



Download
Manual



🔍 Growatt New Energy

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GR-UM-180-A-02



Installation Manual of SPH-UP series

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1 Brief Introduction

1.1 Preface

This manual will provide the users who use the 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

SPH inverter must be installed by professional electrical personnel who have obtained the certification of the relevant departments.
We have two kinds of SPH inverter for different battery types, one is for lithium battery and the other is for lead-acid battery. We recommend customer should decide which kind of inverter if required prior to purchasing. GROWATT can only provide lithium battery that is compatible with inverter, no lead-acid battery will be provided by Growatt as customer can easily buy these from the market. It is dangerous if customer choose inverter compatible with lithium battery (which must be provide by GROWATT) but uses it for lead-acid battery or uses lead-acid battery for lithium battery inverter.
Installer can install SPH Series inverters rapidly, build communication system or troubleshoot by reading 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 (0)755 2747 1942

1.3 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:

- SPH 3000 TL BL-UP
- SPH 3600 TL BL-UP
- SPH 4000 TL BL-UP
- SPH 4600 TL BL-UP
- SPH 5000 TL BL-UP
- SPH 6000 TL 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, but we don't provide SPH 5000TL BL-UP and SPH 6000TL BL-UP.

Overview:

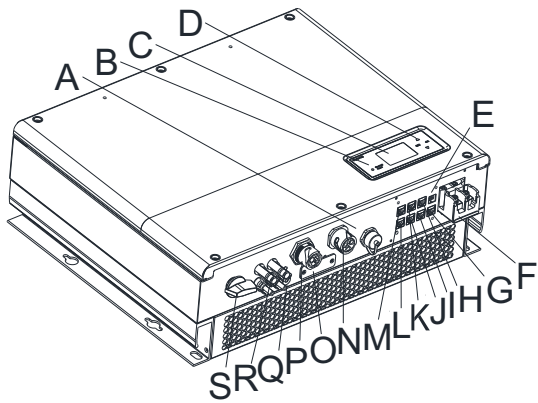


Chart 1.1

Position	Description
A	USB interface
B	LED of status display
C	LCD screen
D	Function button
E	Dry contact
F	Battery terminal
G	VPP communication
H	RS485-2 communication
I	RS485-1 communication
J	NTC: Lead-acid temperature sensor terminal
K	CAN communication interface of Lithium battery
L	RJ45 interface of DRMs(used only in Australia)
M	RS485 communication interface of Merter/CT input terminal
N	AC Grid (on grid connection)
O	RSD(do not open except by Professional staff)
P	EPS output(off grid connection)
Q	Ground point
R	PV input
S	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 product warranty may be voided if the inverter is not installed 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. Connecting the equipment to the grid requires permission from the local power company
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:

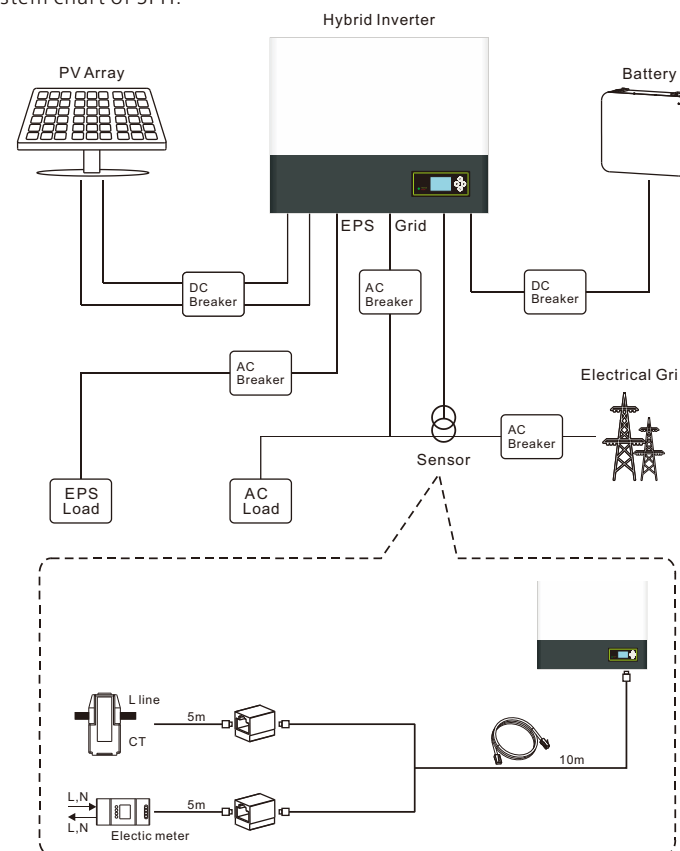




Chart 2.1

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, if the specification is IP20 environment, the pollution degree of the unit is PD2, meanwhile the temperature should be control in the 0-40℃ 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 inverter 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


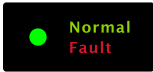
2.3 Symbols introduction on the SPH inverter

Symbol	Description
	Caution: Risk of electrical shock!
	Caution : hot surface
	Caution: risk of danger
	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 machine complies with the requirements of the applicable CE guidelines
	Refer to the operating instructions.


3 Product Description

3.1 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
		Green light blinking	1.Alarm state
		Red light blinking	2.Software updating

3.2 Label Explanation

GROWATT Hybrid Inverter	
Model name	SPH 6000TL BL-UP
PV input data	
Max.PV voltage	550 d.c.V
PV voltage range	120-550 d.c.V
PV Isc	20 d.c.A*2
Max. input current	13.5 d.c.A*2
AC output/input data	
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
EPS output data	
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
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
Others	
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	SAA211107
	
X Made in China	

Description of label:

Hybrid Inverter	
Model name	SPH 6000TL BL-UP
PV input data	
Max. PV voltage	550V d.c.V
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Max.input current	13.5 d.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
EPS output data	
Rated output apparent power	4000VA
Rated voltage	230 a.c.V
Rated output current	17.5 a.c.A
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Type of Battery	Lithium/Lead-acid
Others	
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	SAA211107

3.3 Size and weight

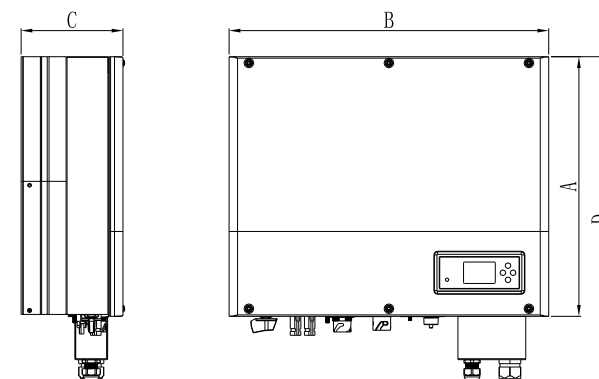


Chart 3.1


	A(mm)	B(mm)	C(mm)	weight(kg)
SPH TL BL-UP	456	565	188	27

3.4 The advantage of the unit of SPH

Features below:

- All of the designs are designed to enhance the self-use function of photovoltaic energy.
- Smart management, work mode can be set
- Safe battery used
- Easy installation
- Two MPP tracker input
- The switching time between off-grid and grid-connected is less than 10mS
- With multi-machine anti - current parallel function

4 Unpacking



Warning

⚠ Please check that the package is in good condition before unpacking to ensure that there are no transportation or handling damage that may affect the insulation integrity or safety clearance; Failure to do so could result in a safety hazard.

⚠ Unauthorized removal of necessary protections, improper use, incorrect installation and operation may lead to serious safety and shock hazards and/or equipment damage.

⚠ In order to reduce the damage caused by the moving process, please move the inverter correctly. The total weight of the SPH series inverter is up to 27KG.

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:

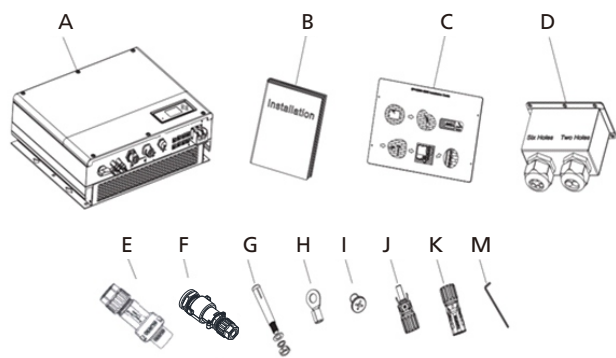


Chart 4.1

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	4	M6 setscrew
H	2	Battery power terminal
I	6	screw
J	2	MC4 connector

Item	Number	Description
K	2	MC4 connector
M	1	Hex screwdriver

SPH-UP has an Uninterrupted Power Supply(UPS) level switch with a maximum 16ms transfer time. But can not use it as a Uninterrupted Power Supply(UPS) for critical scenarios like medical power source. For maintenance purposes, a T5B-2-8400/E is needed on EPS and on-grid side. T5B-2-8400/E is an optional choice for installers, it will provide a power supply for EPS load when SPH-UP is under maintenance.

0.The EPS load is vacant;
1.The EPS load is powered from the EPS side;
2.The EPS load is powered from the Grid side.

