GROWATT

SPH 3000-6000TL-HU Series

User Manual

About this Document

This manual is prepared to provide detailed product information and installation instructions for users of the SPH series products manufactured by Shenzhen Growatt New Energy Technology Co., Ltd. (hereinafter referred to as Growatt). Please read this manual carefully and keep it in a place that is convenient for installation, operation and access. Growatt reserves the right to make any modifications to this manual without further notification to customers.

Only professional electrical engineers certified by relevant departments are allowed to install the SPH inverter. The installer must read this manual carefully for safe and fast installation, troubleshooting, and smooth operation.

If you have any questions during the installation process, you can log in to www.growatt.com and leave a message. You can also call our 24-hour service hotline at +86 755 2747 1942.

The SPH 3000-6000TL-HU comes with a single inverter structure. To work with batteries, you must use Growatt ALP 5.0L-E1 lithium batteries to facilitate installation and ensure safety.

Contents

1 Product Introduction

1.1 Intended Use

The SPH grid-connected system consists of PV modules, SPH 3000-6000TL-HU inverter, ALP batteries, public grid and others, as shown in Figure 1. It comes with two independent MPPTs. Up to 8 batteries can be connected in parallel. In addition, the SPH has an EPS output port with a maximum on/off-grid switching time of 15ms, which can be used as backup power when working with the battery.

The SPH series inverters are used to store energy generated by photovoltaic panels or drawn from the grid (if permitted) in the battery. The SPH can also export energy to the grid and utilize the solar power for self-consumption, or serve as a backup power source when the grid is down. The SPH series includes the following six models:
SPH 3000TL-HU
SPH 3600TL-HU
SPH 4000TL-HU
SPH 4600TL-HU
SPH 5000TL-HU
SPH 6000TL-HU
They are hereinafter referred to as "SPH".

Note:
We offer the SPH of different power levels in different countries. For example, in Germany, we can provide SPH 3000TL-HU, SPH 4600TL-HU, while SPH 5000TL-HU and SPH 6000TL-HU are not available.

Highlights of SPH series inverters:
1. Intelligent management. Three working modes are available: Load First, Battery First and Grid First, enabling diverse application scenarios.
2. Easy to install. Modular design, with integrated smart meter.
3. Two independent photovoltaic MPPT inputs; designed to enhance maximum self-consumption.
4. Support multiple inverters connected in parallel.
5. On-/off-grid switching time is less than 15 ms.

1.2 System Diagram

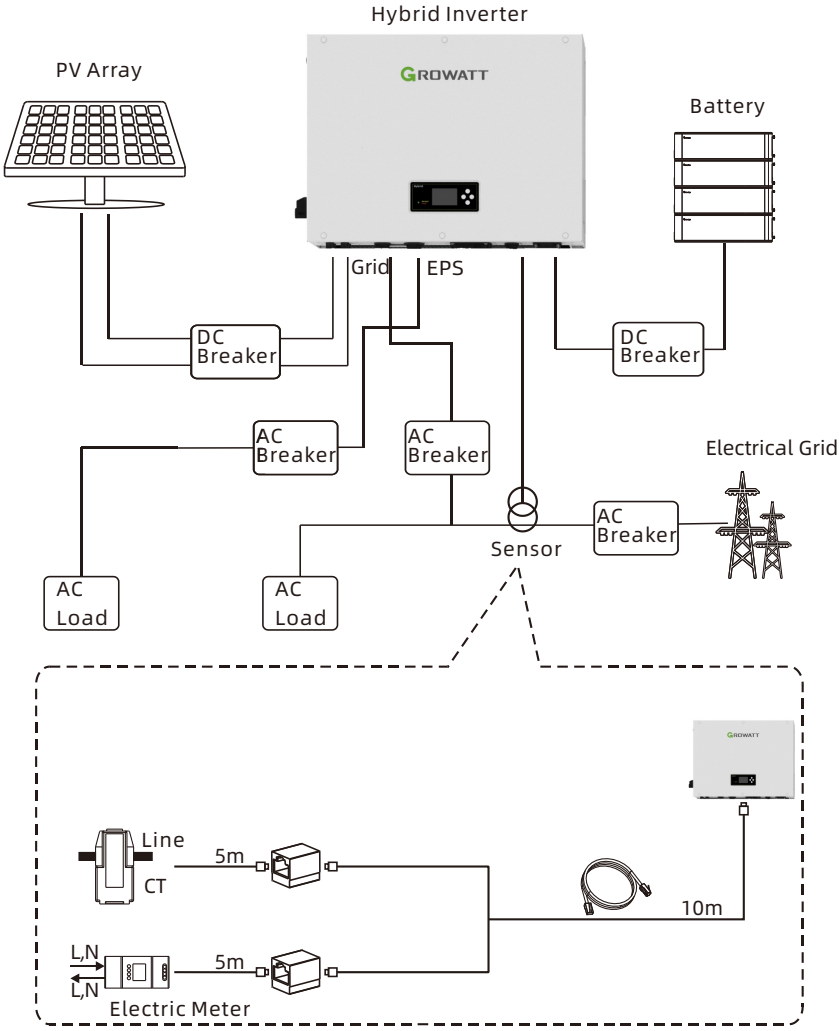


Figure 1. 1 System diagram of the SPH

1.3 Description of SPH 3000-6000TL-HU

The SPH 3000-6000TL-HU inverter is mainly composed of inverter circuit, buck-boost converter circuit, control circuit and communication circuit. The product appearance is shown below:

A: Dimensions of SPH 3000-6000TL-HU

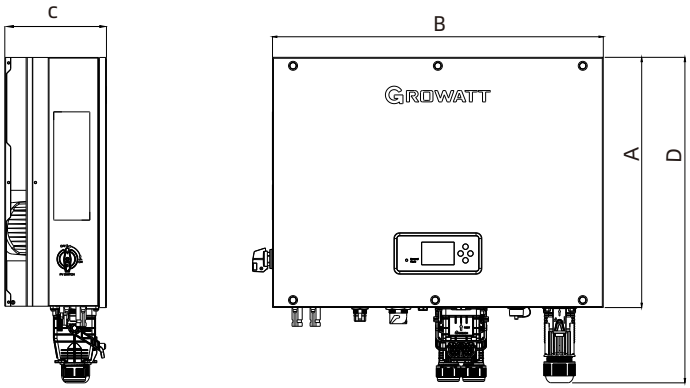


Figure 1.2 Appearance of the SPH

	A (mm)	B (mm)	C (mm)	D(mm)	Weight(kg)
SPH 3-6KTL-HU	458	605	186	595	32

B: External terminals of SPH

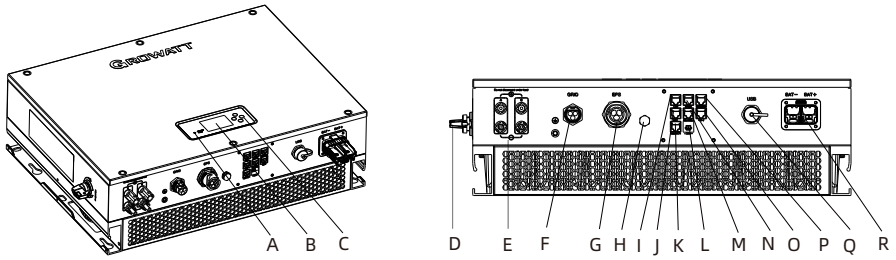


Figure 1.3 Wiring terminals of SPH

NO.	Description
A	LED status indicator
B	LCD screen
C	Buttons
D	PV switch
E	PV input terminal
F	AC grid port (for grid connection)
G	EPS port (for off-grid connection)
H	Vent valve (balancing pressure while ensuring waterproofing)
I	CAN communication port connected to the lithium battery
J	NTC: lead-acid battery sensor terminal
K	RS485 communication port for Meter1/CT1
L	Dry contact
M	RS485-1/485-3 communication
N	RJ45 port for DRMs (Demand response Modes), for Australia only
O	RS485-2 communication
P	Built-in Meter 1 communication
Q	USB port
R	Battery power terminal

C: Button description

Symbol	Designation	Description	
	Push buttons	Operate the display screen and set system parameters	
	SPH status indicator	Steady green	SPH runs normally
		Steady red	Fault state
		Blinking green	Alarm state
		Blinking red	Software update

2 Safety

When installing or operating the battery system, the safety information contained in this section must always be followed. For safety reasons, it is the installer's responsibility to get familiar with this manual and all warnings before installation.

2.1 General safety

The inverter and battery has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, there are residual risks despite careful construction. Before installing or using the equipment, please read the instructions carefully and observe the all safety precautions at all time. Growatt shall not be liable for any consequence of the following circumstances:

- Damage during the transportation by the customer.
- Damage caused by improper operations of a third part or customer, including those in transportation, storage, installation and use of the product.
- Improper installation by unprofessional and uncertified personnel.
- Failure to follow the operation instructions and safety precautions provided in this document.
- Unauthorized modifications or removal of the software package.
- The product's tamper evident label is removed or any item is missing due to customer's negligence or intentional damage.
- Operating the equipment in environments that cannot meet the requirements specified in this document.
- Damage caused by repairing, disassembling, and modifying the product without authorization.
- Tampering with labels on the chassis or modifying the date of production.
- Damage due to force majeure, such as lightning, earthquakes, fire, and storms.
- Warranty expiration.

2.2 Safety Precautions

2.2.1 Environment Requirements

- Do not expose the equipment to environments where the temperature is above 50℃.
- Do not install or use the battery in a humid place with corrosive gases or liquids, such as the bathroom.
- Do not expose the equipment to direct sunlight for extended periods.
- Place the equipment in a safe place and ensure that they are not accessible to children and animals.
- Battery power terminals shall not come in contact with conductive objects such as wires.
- Do not dispose the batteries in a fire, which may cause an explosion.

- Do not put the battery in contact with liquids.
- For indoor installation, do not install the equipment in the bedroom, living room, kitchen, etc.
- For outdoor installation, please build a sun and rain shelter to protect the equipment from direct sunlight, rain or snow.

2.2.2 Safe Operation and Protection Measures

1. This manual contains important information about your operating system. Please read the manual carefully before operation. Follow all instructions in the manual strictly, otherwise it may cause device damage, personal injury and property loss, or void the product warranty. Keep the manual handy for maintenance and repair;
2. Use appropriate measuring equipment when connecting or testing the system to ensure the electrical parameters comply with requirements. Be sure to connect and use matching specifications to prevent arcing or shock. Ensure that the whole system has been reliably grounded;
3. Do not repair or maintain the equipment in wet weather. Do not touch the SPH system with wet hands;
4. It is strictly prohibited to disassemble the SPH system without permission. If the equipment requires maintenance, please contact your local designated system installation and maintenance personnel. Only qualified and trained personnel are allowed to repair, replace or maintain the SPH system;
5. Before installation, replacement and maintenance, please remove all metal objects that may cause short circuits, such as watches, rings, etc.;
6. Do not crush, drop or puncture the battery pack and SPH inverter;
7. When storing and transporting the SPH system, do not stack them without packaging boxes.
8. Handle the battery carefully to avoid leakage. Leaked electrolyte is toxic and harmful to skin and eyes;
9. All electrical installations must comply with local electrical safety standards;
10. Ensure that you have obtained approval from the utility company before connecting equipment to the power grid;
11. Turn off the PV switch when installing PV modules during the day; otherwise the voltage of the module terminal would be too high under sunlight, leading to safety hazards.

2.3 Label Description

Label	Description
	Risk of high voltages which might lead to electric shocks
	Burn hazard. Hot surface. Do not touch.
	Delayed discharge: Residual voltage exists after the SPH is powered off. Wait at least 5 minutes until it discharges to the safe level
	Grounding: indicates the position for connecting the PE cable
	Direct current (DC)
	Alternating current (AC)
	CE marking This product complies with the requirements of the applicable EU directives
	Li-ion batteries can be recycled
	Danger! Explosive gas
	Be aware of battery leakage
	Heavy object! Moving the equipment without help of other people might cause injury
	Keep the inverter out of children's reach.

Label	Description
	Ensure the correct polarity
	Keep away from open flames and heat source
	Refer to the manual
	Do not dispose of the product together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site
	Regulatory Compliance Mark (RCM) for Australia
 WARNING	Indicates a potentially hazardous situation, if not avoided, could result in serious injury or death

DANGER

Risk of high voltage!

- Only professional personnel are allowed to perform the operation.
- Keep children, people with disabilities and non-professionals away from the system.
- Supervise and make sure children don't play near the installation position of inverter machine.

DANGER

Risk of burns! Do not touch a running SPH.

It generates high temperature on the cover, chassis and heat sink during operation.

CAUTION

The SPH inverter emits radiate, which might affect your health aversely!
Do not stay close to the SPH inverter (within 20 cm) for a long time.

Grounding the SPH inverter

Information
Please ensure that SPH inverter has been securely connected to ensure personal safety.

