithium / Lead-acid | lithium / Lead-acid | lithium / Lead-acid | lithium / Lead-acid | lithium / Lead-acid |
| DoD | 80% /50% | 80% /50% | 80% /50% | 80% /50% | 80% /50% | 80% /50% |
| Capacity of battery | 3~12kWh | 3~12kWh | 3~12kWh | 3~12kWh | 3~12kWh | 3~12kWh |
| Efficiency | | | | | | |
| Max. efficiency | 97.1% | 97.2% | 97.2% | 97.3% | 97.3% | 97.5% |
| Euro weighted efficiency | 96.8% | 96.9% | 96.9% | 97% | 97% | 97.1% |
| CEC efficiency | | | | | | |
| MPPT efficiency | 99.5% | 99.5% | 99.5% | 99.5% | 99.5% | 99.5% |
| Protection devices | | | | | | |
| DC reverse polarity protection | yes | yes | yes | yes | yes | yes |

| Model Specifications | Growatt SPH3000 | Growatt SPH3600 | Growatt SPH4000 | Growatt SPH4600 | Growatt SPH5000 | Growatt SPH6000 |
|---|---|---|---|---|---|---|
| BAT reverse protection | yes | yes | yes | yes | yes | yes |
| Output over current protection | yes | yes | yes | yes | yes | yes |
| Output over voltage protection-varistor | yes | yes | yes | yes | yes | yes |
| Ground fault monitoring | yes | yes | yes | yes | yes | yes |
| Grid monitoring | yes | yes | yes | yes | yes | yes |
| Integrated all - pole sensitive leakage current monitoring unit | yes | yes | yes | yes | yes | yes |
| General Data | | | | | | |
| Dimensions (W / H / D) in mm | 450*565 *180 | 450*565 *180 | 450*565 *180 | 450*565 *180 | 450*565 *180 | 450*565 *180 |
| Weight | 27KG | 27KG | 27KG | 27KG | 27KG | 27KG |
| Operating temperature range | -25°C ... +60°Cwith derating above 45°C | -25°C ... +60°Cwith derating above 45°C | -25°C ... +60°Cwith derating above 45°C | -25°C ... +60°Cwith derating above 45°C | -25°C ... +60°Cwith derating above 45°C | -25°C ... +60°Cwith derating above 45°C |
| Noise emission (typical) | ≤ 25 dB(A) | ≤ 25 dB(A) | ≤ 25 dB(A) | ≤ 25 dB(A) | ≤ 25 dB(A) | ≤ 25 dB(A) |
| Altitude | 2000m | 2000m | 2000m | 2000m | 2000m | 2000m |
| Self-Consumption | < 4 W | < 4 W | < 4 W | < 4 W | < 4 W | < 4 W |
| Inverter Topology | transfor merless | transfor merless | transfor merless | transfor merless | transfor merless | transfor merless |
| DC/DC topology | HF transformer | HF transformer | HF transformer | HF transformer | HF transformer | HF transformer |
| Cooling concept | Natural | Natural | Natural | Natural | Natural | Natural |
| Environmental Protection Rating | IP65 | IP65 | IP65 | IP65 | IP65 | IP65 |
| Relative humidity | 100% | 100% | 100% | 100% | 100% | 100% |
| Features | | | | | | |
| DC connection | MC4/H4 (opt) | MC4/H4 (opt) | MC4/H4 (opt) | MC4/H4 (opt) | MC4/H4 (opt) | MC4/H4 (opt) |
| AC connection | connector | connector | connector | connector | connector | connector |

| Model | Growatt SPH3000 | Growatt SPH3600 | Growatt SPH4000 | Growatt SPH4600 | Growatt SPH5000 | Growatt SPH6000 |
|---------------------------------------|---|---|---|---|---|---|
| Specifications | | | | | | |
| BAT connection | Screw | Screw | Screw | Screw | Screw | Screw |
| Display | LCD | LCD | LCD | LCD | LCD | LCD |
| Interfaces: RS485/USB /CAN/Wi-Fi/GPRS | yes /yes /opt/opt/opt | yes /yes /opt/opt/opt | yes /yes /opt/opt/opt | yes /yes /opt/opt/opt | yes /yes /opt/opt/opt | yes /yes /opt/opt/opt |
| Warranty: 5 years / 10 years | yes /opt | yes /opt | yes /opt | yes /opt | yes /opt | yes /opt |
| Certificates and approvals | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 | CE,IEC62109,G83 VD E0126-1-1 ,G59,AS4 777, AS/N ZS 3100, CEI 0-21 VDE-AR-N 4105 |

12.2 DC input terminal parameter

MC 4 specification:

| | 2.5mm ² /14AWG | 4mm ² /12 AWG | 6mm ² /10 AWG | 10mm ² /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 | IP 68 | | | |

| | |
|---------------------------|------------------------------|
| 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") |

12.3 Torque

| | |
|-----------------------|--------------------|
| Upper cover screws | 1.3Nm(10.8 1bf.in) |
| Shell and RS232screws | 0.7Nm(6.2 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.

| Name | Description | GROWATT P/N |
|--------------------|-----------------------------------|--------------|
| Shine link | Used for data record in EU | MR00.0005900 |
| | Used for data record in Australia | MR00.0006100 |
| Shine Wi-Fi-S | COM interface | MR00.0008600 |
| Shine 3G | COM interface | MR00.0004700 |
| SP-CT | Wireless meter sensor | MR00.0006700 |
| Single phase meter | RS485 meter sensor | MR00.000XXXX |
| three phase meter | RS485 meter sensor | MR00.000XXXX |

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-SPH series | CE,IEC62109,G83 VDE0126-1-1,G59,AS4777, AS/NZS 3100, CEI 0-21 VDE-AR-N4105 |

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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