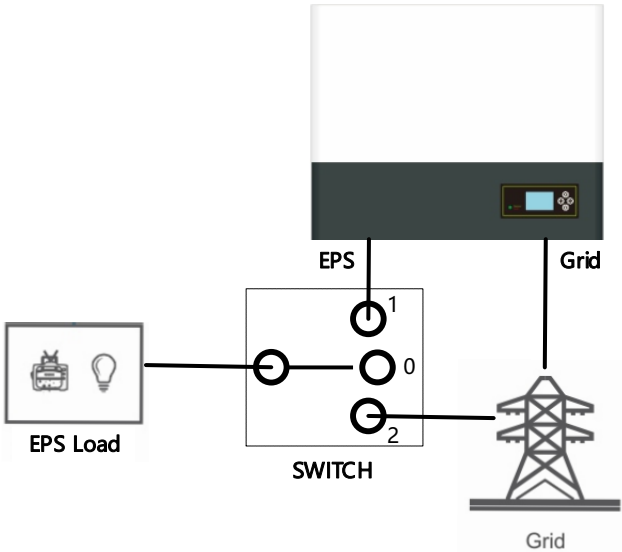


Chart 4.2

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:

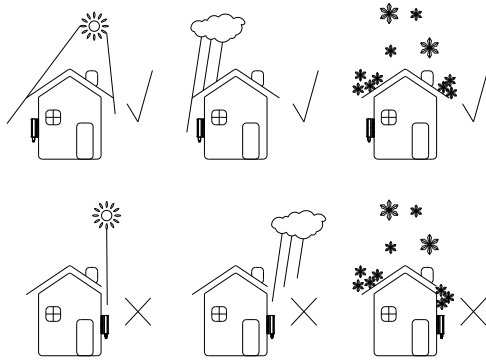


Chart 5.1

- 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:

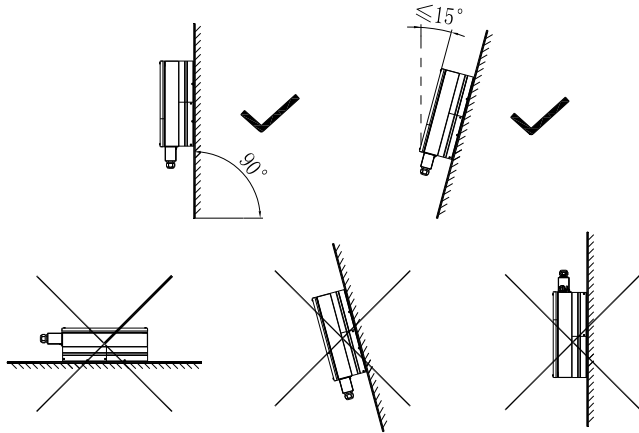


Chart 5.2

- 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:

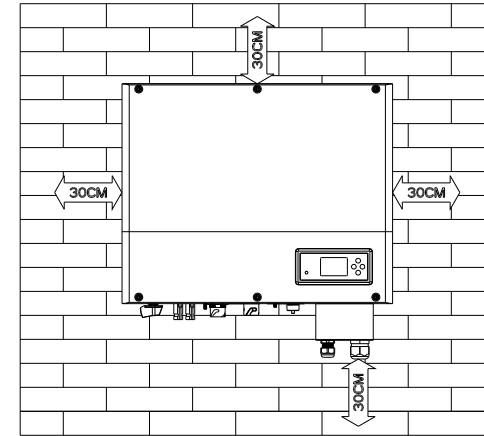


Chart 5.3

- 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:

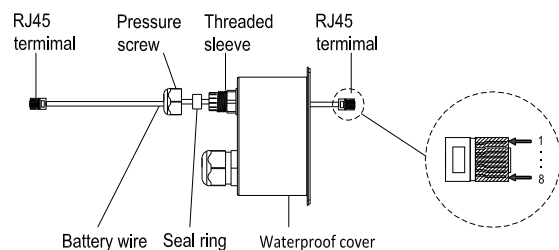


Chart 5.5

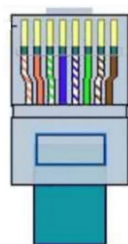


Chart 5.6

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 two types of sensors for use with SPH. One is wired current sensor, one is meter sensor, if you choose wired sensor or meter. Before installing you should know something that as below:

The cable of wired sensor is suggested not longer than 15m, and the meter is suggested not longer than 100m. So you need to consider the length between SPH with combiner box for the sensor should be installed in the live line.

The layout of the inverter for residential installation as follow:

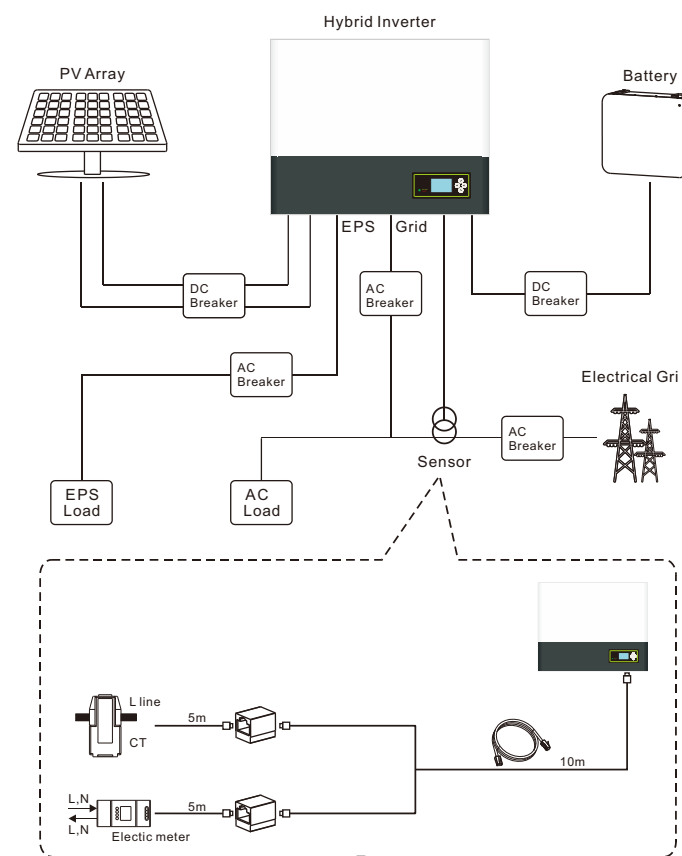
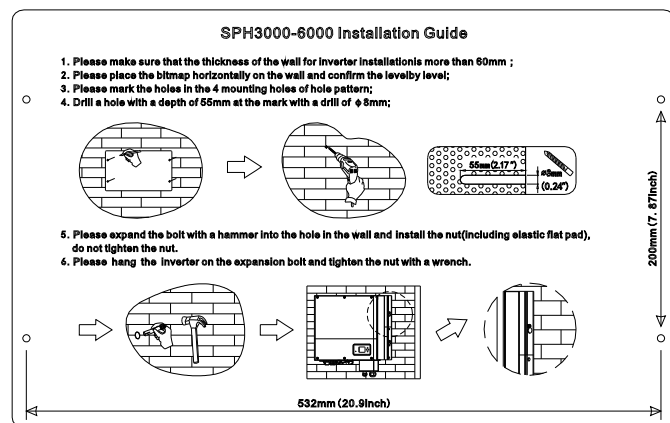


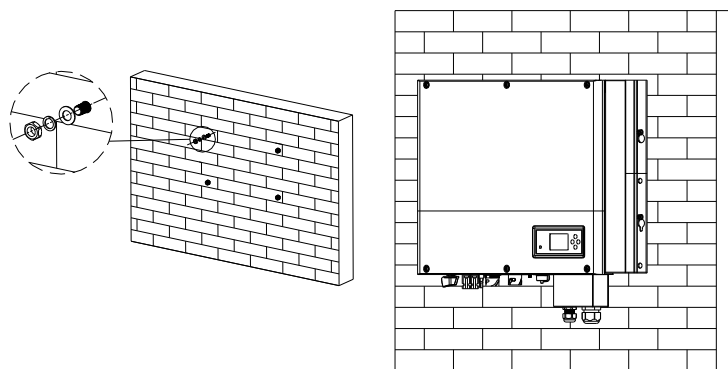
Chart 5.7 SPH 3000-6000TL BL-UP

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 $\varnothing 8$ holes at the mark point, the depth is not less than 55mm.
5. Knock four explosion bolt into $\varnothing 8$ holes (As the chart 5.8b below).
6. Hang the inverter 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.

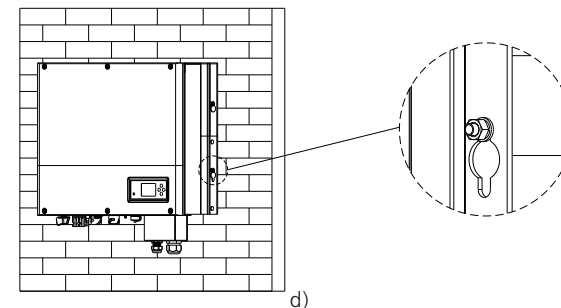


a)



b)

c)



d)

Chart 5.8

5.4 SPH System Connection Mode

5.4.1 Conditions for DC Connection



The solar modules connected to the inverter must conform to the Class A requirements of the IEC 61730 standard. Please use the same brand male and female PV connectors.

SPH single-phase inverter has 2 independent input MPPT1 & MPPT2

Notice: 1. that the connectors are in paired (male and female connectors).
2. in built DC switch isolator is optional in Australia for SPH



CAUTION

If the inverter is not equipped with a DC switch but this is mandatory in the country of installation, install an external DC switch. The following limit values at the DC input of the inverter must not be exceeded:

Types	Max current MPPT1	Max current MPPT2
SPH 3000-6000TL BL-UP	13.5A	13.5A

5.4.2 Connecting the PV Array (DC input)



DANGER

Danger to life due to lethal voltages!

The photovoltaic array provides DC voltage to the inverter under light. Before connecting the photovoltaic array, ensure that the DC switch and AC circuit breaker are disconnected from the inverter when adjusting the photovoltaic array. Do not connect or disconnect the DC connector under load. Make sure the maximum open circuit voltage (Voc) of each PV string is less than the maximum input voltage of the inverter. 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.



CAUTION

- 1.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.
2. Please don't connect PV array positive or negative pole to the ground, it could cause serious damages to the inverter.
3. Check the connection cables of the PV modules for correct polarity and make sure that the maximum input voltage of the inverter is not exceeded.
4. Grounding the PV modules: The SPH is a transformer less inverter. That is why it has no galvanic separation. Do not ground the DC circuits of the PV modules connected to the SPH. Only ground the mounting frame of the PV modules. If you connect grounded PV modules to the SPH, the error message "PV ISO Low".
- 5.Comply with the local requirements for grounding the PV modules and the PV generator. GROWATT recommends connecting the generator frame and other electrically conductive surfaces in a manner which ensures continuous conduction with ground in order to have optimal protection of the system and personnel.
6. Please disconnect the PV DC switch when maintaining the inverter.