GROWATT

Hybrid Inverter
SPH 6000TL-HU

PV Input Data

Max. PV voltage	600 d.c.V
PV voltage range	100-560 d.c.V
PV Isc	24 d.c.A*2
Max input current	16 d.c.A*2

AC Input /Output Data

Rated input/output power	6000 W
Rated output apparent power	6000 VA
Nominal voltage	230 a.c.V
Rated input/output current	26 a.c.A
Nominal frequency	50/60Hz
Power factor range	0.8leading~0.8lagging

Stand Alone Data

Nominal AC output power	6000 VA
Nominal AC output voltage	230 a.c.V
Rated output current	26 a.c.A
Nominal AC output frequency	50/60Hz

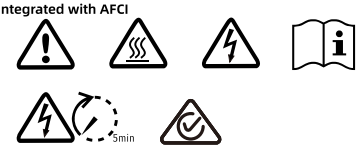
Battery Data

Battery voltage range	42-59 d.c.V
Rated charging and discharging current	125 d.c.A
Type of battery	Lithium/Lead-acid

Others

Overvoltage category	PV:II BAT:II AC:III
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-25℃~+60℃
Inverter topology	Non-isolated
Certificate number	

Integrated with AFCI



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Manual

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PASS

X

Made in China

Figure 2. 1 Inverter label

2.4 Emergency Responses

The manufacturer has taken foreseeable risk scenarios into consideration and the product has been designed to reduce hazards and dangers. However, if the following situation occurs, please do as below:

Emergency	Description and suggested measures
Leakage emergency	Avoid contact with leaked liquids or gases. Should you come into direct contact with the battery electrolyte, do as follows: • Eye contact: flush your eyes with flowing water for 15 minutes, and seek immediate medical attention. • Skin contact: wash the affected area with soap and water, and seek immediate medical attention. • Ingestion: seek immediate medical attention
Fire emergency	Normally, the battery system won't ignite spontaneously. If a fire occurs, do not try to extinguish the fire but evacuate people immediately.
Flood emergency	If the battery system is soaked or submerged in water, do not touch the batteries to avoid electric shock. Contact Growatt or your distributor immediately for technical assistance.
Shell damage	The shell damage requires extra attention as it is of high risk. Do not use batteries with a damaged shell, which may cause safety hazards. Contact Growatt or your distributor to dispose of them.

Storage and Transportation 3

3.1 Storage Requirements

- Handle the batteries according to the signs on the packing case.
- Do not put batteries upside down or on their side.
- Do not store damaged batteries near undamaged ones.
- Do not stack more than 5 units in one line when storing the inverter and do not stack them without packages.
- The storage environment requirements are as follows:

1) Store the SPH in a dry, clean and well-ventilated place.
2) Relative humidity: 5% to 95% RH.
3) Place the SPH system away from corrosive and organic materials.
4) Protect the batteries against direct sunlight and rain.
5) Keep the SPH system at least two meters away from heat sources (such as a radiator).
6) Avoid exposure to intense infrared radiation.

3.2 Transportation Requirements

- Transportation requirements are as follows:
- The SPH system shall not be transported with other flammable, explosive or toxic substances.
- Ensure that the original package and labels are intact and identifiable.
- Avoid direct exposure to sunlight, rain and condensing water caused by temperature difference.
- Do not stack more than 5 units of SPH during transportation and storage.
- Keep the temperature between 25°C to 60°C and the relative humidity within the range of 5%~95% RH during transportation.

4 Installation and Cable Connections

WARNING	➢ Read through this manual before installation to get familiar with the product information and safety precautions. ➢ Only qualified and well-trained technicians who fully understand the whole photovoltaic system, grid network, battery system, working principle and national/local standards are allowed to perform operations on the SPH system. ➢ Installers must use insulating tools and wear safety gear during operation. ➢ Device damage caused by failure to comply with the storage, transportation, installation or operation requirements specified in this document is not covered under any warranty. ➢ Do not install or use the SPH system near explosive or inflammable materials. ➢ Operate the SPH system in a well-ventilated environment with temperature ranging from -10°C to 50°C. For outdoor installation, build a sun & rain shelter to avoid exposure to direct sunlight and rain. ➢ The SPH system should be protected from dust and dirt. Do not expose it to environments with high humidity.

4.1 Basic Installation Requirements

Observe the following installation requirements:

A. The installation location must be able to bear the weight of the SPH system for a long time.

B. Do not install the SPH system on a structure made of flammable or thermally unstable materials.

C. When installing the SPH system outdoors, it is recommended to install an awning above the system to avoid exposure to sunlight and rain; otherwise it may cause damage to the system.

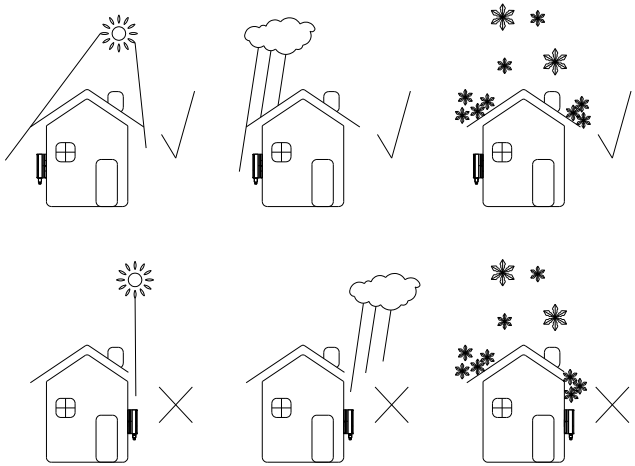


Figure 4. 1 Environment requirements

E. Observe the clearance requirements:
1) Keep the SPH at least 600 mm away from any heat source such as the water heater, gas heater, air conditioner or any other equipment.
2) Keep a distance of at least 600 mm from the outlet.
3) Keep a distance of at least 600 mm from a window or other vent.

F. The installation location should be free from obstacles for the use of disconnector. To ensure the proper operation of the equipment and facilitate operations, please reserve enough space around the SPH. Please refer to the figure below:

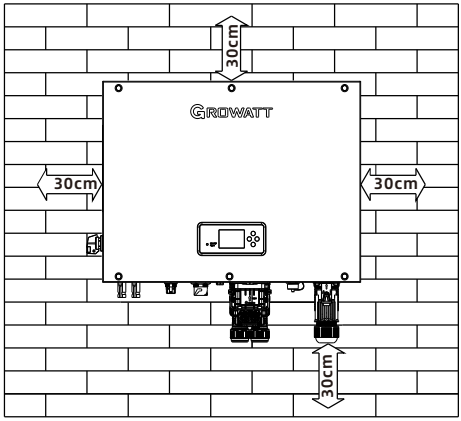


Figure 4. 2 Environment requirements

G. Do not install this system near a television antenna or any other antenna or antenna cable.
H. Do not install the system in living areas.
I. Ensure that the system is inaccessible to children.
J. Do not place flammable and explosive dangerous goods around the system to avoid severe danger.
K. If installed on a non-flame-retardant structure, it is recommended to add a flame-retardant device between the SPH system and the installation structure.
L. Do not turn the system module upside down and make sure that the SPH is level.
M. If installed indoors, please ensure proper ventilation. The installation angle requirements are shown below:

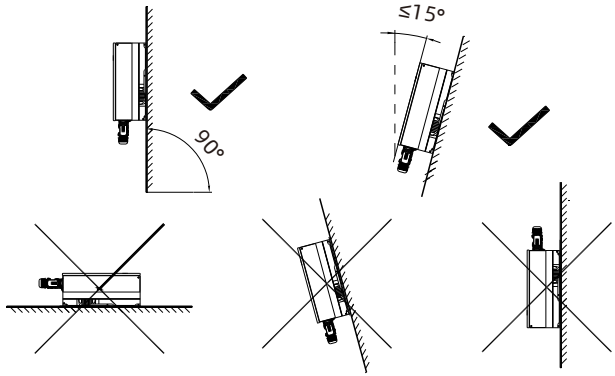


Figure 4. 3 SPH installation angle requirements

4.2 Installation Tools

Figure 4. 4 Installation tools

No.	Function
1	RJ45 terminal crimping plier
2	Battery terminal crimping plier
3	Disconnect PV connectors
4	Tighten nuts
5	Tighten screws
6	Knock bolts
7	Drill holes

Please wear the following safety gears:

 Insulated Gloves	 Safety Goggles	 Safety Shoes

Figure 4. 3 Safety gears

4.3 Installation Procedure

4.3.1 Checking before Installation

- Check the package before unpacking it. If any damage is found, do not unpack the package and contact your distributor
- Check the quantity of all components according to the packing list. If any damage is found or any component is missing, please contact your distributor.

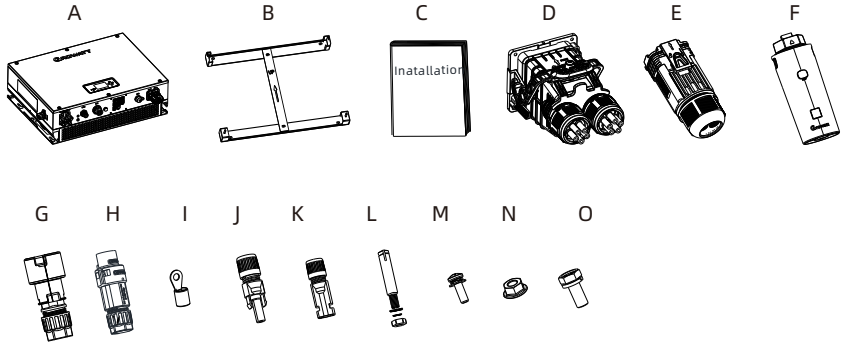


Figure 4. 6 SPH system packing list

NO.	Description	Qty
A	SPH inverter	1
B	Wall mount bracket	1
C	User Manual	1
D	Waterproof cover for communication port	1
E	Waterproof cover for battery power terminal	1
F	Datalogger (ShineWiFi)	1
G	EPS connector	1
H	AC grid connector	1
I	Battery power terminal	2
J/K	MC4 connector	2/2
L	M4 expansion screw	6
M	M4 recessed pan-head screw (three-in-one)	4
N	M6 flange nut	2
O	M6 Phillips hex head screw	2

Note:

Item G "EPS connector" has been pre-installed on the inverter before delivery.

4.3.2 Installation

4.3.2.1 System layout (consider the length of the sensor)

Two types of sensors can be used with the SPH. One is a wired current sensor and the other is an electric meter sensor. If you choose a current sensor or an electric meter sensor, beware of the following information before installation: The cable length for wired sensors is recommended not to exceed 15 meters, and that for electric meters is recommended not to exceed 100 meters. Therefore, you need to consider the length between the SPH and the combiner box in order to install the sensor on the live line. Please refer to Figure 1.1 for the system layout.
Two types of Export Limitation sensors can be used with the SPH. One is a wired current sensor (not used in Australia) and the other is an electric meter sensor. Before installation, beware of the following information: It is recommended that the communication cable length of the electric meter should not exceed 100 meters. Therefore, you need to consider the length between the SPH and the combiner box in order to install the sensor on the live line. Please refer to Figure 1.1 for the system layout.

4.3.2.2 Installation steps

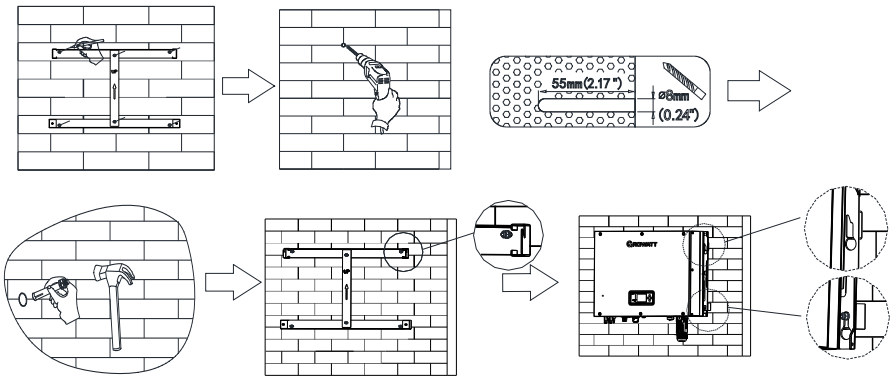


Figure 4. 7 SPH installation steps

Step1: Select the suitable installation location. Place the wall-mounted bracket against the cement wall to determine the hole positions for fixing the bracket, and mark the positions with a marker. Please note that the thickness of the wall must not be less than 60mm, and the load-bearing capacity of the wall should be not less than 100kg; and the bracket needs to be placed level.

Step2: After marking the positions, remove the bracket and drill holes (4) at the marked positions using an impact drill; use a drill bit with a diameter of ϕ8mm and drill to a depth of not less than 55mm.

Step3: Install 4 expansion screws into the holes.

Step 4: Install the wall-mounted bracket onto the expansion screws and tighten with nuts. Pay attention to the installation direction of the bracket, which can be confirmed by the direction of the arrow in the middle of the bracket. The arrow pointing upward is the correct direction.

Step 5: Place the inverter onto the bracket. There are two holes above the heat sink on both sides to be hooked with the two hooks on the upper bracket. Secure the inverter to the bracket by tightening the screws on both sides.

Note:

When drilling holes, avoid the water pipes and power cables buried in the wall.

4.4 Electrical Connection

WARNING	Do not forget to wear the ESD wrist strap, safety gloves and goggles

4.4.1 AC grid connector and EPS connector wiring instructions

4.4.1.1 Wiring ports for the AC grid connector and EPS connector

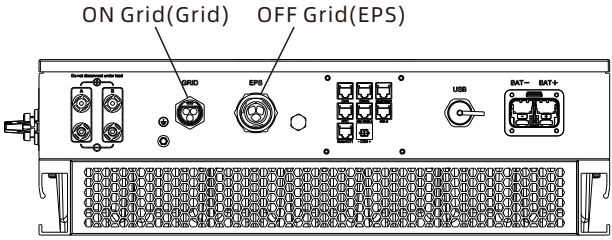


Figure 4. 8 Wiring ports for the AC grid connector and EPS connector

The SPH has one AC Grid output port (left) and one off-grid(EPS) output port (right) as shown in the figure above. The AC Grid port is for grid connection, while the EPS port is for emergency power supply, connected to critical loads.