Connection of PV terminal

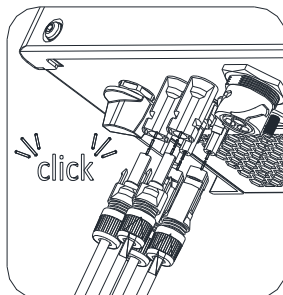
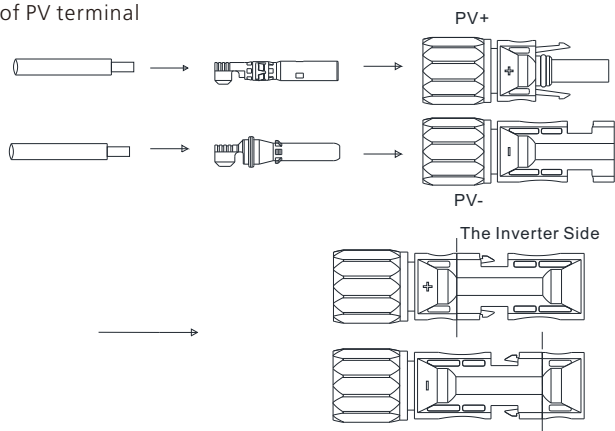


Chart 5.9

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: 13.5A
Max PV input power per string: 5300W

Remark:

- 1.We suggest you use the cable=4mm²/12 AWG to connect.
- 2.Please do not connect to DC source!

5.4.3 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.

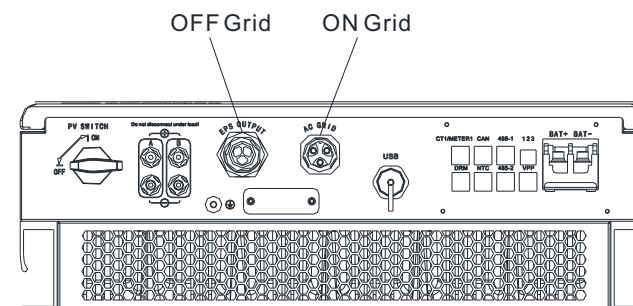


Chart 5.10 SPH 3000-6000TL BL-UP



NOTE

When installing the inverter, regardless of whether the EPS port is used or not,item F in the chart 4.1 needs to be completely assembled on the SPH as shown in Figure 5.10-1.Note: Locking screws

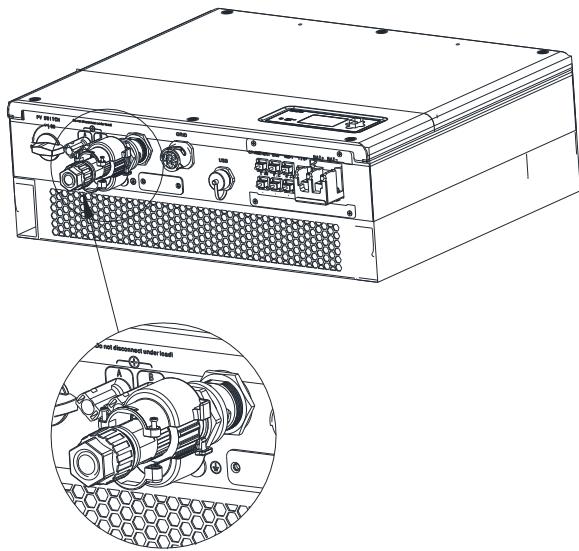


chart 5.10-1

Wire suggest length

Conductor cross section	Max cable length					
	SPH 3000TL BL-UP	SPH 3600TL BL-UP	SPH 4000TL BL-UP	SPH 4600TL BL-UP	SPH 5000TL BL-UP	SPH 6000TL BL-UP
5.2mm ² 10AWG	40m	33m	28m	26m	25m	23m
6.6mm ² 9AWG	50m	42m	36m	33m	32m	29m

The AC wiring step:

Step 1. Uninstall the parts of the AC connection plug from the accessory bag.

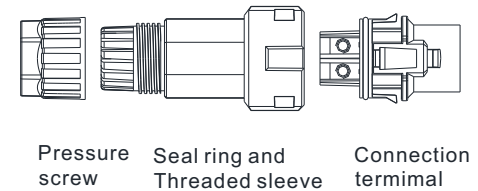
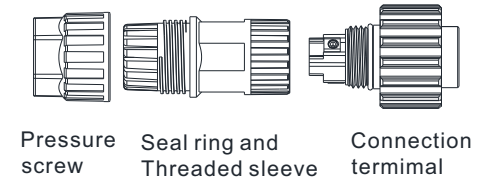
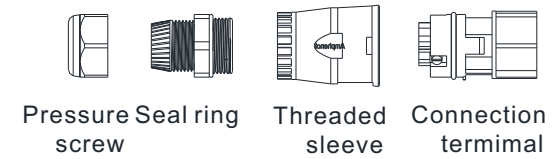


Chart 5.11

Step 2: Insert the stripped and bared cable through pressure screw, seal ring, threaded sleeve in sequence, insert cables into connection terminal according to polarities indicates on it and tighten the screws firmly. Please try to pull out the wire to make sure the it's well connected.

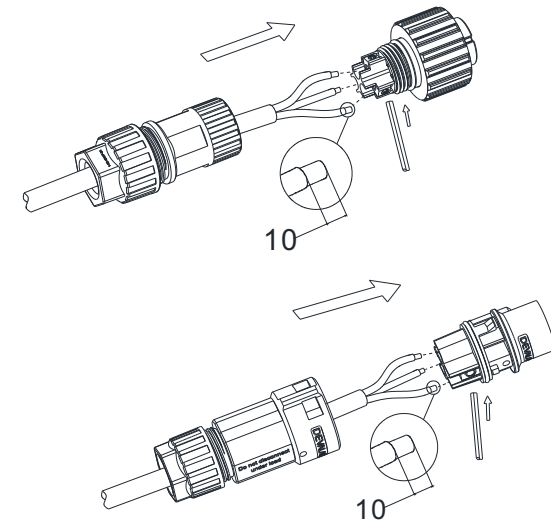


Chart 5.12

Step 3: Push the threaded sleeve into the socket, Tighten up the cap on the terminal.

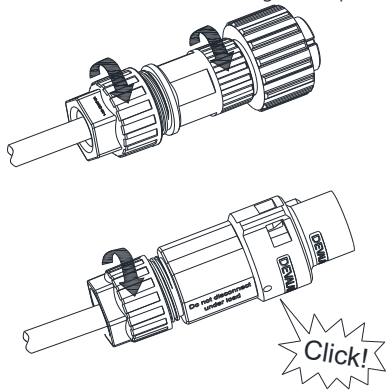
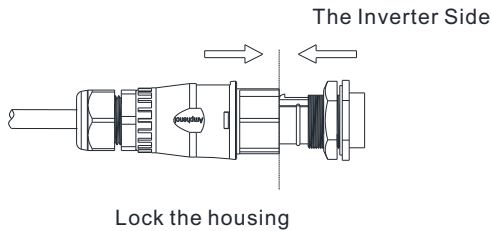
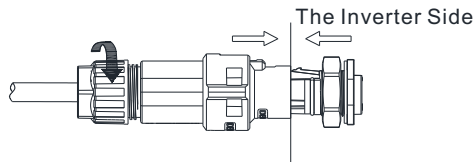


Chart 5.13

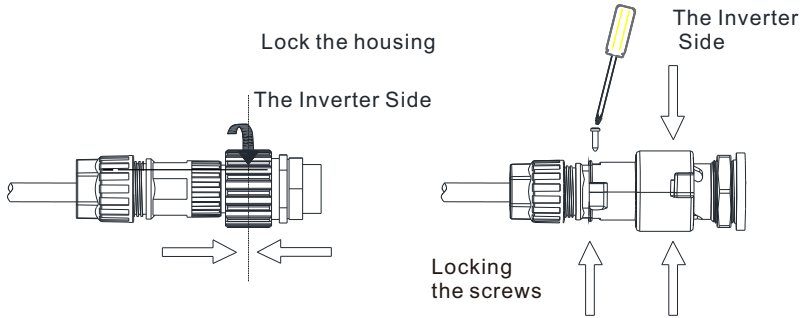
Step 4: Finally, Push or screw the threaded sleeve to connection terminal until both are locked tightly on the inverter, and use a screwdriver to tighten the screws.



Lock the housing



Lock the housing



Lock the housing

Chart 5.14

Step5: To remove the AC connector, press the bayonet out of the slot with a small screwdriver and pull it out, or use a screwdriver to loosen the screws, remove the connector protective sleeve, loosen the threaded sleeve, and pull it out.