4.4.1.2 Special requirements on the EPS connector (anti-disassembly)

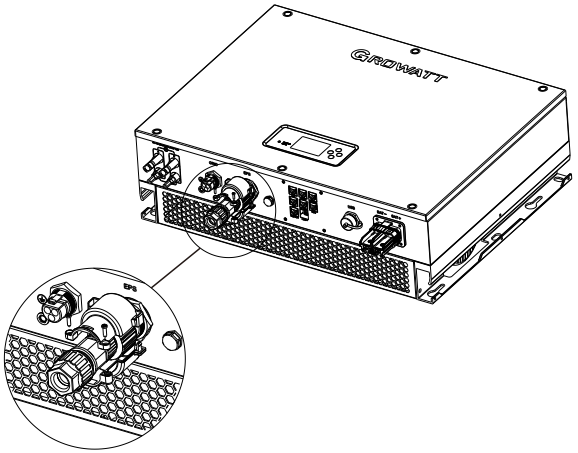


Figure 4. 9 Special requirements on the EPS connector

NOTICE	EPS connector The EPS connector (Item G in Figure 4. 6 has been pre-installed on the inverter. During installation, whether you intend to connect the EPS port, the EPS connector should be installed on the inverter, as shown in Figure 4. 9.

4.4 .1.3 AC grid port and EPS port wiring cable specification recommendations

Conductor cross section	Max cable length					
	SPH 3000 TL-HU	SPH 3600 TL-HU	SPH 4000 TL-HU	SPH 4600 TL-HU	SPH 5000 TL-HU	SPH 6000 TL-HU
5 .2mm2 10AWG	40m	33m	28m	26m	25m	23m
6 .6mm2 9AWG	50m	42m	36m	33m	32m	29m

4.4 .2 EPS Connector Wiring Instructions

4.4 .2.1 Remove the EPS Connector

The EPS connector has been pre-installed on the SPH inverter. If you do not need to connect to EPS loads, do not remove the EPS connector to avoid electric shocks due to accidental contact.

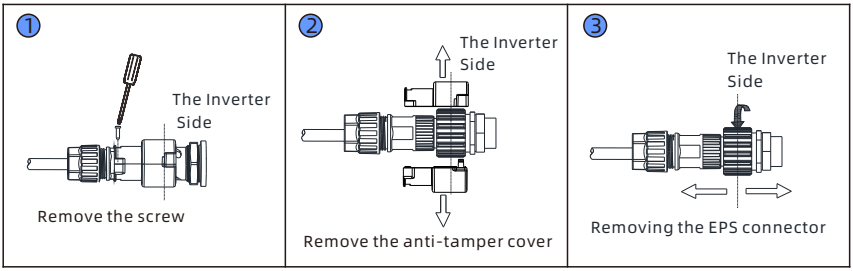


Figure 4. 10 Remove the EPS connector

Step 1: Loosen the screws on both sides of the anti-tamper cover.
Step 2: Remove the anti-tamper cover.
Step 3: Rotate the EPS connector to remove it from the inverter and pull it out.

4.4 .2.2 Install the EPS Connector

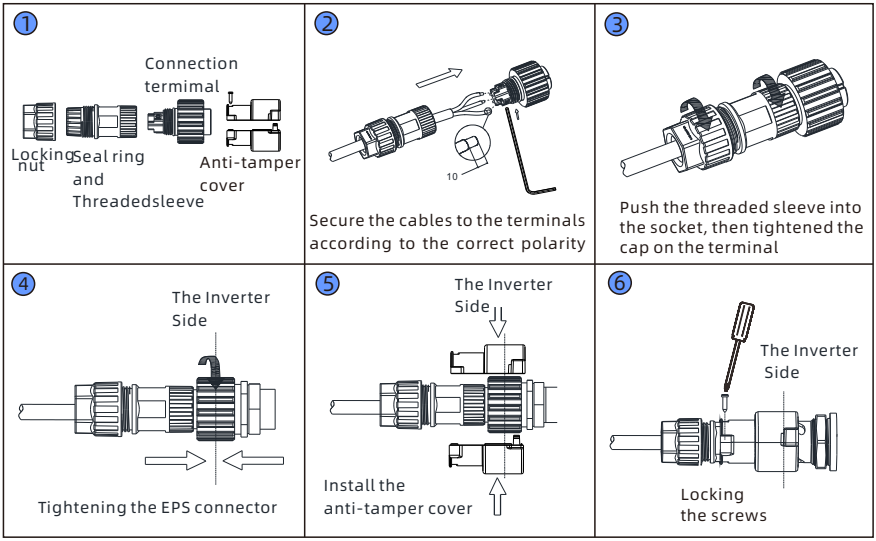


Figure 4. 11 Install the EPS connector

Step 1. Pass the stripped cable through the locking nut, sealing ring, and threaded sleeve in sequence. Insert the cable into the terminal block according to the polarity indicated on the terminal block. After tightening the screw, give the cable a gentle tug and it should not come loose to ensure a secure connection.
Step 2. Push the threaded sleeve into the terminal block, then tighten the threaded sleeve and the locking nut in turn.
Step 3. Align the wired EPS connector with EPS port and rotate to secure it.
Step 4. Put the anti-tamper cover on the connection terminal and tighten the buckle.
Step 5. Secure the anti-tamper cover with the two screws.

NOTICE	The anti-tamper cover for the EPS connector complies with safety regulations. For better protection and to avoid the risk of electric shock, the EPS connector must be protected with an anti-tamper component.

4.4 .3 Grid Connector Wiring Instruction

4.4 .2.2 Install the Grid Connector

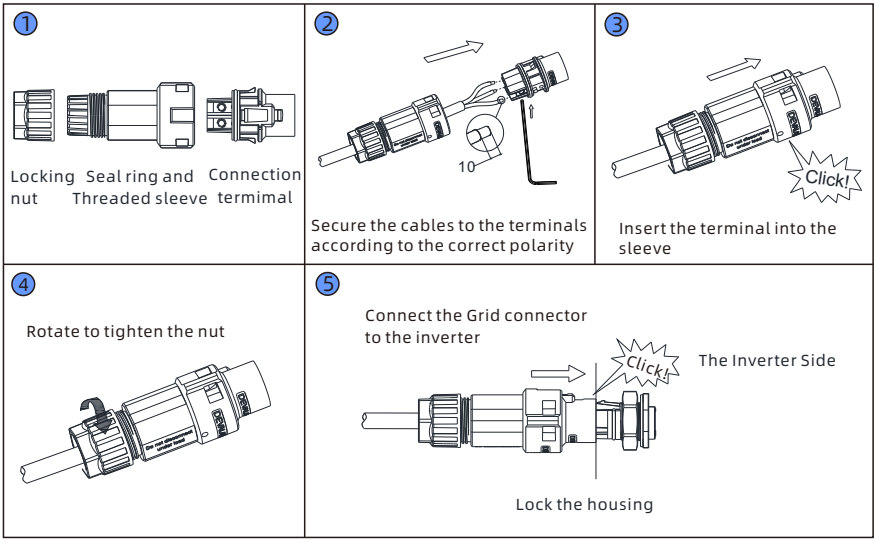


Figure 4. 12 Install the Grid connector

Step 1. Take the parts from the accessory bag.
Step 2. Pass the stripped cable through the locking nut, sealing ring, and threaded sleeve in sequence, insert the cable into the terminal according to the polarity indicated on the terminal, and tighten the screws.
Step 3. Push the threaded sleeve into the socket
Step 4. Tighten the locking nut on the terminal.
Step 5. Align the assembled Grid connector with the Grid port on the inverter, insert the connector and secure the connection.

Note:
After the Grid connector is installed, a screwdriver is required if you need to remove it, which is shown in Figure 4.13.

4.4 .3.2 Remove the Grid Connector

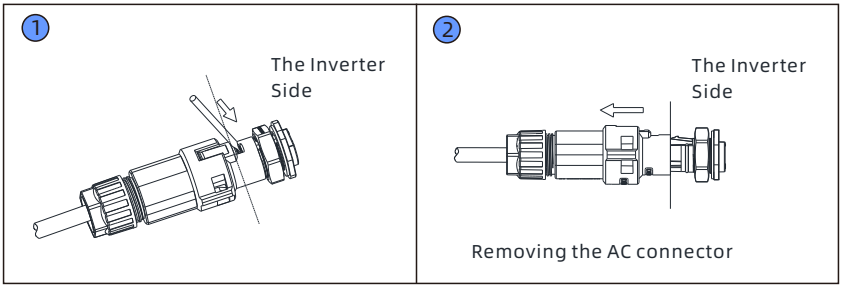


Figure 4. 13 Remove the Grid connector

Step 1: Press the buckle out of the slot using a small screwdriver.
Step 2: Unplug the AC grid connector.

4.4 .4 PV Connector Wiring Instructions

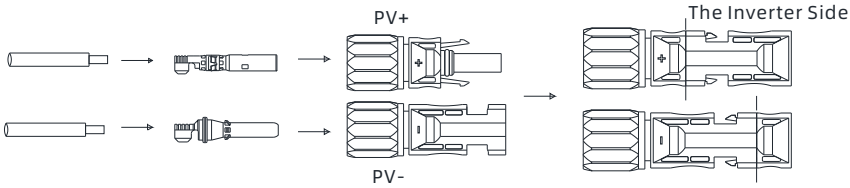


Figure 4. 14 PV connectors

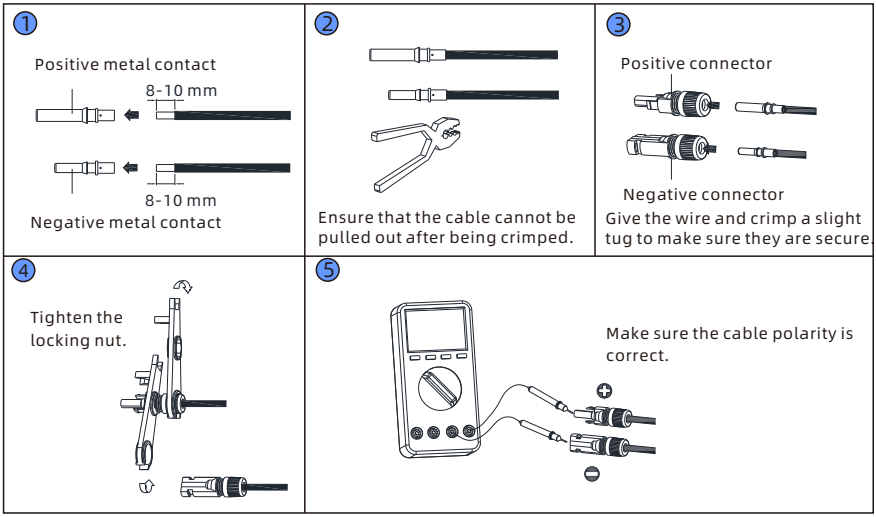


Figure 4. 15 Install the PV connectors

Step 1: Insert the stripped cables into the positive and negative metal contacts respectively.
Step 2: Crimp the metal contacts and the cables with a crimping plier.
Step 3: Loosen the locking nuts from the connectors, then insert the positive and negative metal contacts into the connectors.
Step 4: Tighten the nuts of the connectors.
Step 5: Use a multimeter to ensure the correct polarity of the PV wiring.

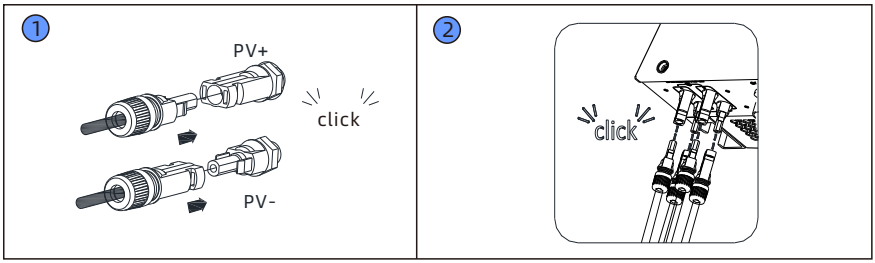


Figure 4. 16 Connecting the PV connectors

WARNING	➢ Before connecting the PV connectors, please confirm that the PV input voltage and current are not beyond the specified range. ➢ When connecting the PV connectors, identify the positive and negative terminals and connect them to the inverter respectively following the color convention. ➢ A "click" sound will be heard when the terminal is connected. Please gently pull the PV cable back to make sure it is securely connected.

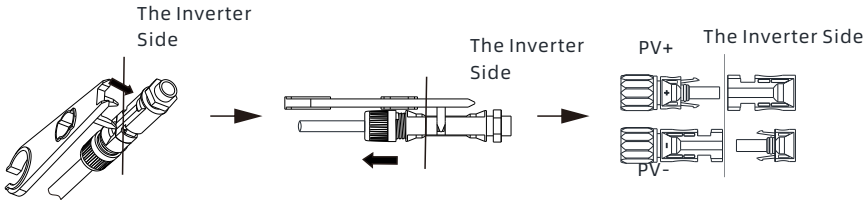


Figure 4. 17 Remove the PV connectors

Step 1: Insert an open-end wrench into the notch and press the wrench with an appropriate force.
Step 2: Pull out the PV connector.

WARNING	The solar modules connected to the inverter must comply with IEC 61730 Class A requirements. Please use the same brand of male and female photovoltaic connectors.

The SPH single-phase inverter has 2 independent inputs: MPPT1 and MPPT2.

Note:

1. PV connectors come in pairs (male and female connectors).
2. The SPH single-phase inverter has two independent inputs: MPPT1 and MPPT. The same photovoltaic output can be connected to MPPT1 and MPPT2 at the same time, or each MPPT can be separately connected to a photovoltaic panel output end, which can be selected according to actual needs.

CAUTION	The DC input of the inverter shall not exceed the following limits: **Types** / **Max current MPPT1** / **Max current MPPT2** SPH 3000-6000TL-HU / 16A / 16A
DANGER	**High voltages are dangerous!** The PV array generates DC voltage to the inverter when exposed to sunlight. Before connecting the PV array, ensure that the DC switch and AC circuit breaker are disconnected from the inverter. Do not connect or disconnect DC connectors on load. Ensure that 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 photovoltaic plant. When the solar panel temperature is -15 ° C, the maximum open-circuit voltage shall not exceed the maximum input voltage of Inverter.

CAUTION	➢ Improper operation may cause fatal injury to the operator or irreparable damage to the inverter. Please do the wiring work with experienced help. ➢ Do not ground the positive and negative terminals of the photovoltaic array; otherwise, the inverter may be seriously damaged. ➢ Check whether the cable polarity of the photovoltaic module is correct. The input voltage of the inverter should not exceed the maximum voltage. ➢ Photovoltaic module grounding: The SPH is a transformerless inverter, so it has no electrical isolation. Do not ground the DC circuit of the PV module connected to the SPH. If a grounded PV module is connected to the SPH, the error message PV ISO Low is displayed. ➢ The grounding of photovoltaic modules and photovoltaic generators must meet local grounding requirements. GROWATT recommends connecting the generator frame and other conductive surfaces to ensure continuous conduction to the ground for optimal protection of systems and personnel. ➢ Turn off the PV DC switch when maintaining the inverter.

Connect the PV input cables with the MC4 PV connectors. The procedure is as follows:
1. Turn off the PV switch.
2. Insert the positive and negative cables of the PV panel into the MC4 connectors, then connect the positive (+) of the connecting cable to the positive (+) of the PV input connector, and connect the negative (-) of the connecting cable to the negative (-) of the PV input connector, noting that the PV input voltage and current should be within the permitted range:
Max PV voltage: 560V (considering the minimum temperature)
Maximum PV input current :16A/MPPT
Maximum PV input power per string :6000W
Note:
1. Cables ≥4mm²/ 12 AWG are recommended.
2. Do not connect to other DC power supply other than the PV panels.

4.4 .5 Datalogger Installation Instructions

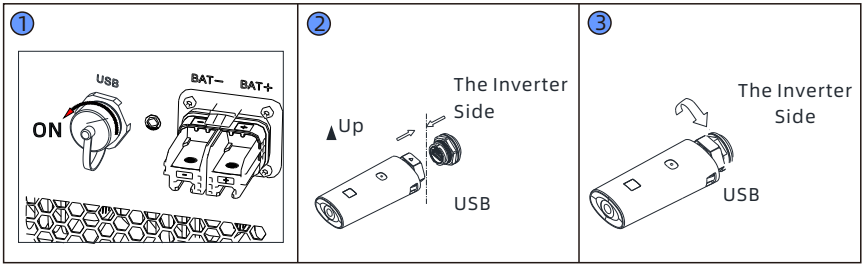


Figure 4. 18 Install the datalogger

Follow the installation steps:
1. Remove the waterproof cover from the USB port.
2. Plug in the datalogger.
3. Secure the datalogger.

4.4 .6 Battery terminal wiring

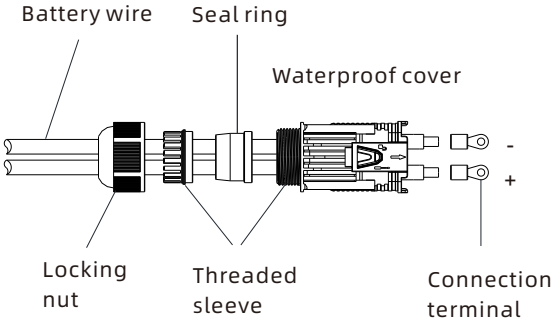


Figure 4. 19 Waterproof battery terminal

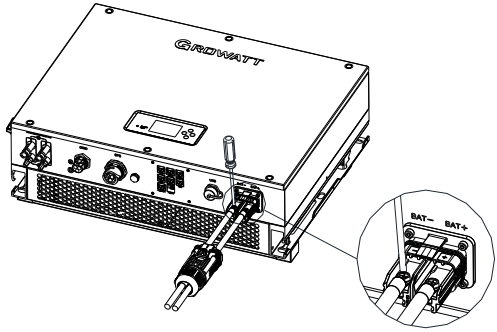


Figure 4. 20 Secure the battery power cables

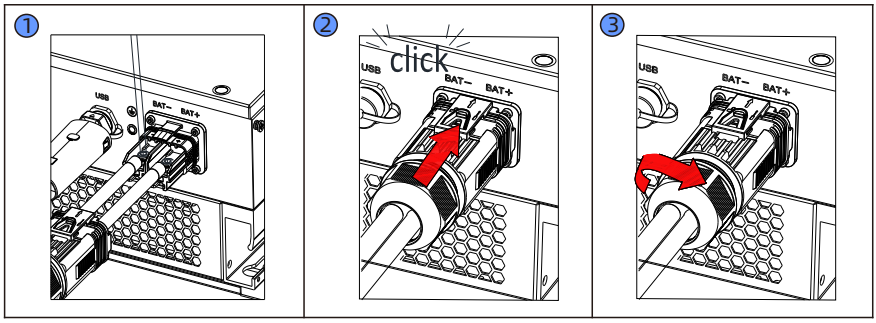


Figure 4. 21 Secure the battery terminal

Steps to install the battery power cable:

1. Take out the OT terminals from the accessory bag and crimp the battery power cables with the terminals. Ensure they have been properly crimped.
2. Thread the cables through the locking nut, waterproof sleeve and the waterproof cover. Pay attention to the polarity. Route the negative pole (black) through the left hole, while the positive one (red) through the right hole.
3. Connect the positive battery power cable (+) to the positive battery terminal on the inverter, and the negative battery power cable (-) to the negative battery terminal accordingly, then tighten the screws.
4. Push the plug forward until it is securely snapped with the inverter's battery terminals.
5. Insert the waterproof sleeve into the handle and fasten the locking nut, then the installation is complete.

NOTICE	➢ The waterproof plug at the end of the battery cable must be tightened. ➢ Please ensure the correct polarity when wiring the battery terminals. Anti-reverse function is not available for the SPH. Incorrect battery wiring may cause damage to the inverter. ➢ It is recommended that the distance between the battery and SPH should not exceed 2 meters, and it is recommended to use the power cable with a cross-sectional area of 2AWG/35mm². ➢ According to local installation regulations, please choose the appropriate circuit breakers on the inverter side and battery side. Depending on the SPH model, it is recommended to choose a DC circuit breaker greater than 1.25 times the rated current. ➢ If you choose the battery provided by Growatt, it will come standard with a power connection cable of about 2.5m, which can be used directly.

4.4 .7 External Communication Port Installation

4.4 .7.1 External communication port description

The SPH inverter has a total of 8 external communication ports. The appearance of the ports is shown in Figure 26. Each port contains 8 pins. The pin definition of each port is shown in Figure 4. 22.

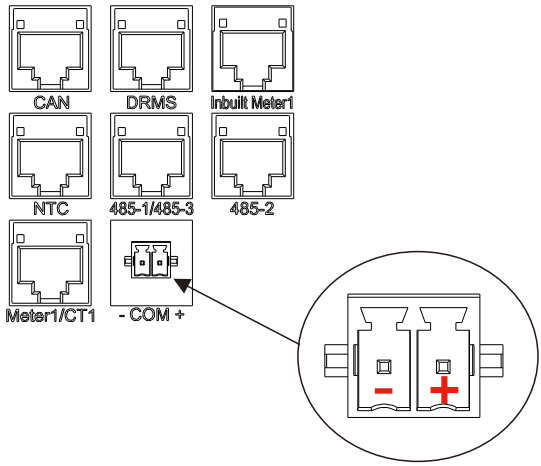


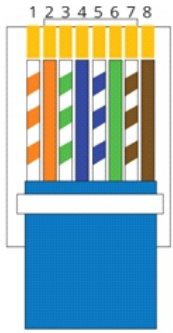
Figure 4. 22 Communication ports

PIN definition of the ports

	P1		P2		P2	
Silk screen	CAN		DRMS		Built-in Meter	
Pin	Definition	Definition	Definition	Definition	Definition	Definition
1	/	NT (Not Connected)	DRM1/5	DRM	/	NT
2	/	NT	DRM2/6	DRM	/	NT
3	/	NT	DRM3/7	DRM	CT2+	CT2 positive pole
4	CAN_H	H of CAN	DRM4/8	DRM	CT1+	CT1 positive pole
5	CAN_L	L of CAN	REF	DRM	CT1-	CT1 negative electrode
6	GND.S	NT	COM	DRM	CT2-	CT2 negative electrode
7	GND.S	Battery wake-up ground	PIN7-PIN8 shorting	NT	/	/
8	WAKE.UP	Battery wake-up positive	PIN7-PIN8 shorting	NT	/	/

	P4		P5		P6	
Silk screen	NTC		485-1/485-3		485-2	
Pin	Definition	Definition	Definition	Definition	Definition	Definition
1	GND S	Ntc-	485-1_ B		485-1_ B	
2	GND S	Ntc-	GND S		GND S	
3	GND S	Ntc-	/		/	
4	GND S	Ntc-	485-1_ B		485-1_ B	
5	NTC	ntc+	485-1_ A		485-1_ A	
6	NTC	ntc+	/		/	
7	NTC	ntc+	485-3_ B		485-3_ B	
8	NTC	ntc+	485-3_ A		485-3_ A	

	P7		P8	
Silk screen	Meter1/CT1		DRY	
Pin	Definition	Definition	Definition	Definition
1	RS485_ B	Rs485 B	DRY-	Dry contact negative
2	CT1_ Pin2	CT positive	DRY+	Dry contact positive
3	CT1_ Pin2	CT positive	/	/
4	RS485_ B	RS485 B	/	/
5	RS485_ A	RS485 A	/	/
6	CT_ Check	Wire breakage detection	/	/
7	GND S	Grounding	/	/
8	Ct1_ Pin1	CT negative	/	/



LAN 1-8 color code
Pin 1: White/Orange
Pin 2: Orange
Pin 3: White/Green
Pin 4: Blue
Pin 5: White/Blue
Pin 6: Green
Pin 7: White/Brown
Pin 8: Brown

4.4 .7.2 External Communication Terminal

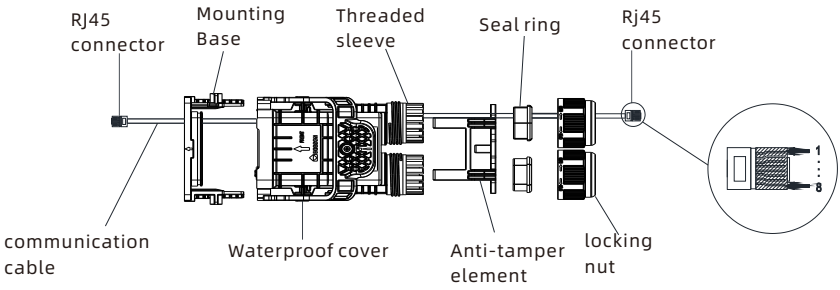
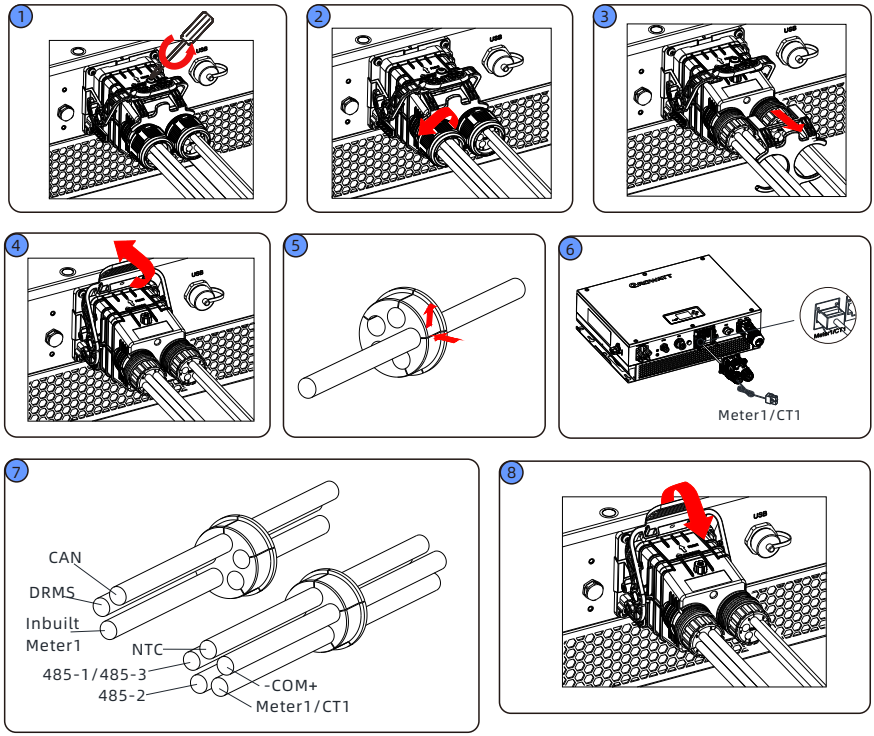


Figure 4. 23 Communication terminal

4.4 .7.3 External Communication Terminal Installation Instructions



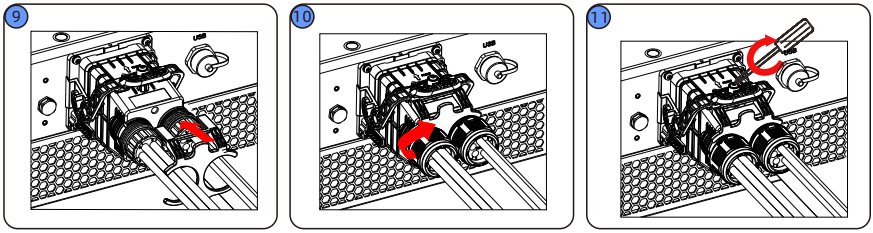


Figure 4. 24 Install the communication terminal

1. Rotate the two rotary nuts of the waterproof cover counterclockwise and remove them.
2. Pull out the anti-tamper component.
3. Loosen the screw on the buckle handle.
4. Push the handle towards the inverter to remove the waterproof cover.
5. Pass the external communication cable through the rotary nut, cable support sleeve, and the waterproof cover in sequence.
6. Connect the RJ45 connector to the communication cable, and then insert it into the corresponding communication port on the inverter.
7. Connect all the communication cables as required following steps 4-5.
8. Align the waterproof cover with the positioning posts, insert it into the base, and push the buckle handle in the opposite direction of the inverter to secure it.
9. Tighten the screw on the handle.
10. Install the anti-tamper clip.
11. For any unused support sleeves, use waterproof plugs to seal them and tighten the rotary nuts clockwise.