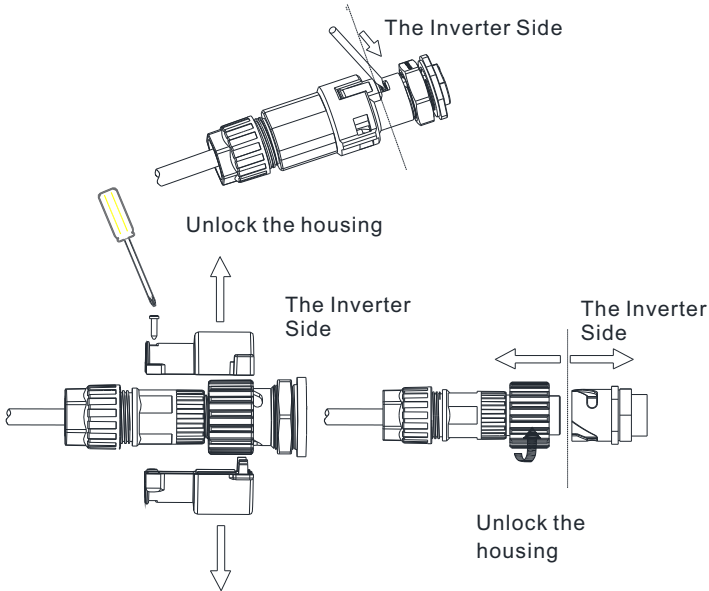


Chart 5.15

The recommended wiring diagram is as follows:

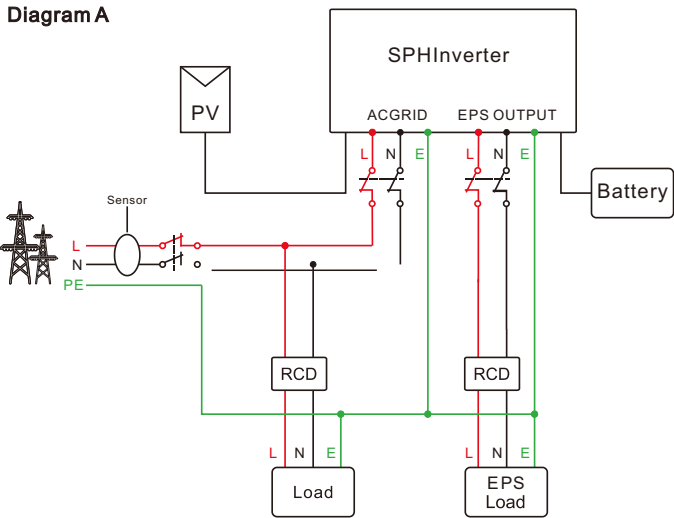


Chart 5.16

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

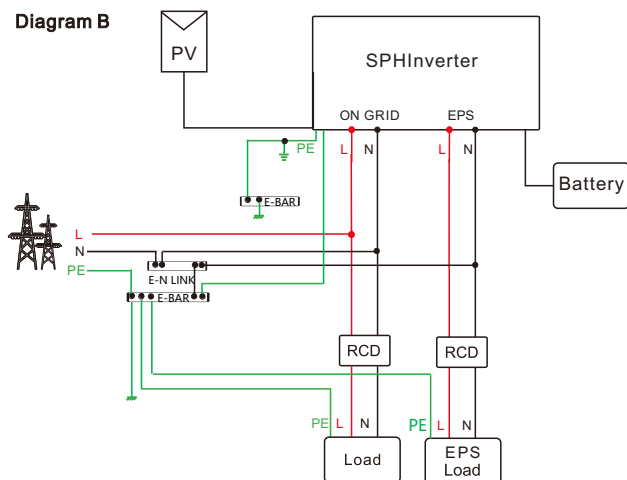


Chart 5.17

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

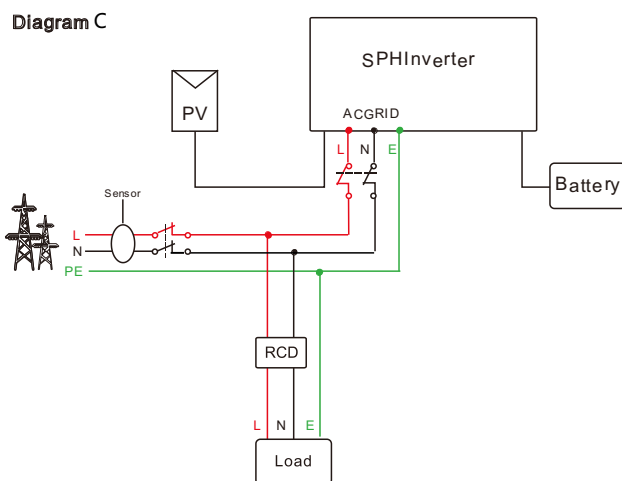


Chart 5.18

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



Warning

- < If you want to use on grid only, please refer to chart 5.17 connect with AC grid and float EPS OUTPUT.
- < If you have no battery now, you can also float BAT terminal, and this hybrid inverter will only work like a PV inverter.
- < 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.
- < On grid terminal and off grid terminal can't directly connect together.
- < Off Grid terminal can't connect to grid.
- < 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.
- < The first start of system needs Grid power.

NOTE: The inverter has the function of detecting residual current and protecting the inverter against residual current. If your inverter must equip a AC breaker which has the function of detecting residual current, you must choose a Type A RCD breaker with the rating residual current more than 300mA.

5.4.4 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.

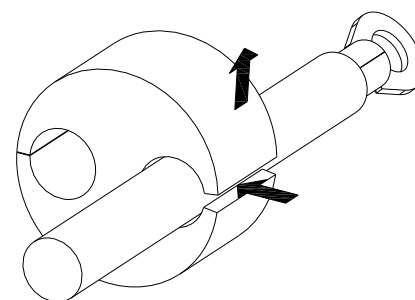


Chart 5.19

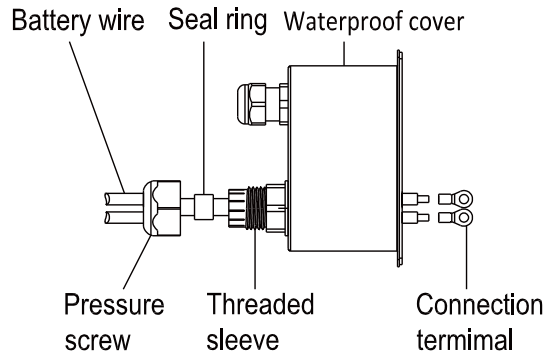


Chart 5.20

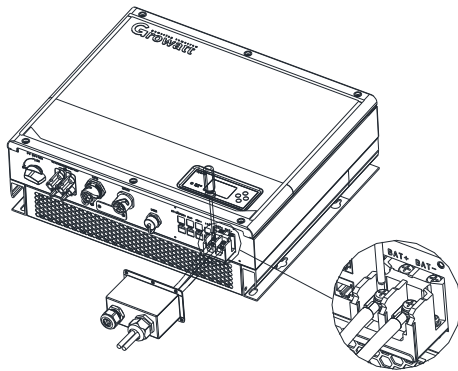


Chart 5.21

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.

5.4.5 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 "CT1/METER1" 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.

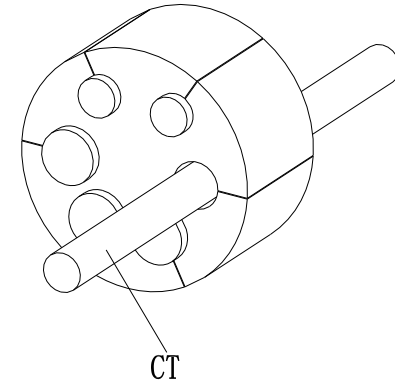


Chart 5.22

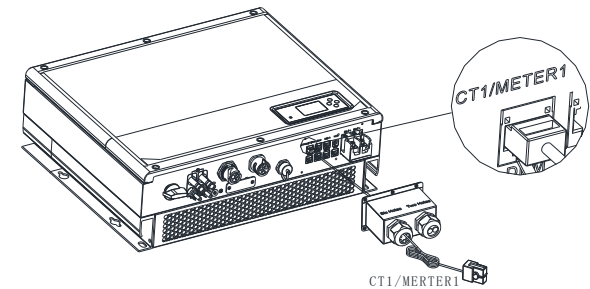


Chart 5.23

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:

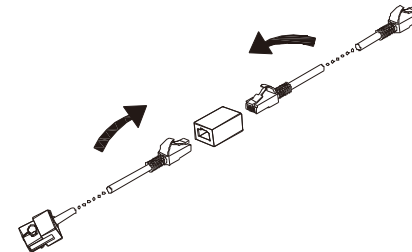


Chart 5.24

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

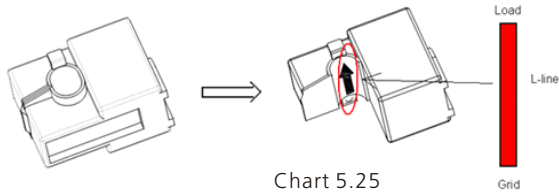


Chart 5.25

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.

5.4.6 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 "CT1/METER1" 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.

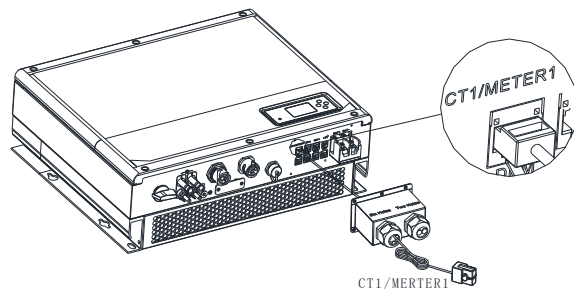


Chart 5.26

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.

 Information	<p>The position of export limitation CT or Meter must between the Inverter & Load and grid.</p>
---	---

This series inverter has integrated export limitation functionality. To use this function, you can connect smart meter or CT.

5.4.7 Connection of communication terminal for lithium battery (CAN)

When using CAN communication with lithium batteries (for example ARK LV 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 "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.