4.4 .7.4 External Communication Port Functions and Settings Instructions

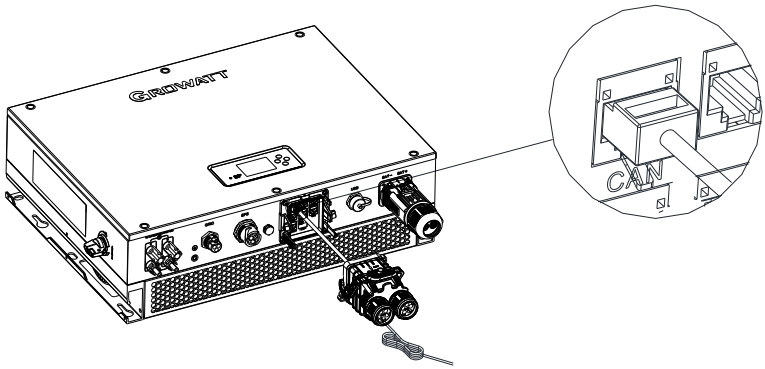


Figure 4. 25 CAN communication wiring

1. If a lead-acid battery is used, you do not need to install this communication cable.
2. CAN battery communication and 485-2 battery communication cannot be installed simultaneously. Please choose the correct communication method according to the battery manual.
3. If the "485-2" communication cable or "CAN" communication cable is not used, do not remove the filler plug from the cable support sleeve.

B. DRMS communication port

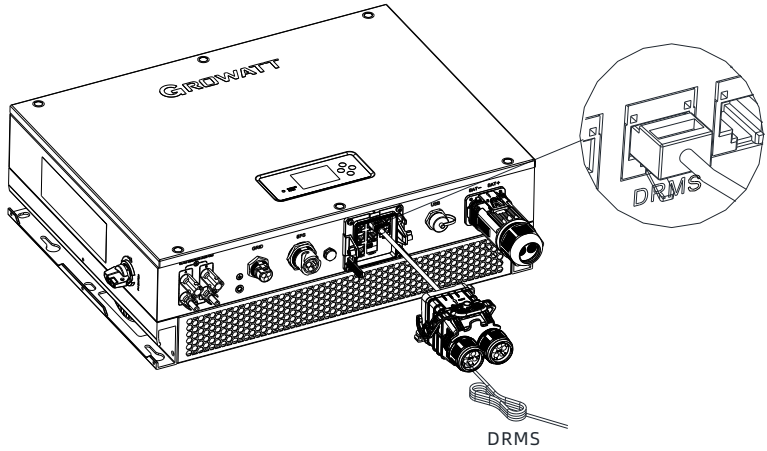


Figure 4. 26 CAN communication wiring

PIN	Simultaneous charging and discharging capacity
1	DRM1/5
2	DRM2/6
3	DRM3/7
4	DRM4/8
5	REF
6	COM
7	Shorting to PIN8
8	Shorting to PIN7

DEMAND RESPONSE MODES (DRMS)

Mode	Requirement
DRM0	Operate the disconnection device
DRM1	Do not consume power
DRM2	Do not consume at more than 50% of rated power
DRM3	Do not consume at more than 75% of rated power AND Source reactive power if capable
DRM4	Increase power consumption (subject to constraints from other active DRMs)
DRM5	Do not generate power
DRM6	Do not generate at more than 50% of rated power
DRM7	Do not generate at more than 75% of rated power AND Sink reactive power if capable
DRM8	Increase power generation (subject to constraints from other active DRMs)

Note: If this port is not used, do not remove the filler plug from the cable support sleeve.

C. Communication port of the built-in Meter 1
This port is not used currently.
D. NTC communication port
This port is not used currently.
E. 485-1/485-3 communication port and 485-2 communication port
This port can be optionally used for establishing communication between SEM/VPP /METER2 and the upper computer. The SEM/METER2 should be purchased separately by the customer.
F. METER1/CT1 communication port.

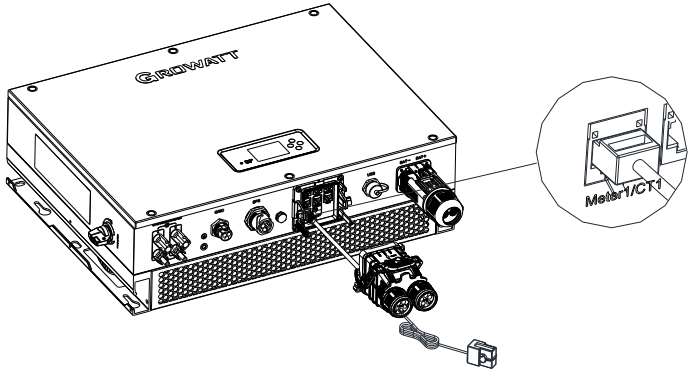


Figure 4. 27 METER1/CT1 communication wiring

1. This communication port is for connection to the meter or the external CT for export limitation. To enable this communication port, you need to set the working mode on the LCD screen. For details, please refer to Section 6.1.2.4.
2. Wiring recommendations:
(1) CT wire specifications: RJ45, standard LAN cable (with an 8P module plug on one end, and the other end connected to the transformer). The external CT wire for export limitation is recommended not to exceed15 m.
(2) In Australia, it is generally not recommended to use a CT for export limitation. If needed, please consult after-sales service.
(3) If you use a meter (the system is set to the Meter mode by default), please connect the meter's communication cable properly and insert it into the METER1 port. Install the meter to the slot of the distribution cabinet, while snap the CT near the main grid breaker of the customer's distribution panel.

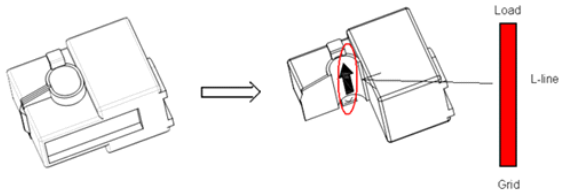


Figure 4. 28 Install the CT

Note:
The direction of the arrow on the CT (from K to L) corresponds to the direction of current flow from the grid to the load in the live line. The sensor should be placed inside the distribution panel.

G. COM communication port

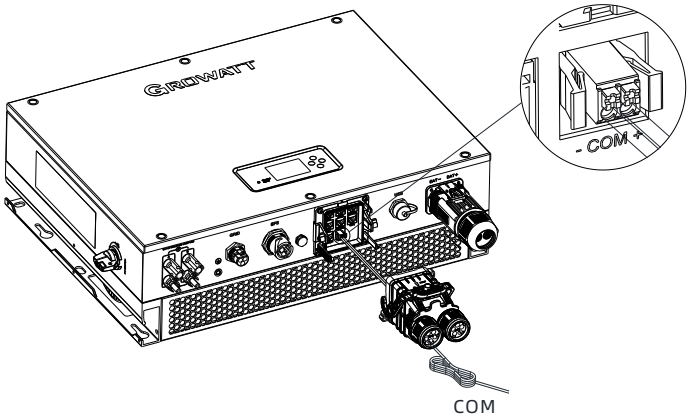


Figure 4. 29 COM port wiring

1. For unused cables such as the Dry Contact cable, do not remove the filler plug from the cable support sleeve.
2. The COM port shown below is the dry contact signal port. The left pin next to the METER1/CT1 port is the negative pole, while the right pin is the positive pole. Please pay attention to the polarity when connecting the cable.
3. The dry contact can provide a source of 12V and less than 200mA (Pin 1 - & Pin 2 +) to devices such as drivers and relays. Please note the output power of this power source.

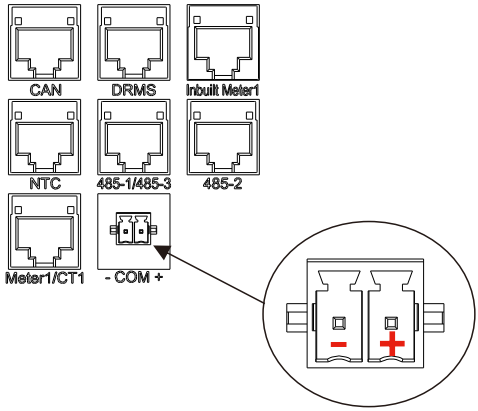


Figure 4. 30 COM communication port

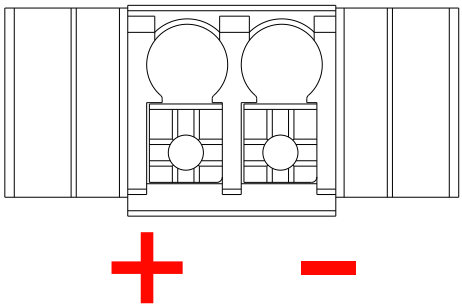


Figure 4. 31 Polarity of the COM port

4.4.8 PE Cable Wiring Instructions

The SPH must be reliably grounded with the PE cable. The ground point is shown below. The minimum wire gauge of the PE cable is 10 AWG.

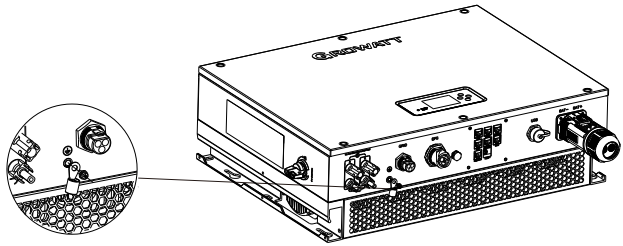


Figure 4. 32 PE cable wiring diagram

PV array grounding

The grounding conductor for the PV panel frame must be securely grounded on the PV array side, the inverter side, and the battery side. The cross-sectional area of the grounding conductor should be equal to that of the DC grounding conductor. The minimum wire gauge is 10 AWG.

DC grounding

Please select the DC grounding mode according to local standards, and select the PV grounding cables of the same specification.

Grounding device

If the positive or negative pole of the PV array in the PV system needs to be grounded, an isolation transformer should be used on the inverter output side for insulation. The isolation transformer must comply with IEC62109-1 and IEC62109-2 standards.

The wiring connection is shown below:

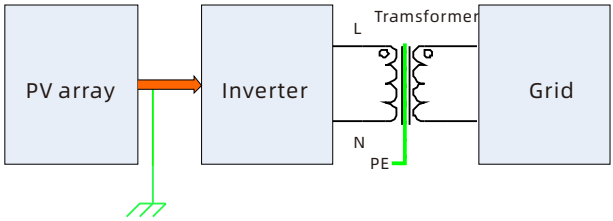
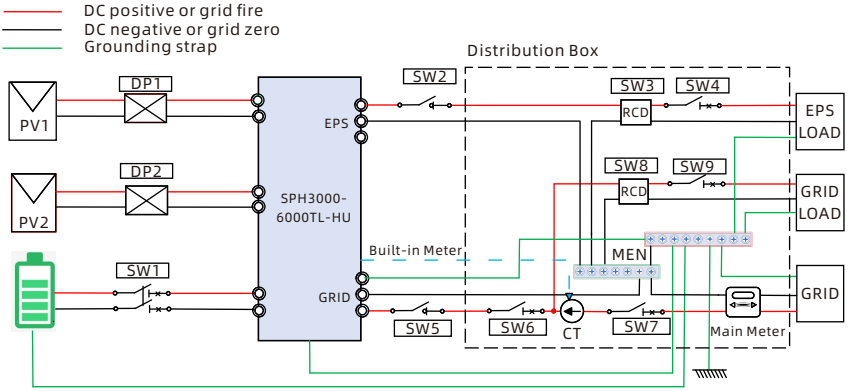


Figure 4. 33 PV array grounding diagram

WARNING	➢ The Growatt SPH 3000-6000TL-HU is a single-phase inverter. If the inverter is installed in Australia or New Zealand, it must NOT be used as part of a three-phase combination. ➢ This inverter complies with IEC 62109-2 Clause 13.9 for ground fault alarm monitoring. In the event of a ground fault alarm, the inverter screen will display the fault code 'Error 303, NE Abnormal,' and the LED indicator would be red.