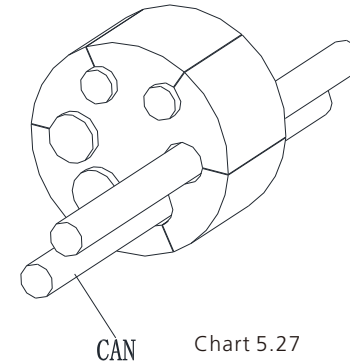


Chart 5.27

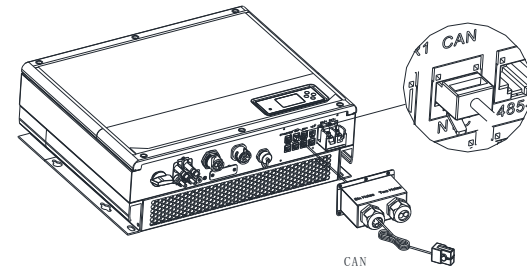


Chart 5.28

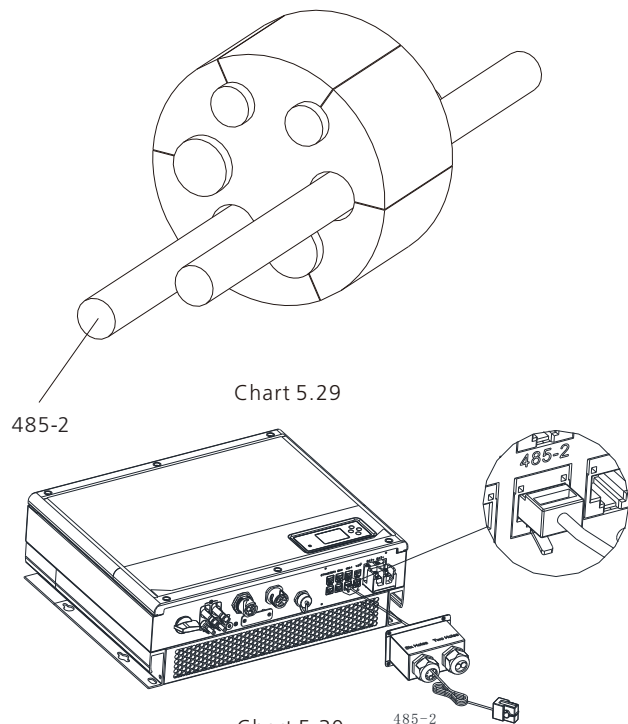
Note:

- 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.

5.4.8 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.

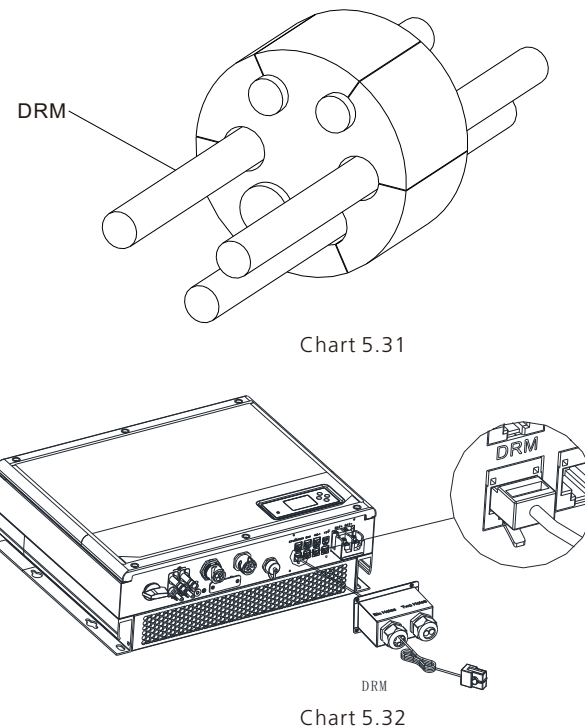
**Note:**

- 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.

5.4.9 Connection of DRMS terminal (Australia only)

When SPH is applied in Australia, the DRMS terminal needs to be connected. The connection method is 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 "DRM" 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.



PIN	Inverter distribution capable of charging and discharging at the same time.
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.

5.4.10 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.

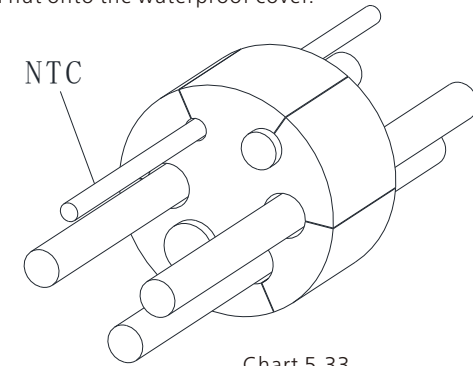


Chart 5.33

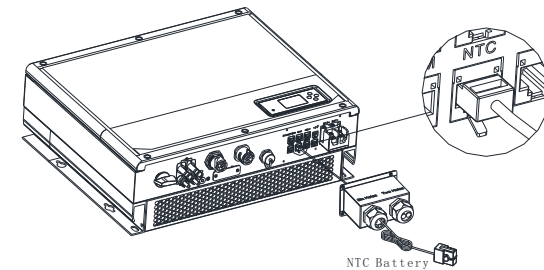


Chart 5.34

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.

5.4.11 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 nut over the cable.
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.

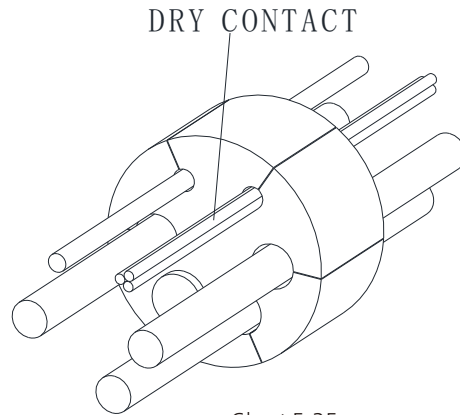


Chart 5.35

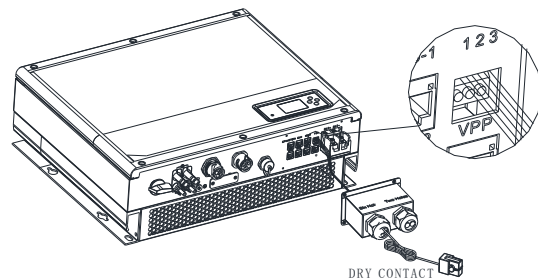


Chart 5.36

Note:

1. If the cable such as "Dry contact" cable is not used, please do not remove the filler plug from the cable support sleeve.
2. Dry contact can give a 12V and less than 200mA source (Pin1- & Pin3+) output to driver relay and so on. Please be careful of the capacity of this power.

5.4.12 Grounding connection

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

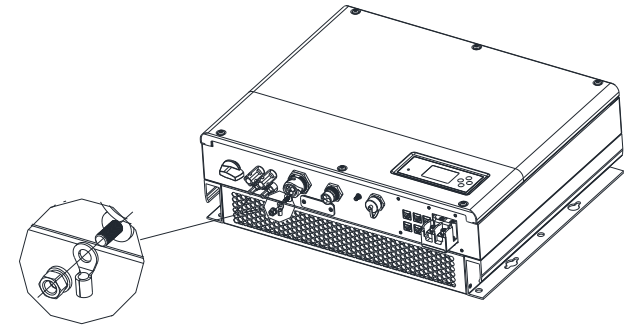


Chart 5.37

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 10.0mm².

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:

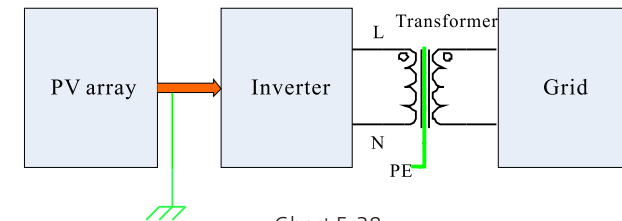


Chart 5.38



Warning

1. Growatt SPH & SPH TL BL-UP series inverters are all single-phase inverters. If the inverter is installed in Australia or New Zealand the inverter must not be used as part of a three-phase combination.
2. This inverter complies with IEC 62109-2 clause 13.9 for earth fault alarm monitoring. If an Earth Fault Alarm occurs, the fault code "Error303, NE abnormal" will be displayed on the inverter screen while the LED indicator red will light up. (Applicable to inverters with graphical display only)

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 SPH works normally, the screen displays "normal" and the 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 (If the export limit function is enabled, the excess PV energy will not be sent to the power grid).

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 is lost, system would switch to backup mode (user can disable this function, refer to 6.3.4) and AC output is supplied via the EPS LOAD port using energy from PV and battery. If the PV is also lost, then only the battery discharges.

Note: SPH EPS LOAD maximum output power is 4000W so loads connected to the EPS LOAD port should not exceed 4000W.

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 Display and button

6.3.1 LCD display area

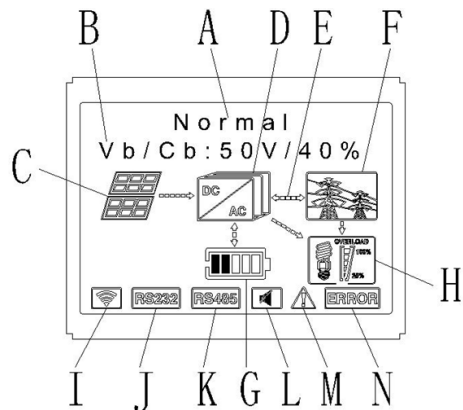


Chart 6.1

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

6.3.2 LED and button instruction

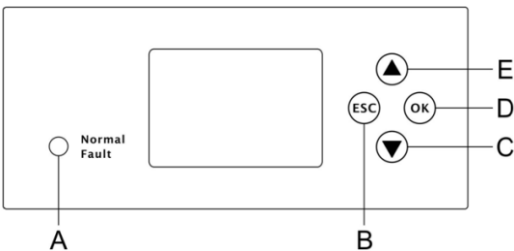


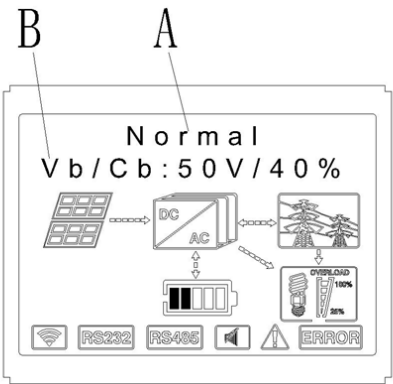
Chart 6.2

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

6.3.3 LCD display column

Grovett 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.