4.4.9 System Wiring Instructions

4.4.9.1 Wiring Diagram A



Australia Wiring Diagram

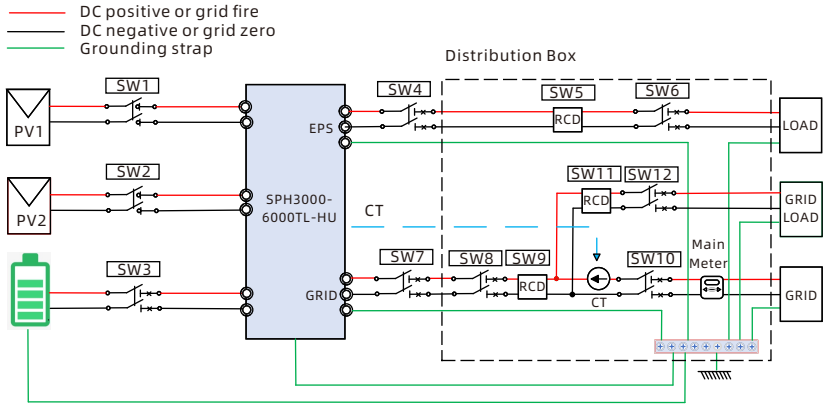
Figure 4. 34 Wiring diagram A

Note: Diagram A is the wiring diagram for regions such as Australia, New Zealand, and South Africa.

Switch type	Switch position	Switch selection
DC switch/ breaker	DP1/DP2	The inverter comes with a built-in PV input switch-disconnector compliant with requirements; follow local regulations to determine whether to install an external PV switch.
	SW1 (mandatory)	Select the battery-side circuit breaker compliant with local regulations; recommended specifications: voltage withstand > 63V, current: not less than 1.25 times of the rated current

Switch type	Switch position	Switch selection
AC switch/breaker	SW5 (depends on on-site conditions)	Grid-side circuit breaker/switch-disconnector, to be installed close to the inverter side; recommended to install one when the distance between the inverter and the main distribution panel is greater than 3m or a blind spot exists between them; depends on the inverter capacity; recommended specification: ≤ 230VAC/35A.
	SW6 (mandatory)	Grid-side circuit breaker connected to the inverter, installed in the main distribution panel; follow local regulations to determine whether to install one; depends on the inverter capacity, recommended specification: ≤ 230VAC/35A.
AC breaker	SW7 (mandatory)	Grid input main circuit breaker, installed in the main distribution panel; depends on the inverter capacity and the household load power.
	SW4/SW9 (mandatory)	Circuit breaker connected to loads, installed in customer's distribution panel; depends on the inverter capacity and the load power; recommended specification: ≤ 230VAC/35A.
	SW2 (optional)	Off-grid output circuit breaker/switch-disconnector, to be installed close to the inverter side; not mandatory depend on the inverter capacity and the load power; recommended specification: ≤ 230VAC/35A.
RCD	SW3/SW8 (mandatory)	Residual Current Device (RCD); recommended specifications: Type A, 30mA

4.4.9.2 Wiring Diagram B



Wiring diagrams for other European countries

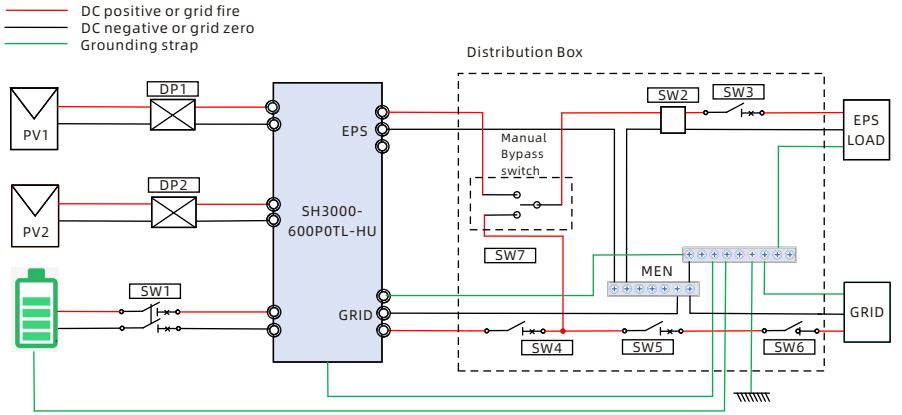
Figure 4. 35 Wiring diagram B

Note: Diagram B is the wiring diagram for European countries.

Switch type	Switch position	Switch selection
DC switch/ breaker	SW1/SW2	The inverter comes with a built-in PV input switch-disconnector compliant with requirements; follow local regulations to determine whether to install an external PV switch.
	SW3 (optional)	Select the battery-side circuit breaker compliant with local regulations; recommended specifications: voltage withstand > 63V, current: not less than 1.25 times of the rated current
AC switch/breaker	SW7 (depends on on-site conditions)	Grid-side circuit breaker/switch-disconnector, to be installed close to the inverter side; recommended to install one when the distance between the inverter and the main distribution panel is greater than 3m or a blind spot exists between them; depends on the inverter capacity; recommended specification: ≤ 230VAC/35A.

Switch type	Switch position	Switch selection
AC switch/breaker	SW8 (mandatory)	Grid-side circuit breaker connected to the inverter, installed in the main distribution panel; follow local regulations to determine whether to install one; depends on the inverter capacity, recommended specification: ≤ 230VAC/35A.
	SW10 (mandatory)	Grid input main circuit breaker, installed in the main distribution panel; depends on the inverter capacity and the household load power.
AC breaker	SW4 (optional)	Off-grid output circuit breaker/switch-disconnector, to be installed close to the inverter side; not mandatory; depend on the inverter capacity and the load power; recommended specification: ≤ 230VAC/35A.
	SW6/SW12 (mandatory)	Circuit breaker connected to loads, installed in customer's distribution panel; depends on the inverter capacity and the load power; recommended specification: ≤ 230VAC/35A.
RCD	SW5/SW11 (mandatory)	Residual Current Device (RCD); recommended specifications: Type A, 30mA.
	SW9 (mandatory)	Type A RCD with a rating not less than 300mA.

4.4.9.3 Wiring Diagram C



Australia Wiring Diagram

Figure 4. 36 Wiring diagram C

Note:

Diagram C is an example of a grid-connected energy storage system wiring. There are no special requirements for the cable connections.

Switch type	Switch position	Switch selection
DC switch/ breaker	DP1/DP2	The inverter comes with a built-in PV input switch-disconnector compliant with requirements; follow local regulations to determine whether to install an external PV switch.
	SW1 (not required)	The inverter is equipped with the battery-side circuit breaker compliant with requirements; do not need to install an external one.
AC switch/breaker	SW4 (mandatory)	Grid-side circuit breaker, installed in the distribution panel; depends on the inverter capacity and the load power, recommended specification: ≤ 230VAC/35A.
	SW5 (mandatory)	Grid-side circuit breaker, installed in the main distribution panel; depends on the inverter capacity, recommended specification: ≤ 230VAC/35A.

Switch type	Switch position	Switch selection
AC breaker	SW6 (optional)	Grid-side circuit breaker, installed in the main distribution panel; depends on the inverter capacity, recommended specification: ≤ 230VAC/35A.
	Sw3 (mandatory)	Off-grid output circuit breaker/switch-disconnector, installed in the main distribution panel; depend on the inverter capacity; recommended specification: ≤ 230VAC/35A.
RCD	SW2 (mandatory)	Residual Current Device (RCD); recommended specifications: Type A, 30mA.
	SW7 (optional)	Can be installed in the customer's main distribution box. During the maintenance period when the inverter fails, manually operate the switch to use the grid power to provide emergency power supply for EPS loads.

WARNING	**Note:** The inverter has the function of detecting the residual current and protecting the residual current of the inverter. If your inverter must be equipped with an AC circuit breaker that can detect residual current, you must choose a Type A RCD circuit breaker with a rated residual current greater than 300mA.

TThe SPH's maximum on/off-grid transfer time is 15 ms. However, it CANNOT be used as an uninterruptible power supply (UPS) and is not applicable for critical scenarios such as medical power supplies. As shown in the diagram above, for maintenance purposes, add the SW7 at the EPS port and on the grid-connection side. You can select CLIPSAL's 4PS40CAM or Schneider's WATSNS40/1M manual disconnector switch. Install it in customer's distribution panel. When the inverter is damaged and failed to supply power to loads, you can manually operate the switch to use the grid power to provide emergency power supply for EPS loads.

Note:

After installing the Manual Bypass Switch,

A. Ensure proper labeling on the distribution box. Otherwise, the EPS port may fail to supply power to the load due to incorrect operations.

B. After the fault of the inverter is cleared, set the Manual Bypass Switch back to the EPS port position.

 **WARNING**	➢ Please pay attention to the color of the connectors when connecting power cables. Only connectors with the same color can be connected. ➢ For safe operation of the system, it is necessary to ensure reliable grounding. ➢ This area is a restricted access area, which is explained as follows: • Area accessible only to electrically skilled persons and electrically instructed persons with proper authorization. • Note 1 to entry: An electrically skilled person is a person with relevant education and experience to enable him or her to perceive risks and to avoid hazards electricity can create. • Note 2 to entry: An electrically instructed person is a person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards which electricity can create.

Power on and off the System 5

 **WARNING**	➢ Personnel who install and operate the SPH System must receive thorough training and possess the local national required qualifications before operation. Only qualified professionals and trained personnel are allowed to install, operate and maintain the equipment. ➢ Please stand on dry, insulating objects and do not wear conductive material such as watches and necklace during operation. Insulated tools should be used. ➢ Avoid contact with any parts with electric potential difference. ➢ Hang the warning sign: Do not touch. Authorized personnel only. ➢ If any abnormality is found when the equipment is energized, turn off the DC switch immediately. After the fault is rectified, turn on the switch again.

5.1 Power on the System

Step 1: Check if all cables are properly connected as required.
Step 2: Check if the PV and grid voltage are within the specified range.
Step 3: Turn on the breaker between the inverter and the grid, the breaker on the inverter's battery side, and the inverter's PV switch.
Step 4: If the inverter indicator is green and the battery indicator is blue, the system has been powered on successfully. When the cables are properly connected, the system would wake up the battery automatically. Therefore, you don't need to power on the battery.

Note:

a. Upon initial power-on of the SPH system, there will be a reminder to set up safety regulations. Please set the safety regulation options as prompted. Alternatively, you can manually enter the setting page after startup to modify the safety regulation options.
b. Set the operating mode (mandatory) based on user's needs, such as Battery First, Grid First or Load First, and whether to disable export limitation when the PV power is sufficient.

5.2 Power off the System

Step 1: Power off the battery. The shutdown operation might differ between different batteries. Please refer to the User Manual of the battery you use.
Step 2: Turn off the breaker between the inverter and the battery.
Step 3: Turn off the switch between the inverter and the PV panels.
Step 4: Turn off the breaker between the inverter and the grid.

6 Commissioning and Maintenance

6.1 Commissioning

6.1.1 Working Mode Description

6.1.1.1 Normal Mode

Normal Mode indicates the normal operating state, including grid-connected mode and off-grid mode.

Grid-connected Mode

When the SPH operates in Grid-connected Mode, users can set appropriate working mode as needed. When configuring on the LCD screen with the buttons, you can only set the working mode for one time segment. When configuring on the website of the datalogger, you can configure the working mode for up to three time segments (for details, you can refer to Section 6.1.2.4).

1. Load First: Load First is the default mode. In this mode, PV energy is prioritized for supplying loads and the surplus solar power will be directed to charge the battery. The further excess power (if any) can be fed to the grid, subject to the Export Limitation settings. If PV energy is insufficient, the battery will discharge to power the loads. If the battery discharges to the user-defined discharge cutoff SOC, it will draw power from the grid to support the loads.
2. Battery First: In this mode, the PV power is sent to charge the battery first, suitable for periods of low electricity tariff. You need to set the start and end time for this mode, and the battery charging cutoff SOC. You can set power levels below the inverter's maximum charging power. If AC CHG (charge from grid) is disabled, the inverter will charge the battery with the PV power as much as possible, and send the surplus power to the loads. The further excess power will be exported to the grid based on the Export Limitation settings. If enabled, the inverter will charge the battery with the solar power first; if insufficient, it will draw power from the grid to support the loads.
3. Grid First: In this mode, PV energy will be primarily fed into the grid, suitable for periods with high electricity tariff. You need to set the start and end time for this mode, and the battery discharge cutoff SOC. Users can set power levels below the battery's maximum output power.

Off-grid Mode

If the grid power fails, the system will automatically switch to Off-grid Mode (you can disable this feature, referring to section 6.1.2.4), and output AC power with the solar and battery energy via the EPS port. If PV power is not available, then only the battery will discharge.

Note:

1. To ensure maximum efficiency and long-term stable operation of the inverter, it is recommended not to exceed 80% of the maximum power rating at the EPS port. For example, for a 6 kW model, it is recommended to connect a maximum load of 4.8 kW, meaning all loads combined should not exceed 4.8 kW when operating.
2. Only one time period can be set for the working mode on the LCD screen. To configure more time segments, please log in to the datalogger website.
3. If you want to charge the battery with power from the grid, you need to enable AC CHG on the SC interface, which requires to input the password. For details, please see Section 6.1.2.4.

6.1.1.2 Fault Mode

The intelligent control system of SPH continuously monitors and adjusts the system's status. if any unexpected situation is detected, such as system faults or device malfunctions, the LCD will display the fault information. In Fault Mode, the LED light will be red.

Note:

For detailed fault information, please refer to Section 8.1.
Some fault information is to remind users of potential faults on the inverter side.

6.1.1.3 Upgrade Mode

Upgrade Mode indicates that SPH is updating its software. During the update process, do not disconnect the power supply. After the update is complete, the SPH inverter will automatically restart and switch to another mode.

6.1.1.4 Self-check Mode

The SPH enters self-check mode before operating. If nothing abnormal is detected, the system will enter Normal Mode after completing the self-check. Otherwise, the system will enter Fault Mode.

6.1.1.5 Standby Mode

The SPH enters self-check mode before operating. If nothing abnormal is detected, the system will enter Normal Mode after completing the self-check. Otherwise, the system will enter Fault Mode.