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:

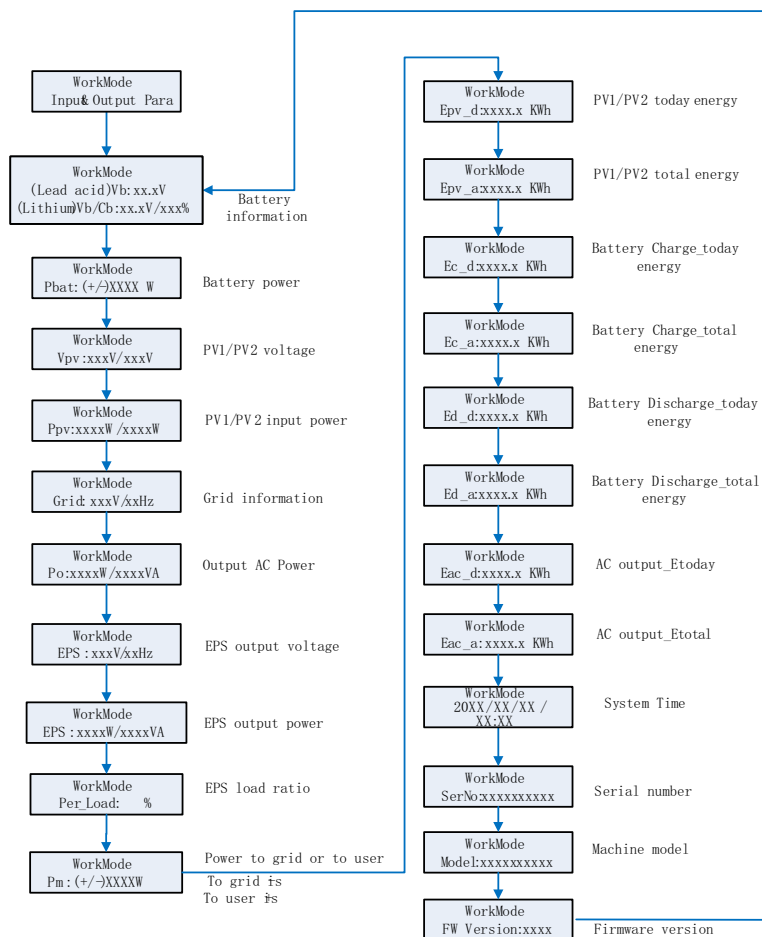


Chart 6.4

Note:

1. "Down" control command (if pushing "up" button, command will go back).
2. Work mode 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.

6.3.4 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.

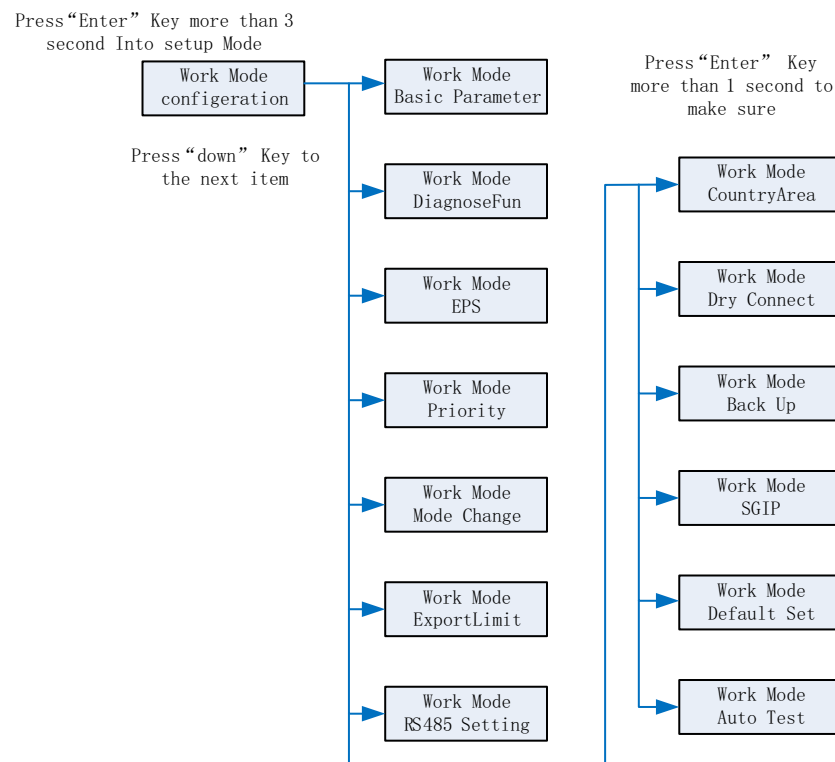


Chart 6.5

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

[illegible]

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).

```

graph TD
    A["WorkMode  
EPS"] -- "Press 'enter' key to make sure" --> B["WorkMode  
EPS:Enable"]
    B -- "Press 'down' key to the next item" --> C["WorkMode  
AC Volt 230 V  
240 V  
208 V"]
    C --> D["WorkMode  
AC Freq 50 Hz  
60 Hz"]
    D --> E["WorkMode  
N PE Relay:ON  
OFF"]
    E --> F["WorkMode  
Bypass:ON  
OFF"]
  
```

Press "enter" key to make sure

WorkMode
EPS

Press "down" key to the next item

WorkMode
EPS:Enable

WorkMode
AC Volt 230 V
240 V
208 V

WorkMode
AC Freq 50 Hz
60 Hz

WorkMode
N PE Relay:ON
OFF

WorkMode
Bypass:ON
OFF

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

1. When EPS Disable & Bypass: OFF, there is no output at the EPS port under any circumstances;
2. When EPS Enable & Bypass: OFF, the EPS port has no output when there is power grid, and the EPS port has output when there is no power grid, and the load needs to be switched through ATS;
3. When EPS Disable & Bypass: ON, the EPS port has output when there is power grid, and the EPS port has no output when there is no power grid;
4. When EPS Enable & Bypass: ON, there is output at the EPS port under any circumstances(The normal working mode of EU models).

The flowchart illustrates the navigation and configuration of the Work Mode settings on the EV charging station. It begins with the 'Work Mode Priority' screen, which leads to the 'Work Mode Opt:Load First(Default) Bat First Grid First' screen. From here, the user can choose 'Bat First' or 'Grid First'. If 'Bat First' is chosen, the user can press the 'down' key to navigate to 'Work Mode Bat First:OK'. If 'Grid First' is chosen, the user can press the 'down' key to navigate to 'Work Mode Grid First:OK'. Both 'Bat First:OK' and 'Grid First:OK' screens lead to a common menu where the user can choose 'OK' to the next item. This menu includes 'Work Mode SC: ---', 'Work Mode Time', 'Work Mode Stop SOC:100%', 'Work Mode Power Rate:100%', and 'Work Mode Save:OK'. The 'Work Mode SC: ---' screen leads to the 'Work Mode AC CHG:Enable Disable' screen. The 'Work Mode Time' screen leads to the 'Work Mode 00:00-00:00' screen. The 'Work Mode Stop SOC:100%' screen has a range of 50% to 100% with 1% accuracy. The 'Work Mode Power Rate:100%' screen has a range of 10% to 100% with 10% accuracy. The 'Work Mode Save:OK' screen leads to a 'NO' screen.

```

graph LR
    A[Work Mode Priority] --> B[Work Mode Opt:Load First(Default)  
Bat First  
Grid First]
    B -- "Press 'down' Key to next item" --> C[Work Mode Bat First:OK]
    B -- "Press 'down' Key to next item" --> D[Work Mode Grid First:OK]
    C -- "Choose 'OK' to next item" --> E[Work Mode SC: ---]
    C -- "Choose 'OK' to next item" --> F[Work Mode Time]
    C -- "Choose 'OK' to next item" --> G[Work Mode Stop SOC:100%]
    C -- "Choose 'OK' to next item" --> H[Work Mode Power Rate:100%]
    C -- "Choose 'OK' to next item" --> I[Work Mode Save:OK]
    D -- "Choose 'OK' to next item" --> E
    D -- "Choose 'OK' to next item" --> F
    D -- "Choose 'OK' to next item" --> G
    D -- "Choose 'OK' to next item" --> H
    D -- "Choose 'OK' to next item" --> I
    E --> J[Work Mode AC CHG:Enable  
Disable]
    F --> K[Work Mode 00:00-00:00]
    G --> L[Range from 50% -100%, and accuracy is 1%]
    H --> M[Range from 10% -100%, and accuracy is 10%]
    I --> N[NO]
  
```

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

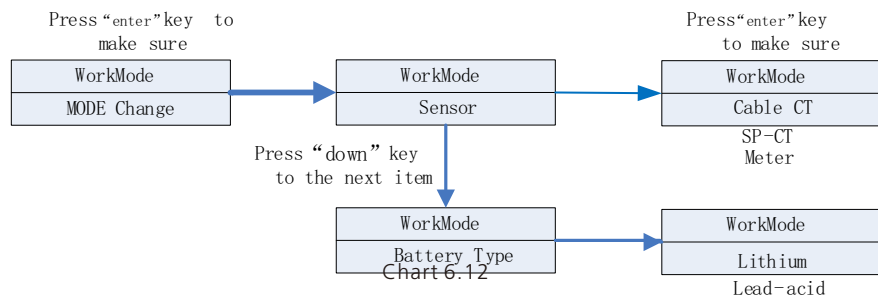


Chart 6.9

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.

4. Under the Export Limit, you can see the setup options below after pressing Enter:

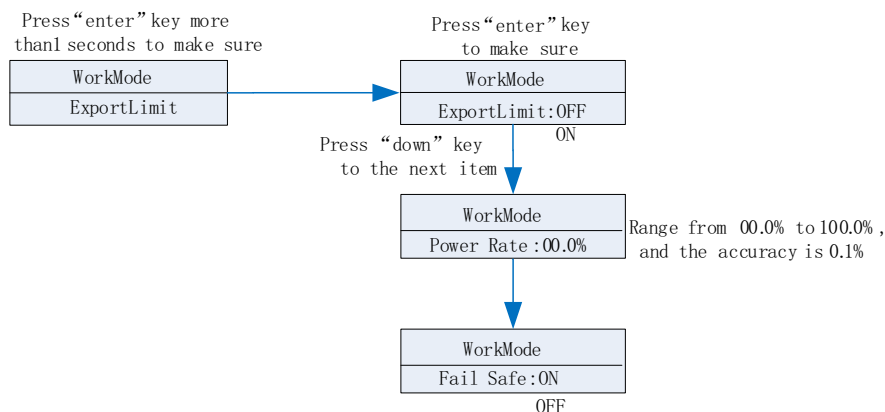


Chart 6.10

Export limit 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%

Fail safe works only in meter mode

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



Chart 6.11

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

6.4 Communication

6.4.1 Use of USB port

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

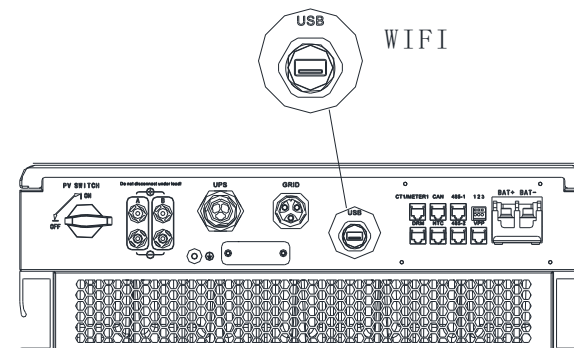


Chart 6.12

Note:

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

6.4.2 The SPH's monitoring

Users can through the following communication solution to monitor the SPH.

Note:

This monitoring can only be used by Growatt's Shine server/Shine phone's monitor provided by the company. Wi-fi -X/ Shine Link-X through USB interface, using computer terminal/mobile phone for data monitoring.

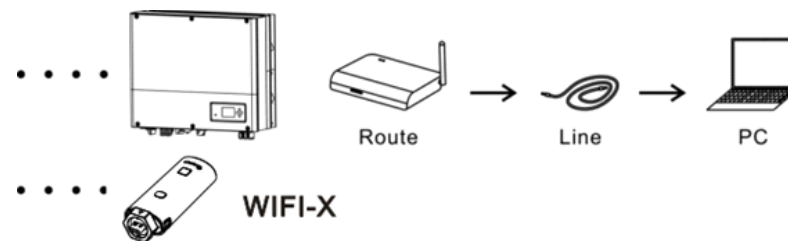


Chart 6.13

The USB collector is connected:

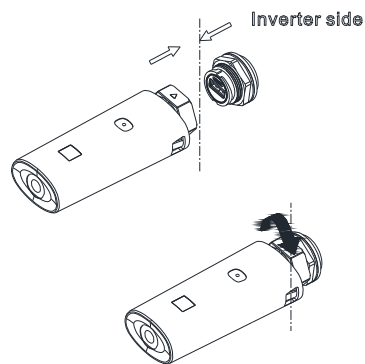


Chart 6.14

Whether it is a Wi-Fi-X/ Shine link-x collector; Connect to the remote monitoring system, scan the QR code on the collector to download the APP. After the download is complete, please prompt for operation. Please see the collector manual for details.

Note:
When connected to the datalogger, when SPH is powered on for the first time with ARK battery, there will be no monitoring data for about 20 minutes. This is because SPH is communicating with the battery and uploading the battery SN number, which is a normal phenomenon.

6.5 Country setting

6.5.1 section describes how to set national security specifications

Growatt offers machines in a variety of specifications. For the SPH TL BL-UP series, the specifications specified by the national safety regulations are set directly on the LCD, without the need for the dip switch.

Note: For compliance with AS/NZS 4777.2:2020, installers will need to select country using instructions in Section 6.5.3 or 6.5.4 and then select Region A, B, or C using instructions in Section 6.5.7 .

6.5.2 Method for setting national security standards for SPH 3000-6000TL BL-UP series models:

Single point down button toggle display or up button
Click the "OK" key to confirm the Settings.

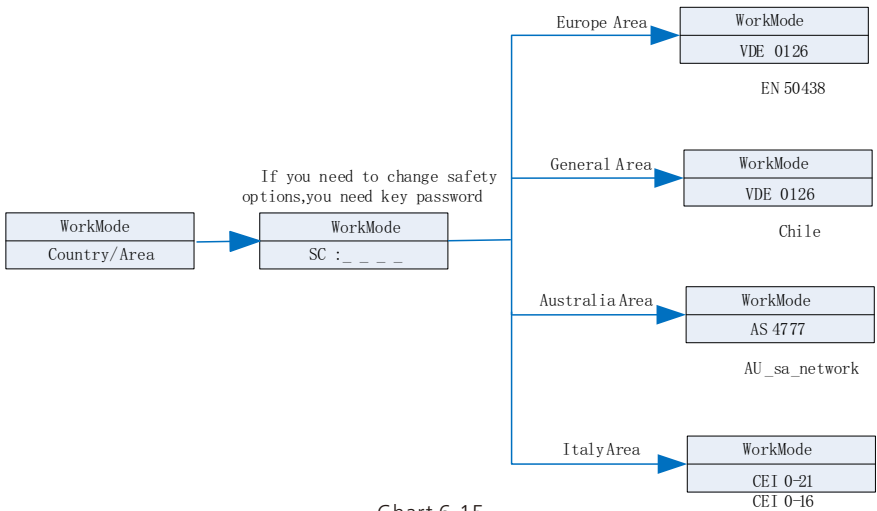




Chart 6.15

 DANGER	Caution : When setting national safety standards for the LCD, turn off the PV switch and AC breaker, but turn on the battery power.
	Caution: 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.

6.5.3 Switch to country table

Country/region / regulations	Model display	Country/region / regulations	Model display
VDE 0126	GT0XXXXXX1	Danmark-EN50438-1	GT0XXXXXXB
Queensland	GT0XXXXXX2	Hungary	GT0XXXXXXC
AS4777	GT0XXXXXX3	Belgium	GT0XXXXXXD
CEI 0-21	GT0XXXXXX4	Thailand MEA	GT0XXXXXXE
G99	GT0XXXXXX5	Thailand PEA	GT0XXXXXXF
XINA1	GT0XXXXXX6	Sp1663	GT1XXXXXX0
VDE-AR-N 4105	GT0XXXXXX7	CQC-1	GT1XXXXXX1
G98	GT0XXXXXX8	TAIWAN	GT1XXXXXX2
Norway-EN50438	GT0XXXXXX9	EN50438-Ireland	GT1XXXXXX3
CQC	GT0XXXXXXA	TUV000	GT1XXXXXX4

6.5.4 Regional power grid setting

Note: This section is for compliance to AS/NZS 4777.2:2015 only

Growatt noticed the Volt-Watt and Volt-Var settings will become mandatory for some of DNSP from 1st December.

2019 in Australia. All the Growatt inverters have capability to meet the different Volt-Watt and Volt-Var settings. Based on CEC notification, SA power network, Horizon Power, Western Power, EnergyX, Ergon energy, Ausnet Services, Essential Energy, Jemena, Citipower, Powercor, Ausgrid and Endeavour will have their own settings.

Steps of Country/Area setting in Growatt SPH models

Step1: Please configure Country/ Area follow the table below

Country/Area	Model display	Country/Area	Model display
Australia	GT4XXXXXX3	Ausgrid	GT4XXXXXX6
Queensland	GT4XXXXXX2	Endeavour	GT4XXXXXX7
Victoria	GT4XXXXXX1	Ergon Energy	GT4XXXXXX8
	GT4XXXXXX4	Energex	GT4XXXXXX9
Horizon Power	GT4XXXXXX5	SA Network	GT4XXXXXXA
New Zealand	GT5XXXXXX8		
<p>Step2: Turn on the AC switch between the SPH inverter and the power grid.</p> <p>Step3: Turn on the AC switch of SPH inverter (both AC and battery are turned on, if there is no battery, only AC is turned on), and the inverter starts automatically.</p> <p>Step4: Make sure the inverter is connected to Internet and staying online in the Shine Phone APP.</p>			



WARNING

- 1.Once the power quality and grid Settings have been selected during debugging, these Settings should be locked and cannot be edited (unless they can be changed by Growatt authorization password).
- 2.After setting the power quality and power grid, you can check whether the safety regulations are correct through the mobile APP.
- 3.When the Country setting is complete, we need to select the right Power Quality Response Mode, if we don't select any mode, the inverter will run under default mode different from region.

6.5.4 Check firmware version, Region, Country/Area and Power Quality Response Modes

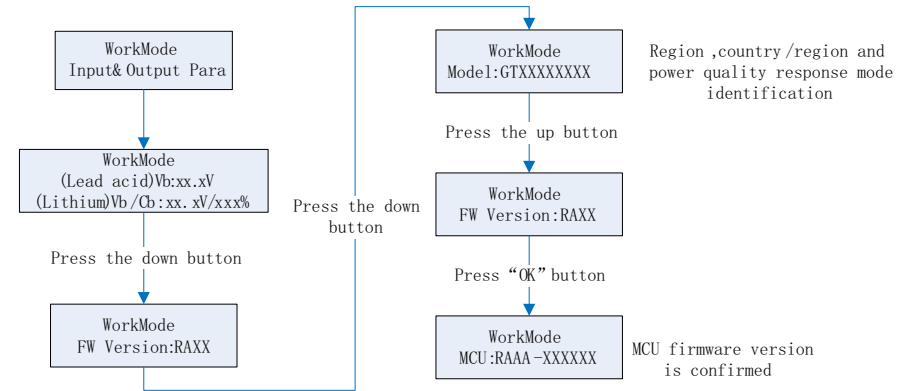


Chart 6.16

6.5.4 Check firmware version, Region, Country/Area and Power Quality Response Modes

Single point down button toggle display or up button

Click the "OK" key to confirm the Settings.

Enter the correct password to change the country/region, region, and PQRM Settings.