6.1.1.6 Shutdown Mode

To shut down the SPH, all power sources must be disconnected, and the SPH inverter will automatically enter Shutdown Mode. The shutdown procedure is as follows:

1. Turn off the PV switch.
2. Turn off the battery-side breaker.
3. Turn off the grid-side breaker.
4. Press and hold the button of the battery system for 3 seconds to turn off the battery.

Afterwards, the LED and LCD on the inverter will be off, and the indicator on the battery module will go out.

Note:
After all actions are completed, you need to wait for more than 5 minutes until the internal voltage has discharged to a safe level.

6.1.2 LCD Screen and Button Description

6.1.2.1 Description of the LCD Screen

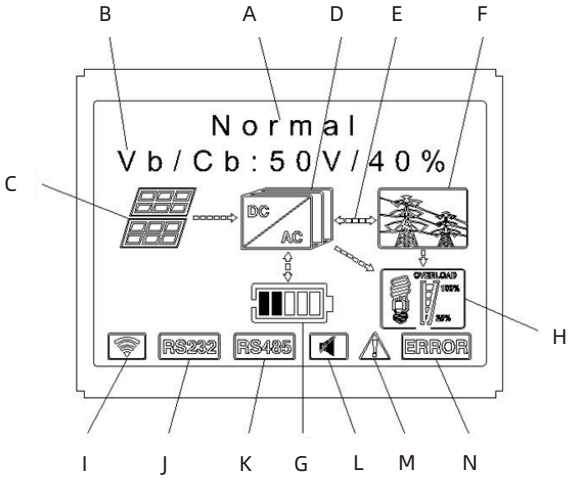


Figure 6. 1 LCD screen

Position	Description
A	Displays the operating status
B	Displays key information
C	PV Input (If connected to two PV inputs, it will display two; otherwise, it will display one)
D	SPH inverter
E	Power flow line indicator
F	Grid
G	Battery (displayed with five girds, each representing 20%)
H	Load output
I	Wireless communication
J	Rs232
K	Rs485
L	Buzzer (reserved)
M	Alarm info
N	Fault info

6.1.2.2 Description of the LED Indicator and Buttons

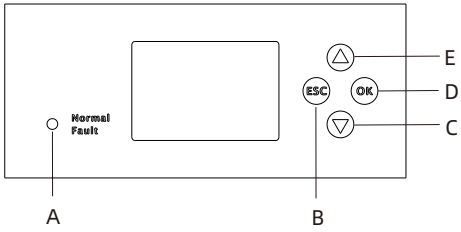


Figure 6. 2 LED indicator and buttons

Position	Description
A	LED indicator
B	ESC (cancel)
C	Down
D	OK
E	Up

Note:
The LED light indicates the status of SPH in two colors. Green indicates that the device is operating normally, while red indicates a malfunction or upgrade in progress. For details, please refer to Section 1.2.1.

6.1.2.3 System Working Mode Settings

Growatt products have been designed and tested according to the applicable international/regional standards. Upon receipt of the product, please set the corresponding safety regulations on the LCD screen based on your country/region.

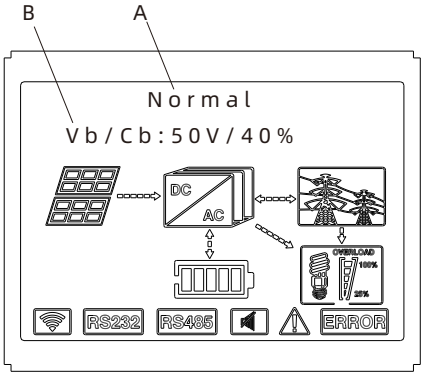


Figure 6. 3 Display of system operating status

Line A:

1. Standby Status: Indicates that the SPH is in Standby Mode. No inverter fault has been detected. It enters Standby Mode due to other reasons, such as the environment factor.
2. Normal Status: Indicates that the SPH is operating normally.
3. Checking Status: The SPH is performing self-check. If no error or warning is detected, it will switch to Normal or Standby Status. Otherwise, it will switch to Fault Status.
4. Programming Status: The SPH is updating its firmware.
5. Fault Status: A fault has occurred and the inverter stops operating for protection.

Line B:

Note: Generally, the pages will turn automatically. You can also manually turn the pages by pressing the " Up" button. The information sequence for the pages is as follows:

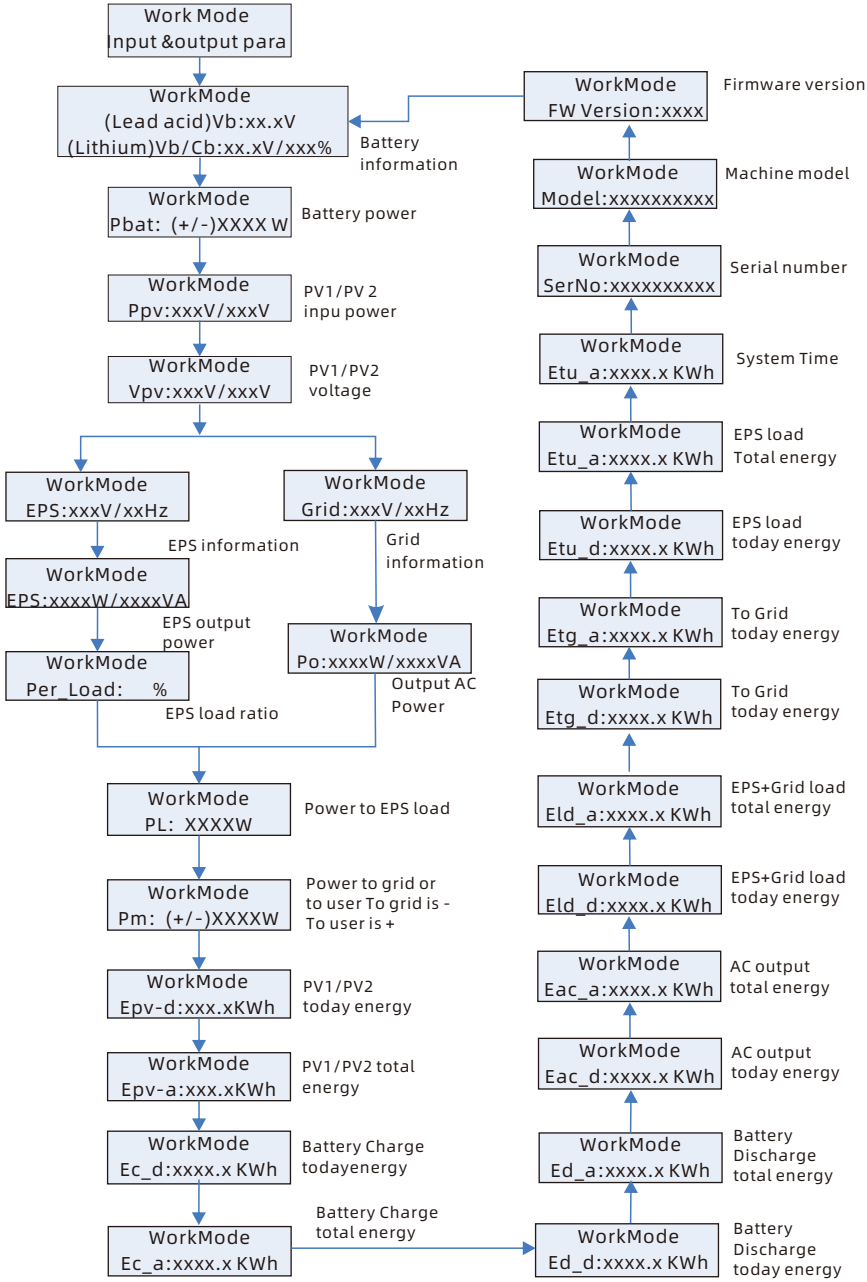


Figure 6. 4 Real-time display in a loop

Note:

1. Press "Down" to proceed (you can press "Up" to return to the previous page).
2. The working mode depends on the situation: If the SPH is in Normal Status, it will display "normal". If the SPH is in Standby Status, it will display "standby", and so on.
3. Special definitions: For example, Vb represents battery voltage. Cb represents the capacity of the lithium battery (this data is only displayed for lithium batteries). Pm represents user's monitoring power of the user.

6.1.2.4 Working mode settings

Press and hold the "OK" button for 3 seconds to enter the settings interface. View the settings options shown in the figure below with the "Up" and "Down" buttons. In the settings interface, press the "OK" button for 1 second to enter a settings option. Press the "ESC" button to exit a settings option.

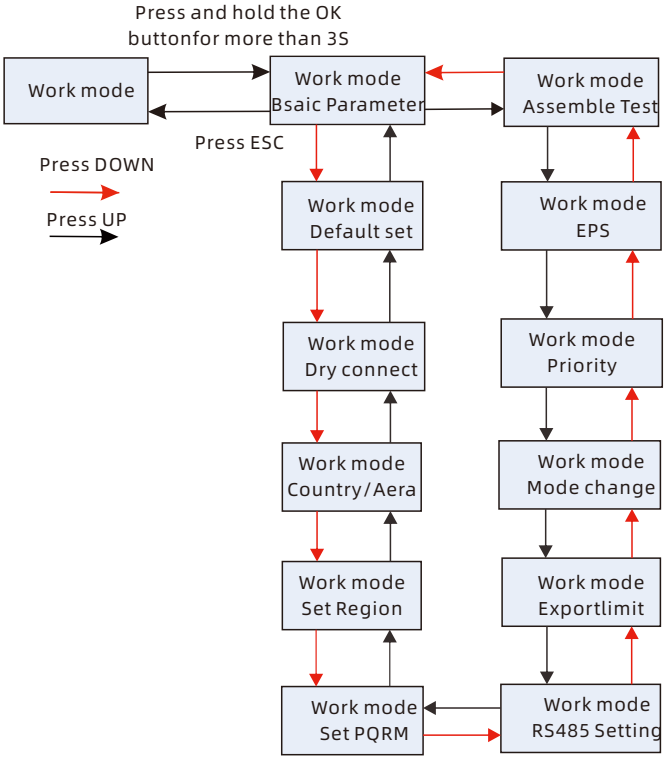


Figure 6. 5 Working mode settings

Note:

1. Press OK to select the specific setting item; press ESC to return to the previous settings page.
2. If you select the CEI standard and use the SPH inverter in Italy, the inverter comes with an auto-test function.

A. Under Basic Parameter, press and hold OK for 1 second, then you can see the following settings options:

Language: English, Italian, German
System Time
Lead-Acid Battery Charging Voltage: 58V (default)
Discharge Low Voltage: 48V (default)
Lead-Acid Constant Current: 25A (default)
RS485 Address

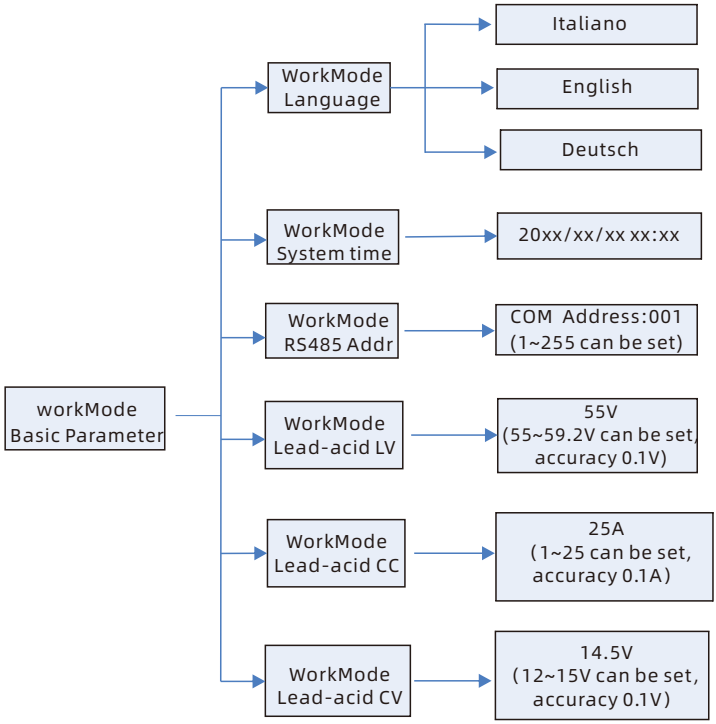


Figure 6. 6 Basic parameter settings

B. Under DEFAULT SET, press OK, then you can see the following option:

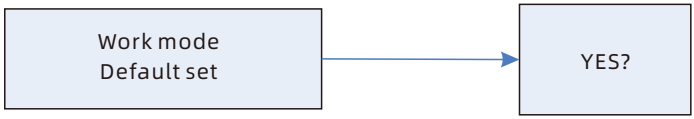


Figure 6. 7 Default setting

Growatt SPH Country/Area setting steps:

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		

Step 1: Turn on the AC breaker between the SPH inverter and the grid.
Step 2: Turn on the grid switch of the SPH inverter (if a battery is connected, also turn on the battery switch; if no battery connected, only turn on the grid), and the inverter will start automatically.
Step 3: Ensure the inverter is successfully connected to the network and remains online in the ShinePhone APP.

WARNING	If energy quality and grid settings are selected during commissioning, these setting items should be locked and cannot be modified (unless otherwise authorized by Growatt) After completing energy quality and grid settings, verify compliance with safety regulations on the APP. After country settings are completed, select the correct energy quality response mode. If no country or region is selected, the inverter will run with Australia and Region A settings.