Reset Country

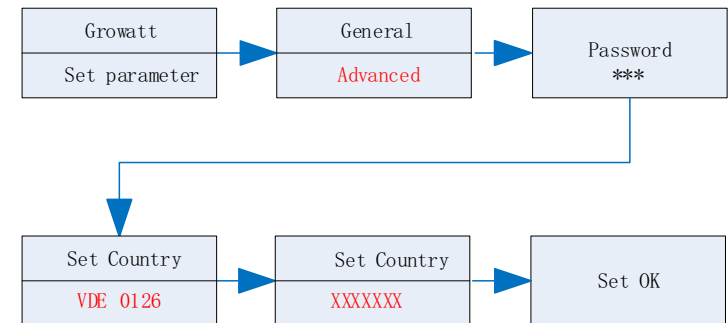


Chart 6.17

Start-up and shut down SPH 7 system

Reset Region

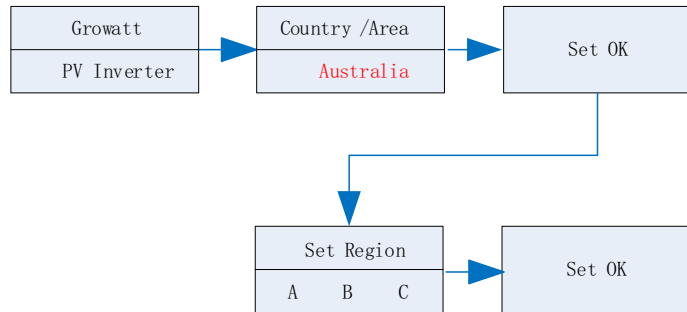


Chart 6.18

Reset PQRM

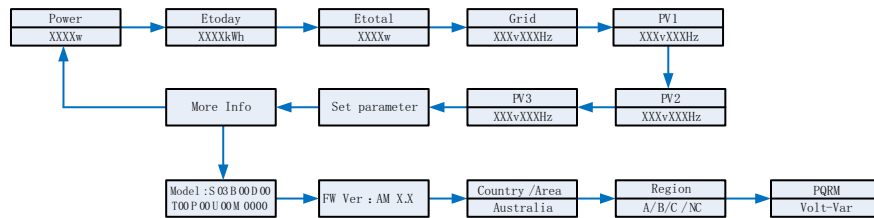


Chart 6.19

Note: If dnsp needs setpoints other than the default values, please refer to the attachment:
adjust the setpoints from the regional default values instruction.

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 be 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.

In order to protect the safety of the operation of the system, the inverter needs to be regularly maintained and cleaned as follows.

- Check whether the grounding wire is loose.
- Whether the terminals are loose.
- Keep the metal housing of the inverter clean.

	<p>Remark:</p> <p>1.Prior to removal of any cover for maintenance or repair, turn off the switch on the AC and DC sides.</p> <p>2.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.</p>
---	--

9 Fault removal

9.1 Troubleshooting method when a fault occurs

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

9.2 System fault information list and troubleshooting suggestions

Warning Message		
Error Message	Description	Suggestion
Warning 401	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.
Warning 203	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.
Warning 506	Battery temperature out of specified range for charge or discharge	1.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.	1.Check the AC voltage is in the range of standard voltage in specification. 2.Check the grid connection is good or not.

Error Message	Description	Suggestion
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.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.
Battery reversed	Battery terminals reversed	1.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. If this warning occurred three time. Off-grid function will be locked one hour and output power again.	1.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.

Error Message	Description	Suggestion
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 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	1.Check the real voltage of battery. 2.Check the wire of battery and inverter is good or not.
BMS Warning:XXX	BMS report warning	1.Check the warning information from lithium battery user manual. 2.Please contact Growatt service center if restart can't solve the problem.
BMS error:XXX	BMS report error	1.Check the warning information from lithium battery user manual. 2.Please contact Growatt service center if restart can't solve the problem.
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 Message	Description	Suggestion
Error 411	Internal communication failed	1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem.
Error 417	Sample fault	1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem.
Error 418	DSP and COM firmware version unmatch, system fault.	1.Read DSP and COM firmware version from LCD or shinebus. 2.Check if the firmware is correct.
Error 303	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 405	Relay fault	1.Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem.

Error Message	Description	Suggestion
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 2.inverter is good or not. 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. Especial not connect to grid
NTC Open	Internal temperature failed	1.Please contact Growatt service center
Error 406	Model set up not meet with certification	1.Please check model set or check the DIP setting
Residual I High	Leakage current too high	1.Check the cable of inverter. Restart inverter. 2.Please contact Growatt service center if restart can't solve the problem
Error 408	Temperature over range	1.Please check the temperature is in the range of specification or not.
PV Voltage High	PV voltage higher than datasheet	1.Please check the voltage of PV input is in the range of specification or not.

10 Decommissioning

10.1 Dismantling the inverter

- 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.

10.2 Package and transport 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 inverter machine overall weight. SPH series frequency converter in the process of moving, please note: handle with care, do not touch the inverter, put as flat as possible.

10.3 Storing SPH inverter

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

10.4 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 specification11

11.1 SPH series inverter machine product specification

Model	SPH 3000TL BL-UP	SPH 3600TL BL-UP	SPH 4000TL BL-UP	SPH 4600TL BL-UP	SPH 5000TL BL-UP	SPH 6000TL BL-UP
Specifications						
Input data(DC)						
Max. recommended PV power(for module STC)	6500W	7500W	8500W	9000W	9500W	10600W
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	20A					
Backfeed current to the array	0A					
AC input / output data						
Rated input / output power	3000/3000 W	3680/3680 W	4000/4000 W	4600/4600 W	5000/5000 W	6000/6000 W
Rated output apparent power	3000VA	3600VA	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
Rated input / output current	13.5/ 13.5 A	16/16 A	17.5/17.5 A	20/20 A	22/22A	27/27 A
Max inrush peak current	10A(5mS)					

Model Specifications	SPH 3000TL BL-UP	SPH 3600TL BL-UP	SPH 4000TL BL-UP	SPH 4600TL BL-UP	SPH 5000TL BL-UP	SPH 6000TL BL-UP
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					
THDI	<3%					
AC connection	Single phase					
Stand alone(AC power)						
Growatt SPH &SPH TL BL-UP Rated output apparent power	3000VA	3680VA	4000VA	4000VA	4000VA	4000VA
Nominal voltage	230V					
Rated Frequency AC output	50Hz					
Rated output current	13A	16A	17.5A	17.5A	17.5A	17.5A
THDv	3%					
Switch time(SPH TL BL-UP))	≤10ms					
BAT data (DC)						
Battery voltage range	42~59V					
Minimum full load voltage	46V	48V	48V	48V	48V	48V
Rated charging and discharging current	66A	75A	85A	85A	85A	85A
Continuous charging / discharging power	3000/3000 0 W	3680/3680 0 W	4000/4000 0 W ^{*1}	4000/4000 0 W ^{*1}	4000/4000 0 W ^{*1}	4000/4000 0 W ^{*1}
Type of Battery	ithium /Lead-acid					
Efficiency						
Max. efficiency	97.2%	97.2%	97.3%	97.4%	97.5%	97.6%

Model Specifications	SPH 3000TL BL-UP	SPH 3600TL BL-UP	SPH 4000TL BL-UP	SPH 4600TL BL-UP	SPH 5000TL BL-UP	SPH 6000TL BL-UP
Euro weighted efficiency	97%	97%	97.1%	97.1%	97.2%	97.2%
MPPT efficiency	≥99.5%					
Protection devices						
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	optional*2					
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					
General Data						
Dimensions (W / H / D) in mm	565*456*188					
Weight	27KG					
Noise emission (typical)	≤ 25 dB(A)					
Altitude	2000m					

Model	SPH 3000TL BL-UP	SPH 3600TL BL-UP	SPH 4000TL BL-UP	SPH 4600TL BL-UP	SPH 5000TL BL-UP	SPH 6000TL BL-UP
Specifications						
Self-Consumption	< 10 W					
Cooling concept	Natural					
Relative humidity	100%					
Features						
DC connection	MC4/H4(opt)					
AC connection	connector					
BAT connection	OT Terminal					
Display	LCD					
Interfaces: RS485/ USB /CAN	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:

1.¹ 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.

2.² in built DC switch isolator is optional in Australia for SPH .

11.2 DC input terminal parameter

MC4 specification:

	2.5mm ² /14AWG	4mm ² /12 AWG	6mm ² /10 AWG	10mm ² /8AWG
DC connection	MC4	MC4	Mc4	MC4
Rated current (90℃ 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℃ to +90℃
Wire stripping length	7.0mm(9/32)
Cable casing diameter	4.5 to 7.8mm(3/16: to 5/16")

11.3 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)

11.4 Appendix

The following chart is the inverter 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-X	Used for data record in EU	MR00.0011200
	Used for data record in Australia	MR00.0011300
Shine Wi-Fi-X	COM interface	MR00.0011000
SPM-CT-E (Sigle phase CT meter)	RS485 meter sensor	MR00.0019000
SPM-E(Single phase meter)	RS485 meter sensor	MR00.0008801
SPM-C(Single phase meter)	RS485 meter sensor	MR00.0010800
TPM(three phase meter)	RS485 meter sensor (standard)	MR00.0008300
	RS485 meter sensor (for Italy)	MR00.0008400

12 Product specification

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
SPH 3000TL BL-UP SPH 6000 TL BL-UP	CE,IEC62109,G98,VDE0126-1-1,AS4777,AS/NZS3100, CEI0-21,VDE-AR-N4105,EN50438,VFR,MEA,PEA,IEC61727,IEC62116
SPH 3600 TL BL-UP SPH 4000 TL BL-UP SPH 4600 TL BL-UP SPH 5000 TL BL-UP	CE,IEC62109,G99,VDE0126-1-19,AS4777,AS/NZS3100, CEI0-21,VDE-AR-N4105,EN50438,VFR,IEC61727,IEC62116

13 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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