E. Reset region

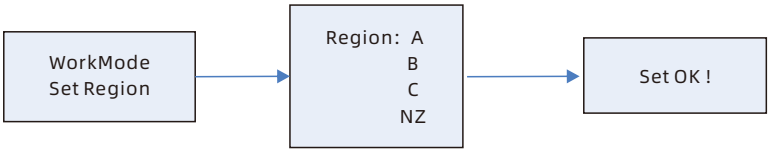


Figure 6. 11 Reset region

F. Set PQRM

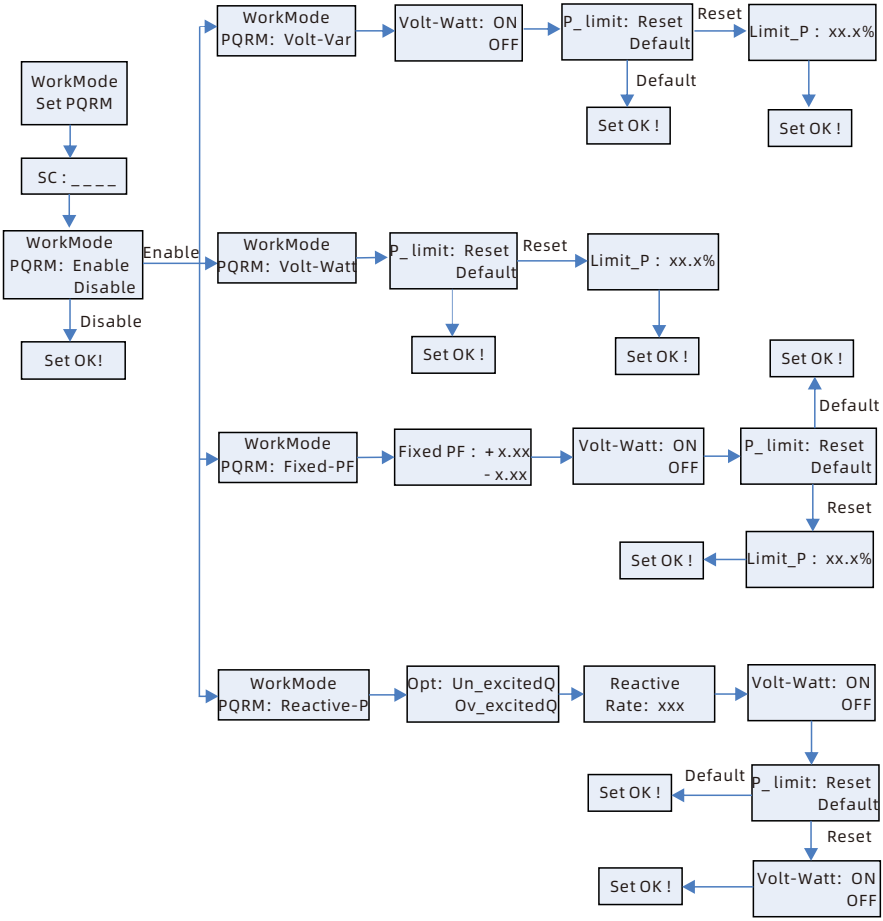


Figure 6. 12 PQRM settings

Note:
If other values need to be set for DNSP other than the default values, please refer to Appendix to adjust the settings according to the regional default value instructions.

C. Under DRY connect, press OK, then you can see the following options:

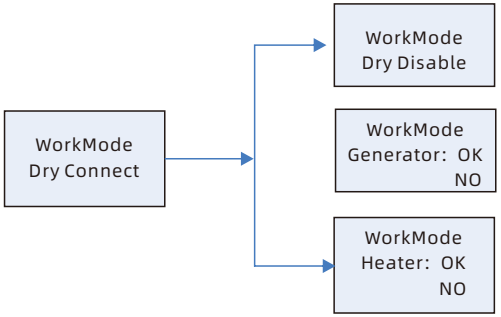


Figure 6. 8 DRY connect settings

D. Under COUNTRY/AREA, press OK, then you can set the country/area according to the safety regulations:

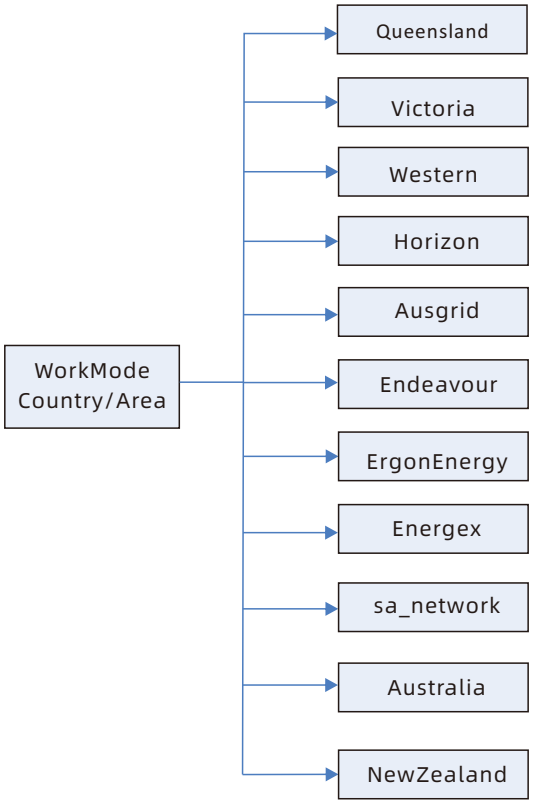


Figure 6. 9 COUNTRY/AREA

To modify the Country/Area, please follow the steps below:

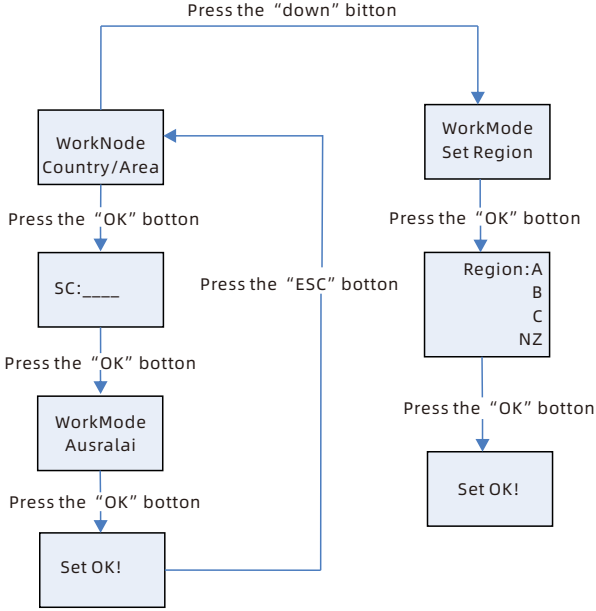


Figure 6. 10 COUNTRY/AREA settings

WARNING	**Note:** When setting the national safety standards on the LCD, please turn off the PV switch and AC breaker, but keep the battery power on.
	Note: Please calibrate the inverter's system time after start-up. If the country setting is incorrect, please turn off the inverter and re-set it.

As of December 18th, 2021 all inverters installed in Australia must comply with requirements of AS/NZS 4777.2: 2020 and have one of the following 3 x default Regions selected upon commissioning:

1. Australia A
2. Australia B
3. Australia C

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. Please confirm with the relevant DNSP as to which region should be selected.

C. Under "Export Limit" , press "OK", then you can see the following settings options:

You can adjust the Export Limitation parameter to control the power fed to the grid. If enabled, the power exported to the grid would be less than or equal to the pre-set value.

The Fault Safety Function is to ensure that if any part of the ELS fails, the active power output at the connection point will decrease to the pre-defined output capacity or less within the specified time.

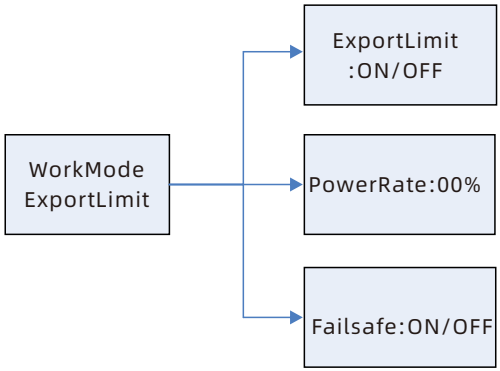


Figure 6. 13 Export Limit Settings

Note:

1. The default value is 00.0%.
2. The Fault Safety Function only works in meter mode.
3. The inverter has three control functions, which can be switched using ShineTools by modifying register 330. This register can be set to 1/2/3:

Setting 1 enables software limit control function.

Setting 2 enables hardware limit control function.

Setting 3 enables both software and hardware limit control functions.

e.g. Run the ShineTools APP, then select "Advanced" to enter the advanced settings interface. In the "Command Type" section, input "6"; in the "Register Address" section, input "330"; and in the "Length/Data" section, input the control mode "1"/"2"/"3".

H. Under "RS485 Setting" , press "OK", and you can see the following settings options:

Figure 6. 14 RS485 settings

C. Under "Mode Change" , press "OK", and you can see the following settings options:

Sensor Type: Cable CT (default), Master, and Meter.

Battery Type: Lithium battery or Lead-acid battery.

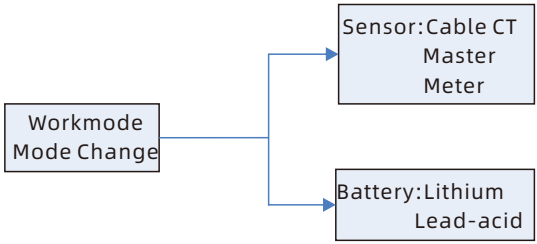


Figure 6. 15 Mode Change settings

J. Under "Priority" , press "OK", and you can see the following settings options:

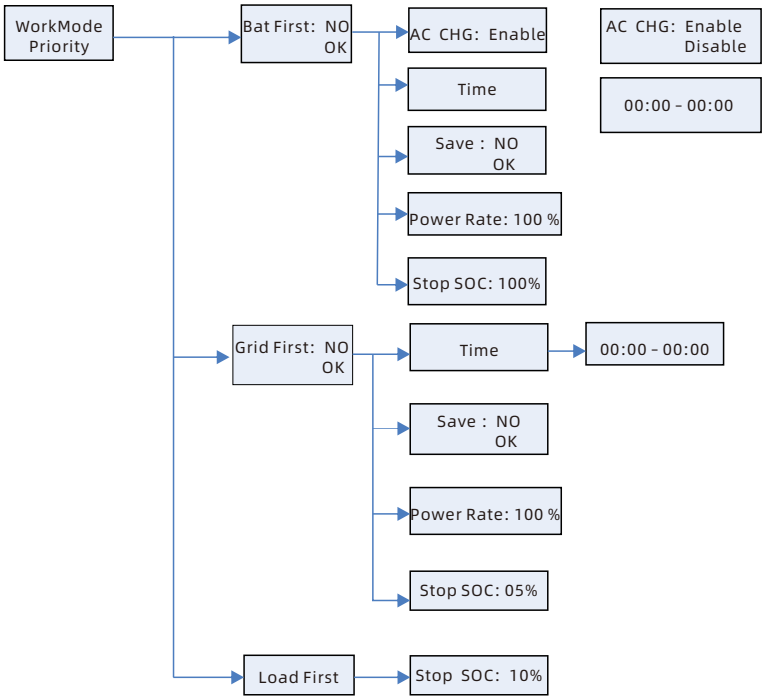


Figure 6. 16 Priority settings

Note:

1. "Power" is used to set the power of the battery. Since different batteries may have different power ratings, you need to check the maximum power of the battery.
2. Set the time format to 24 hours. If the end time is less than the start time, it defaults to spanning midnight.
3. SC initial default password is 1111.

K. Under "EPS", press OK for 1 second and you can see the following settings options:

You can set to enable or disable EPS. It is enabled by default. You can also configure the AC voltage (230V by default), frequency (50Hz by default), Bypass mode, and N_PE relay.

Note:

When EPS is set to "Disable" and Bypass to "OFF", the EPS port has no output under any circumstances.

When EPS is set to "Enable" and Bypass to "OFF", there is no output from the EPS port when the grid is available, and there is output when the grid is unavailable.

When EPS is set to "Disable" and Bypass to "ON", there is output from the EPS port when the grid is available, and no output when the grid is unavailable.

When EPS is set to "Enable" and Bypass to "ON", the EPS port has output under any circumstances.

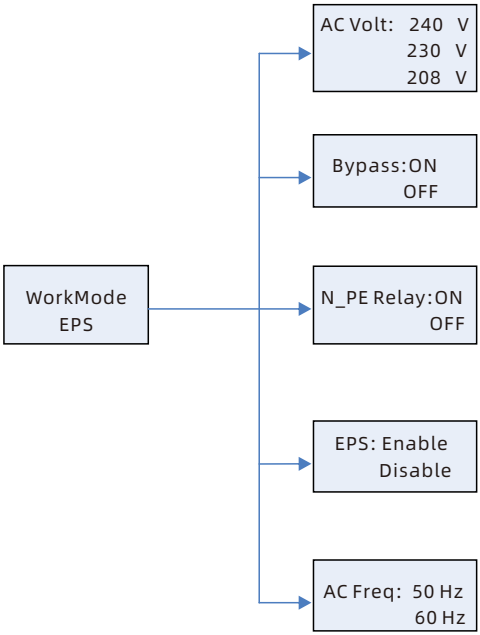


Figure 6. 17 EPS settings

L. To facilitate installation and diagnose any faults that may cause operational issues during installation, a one-click installation diagnostics function is added:

Before starting, please turn off the PV switch. During the installation diagnostics process, if customers have loads connected, please keep the loads running stable to ensure accurate testing. Long press the ESC key for 3 seconds to enter "Assemble Test". Press OK to start the one-click diagnostics.

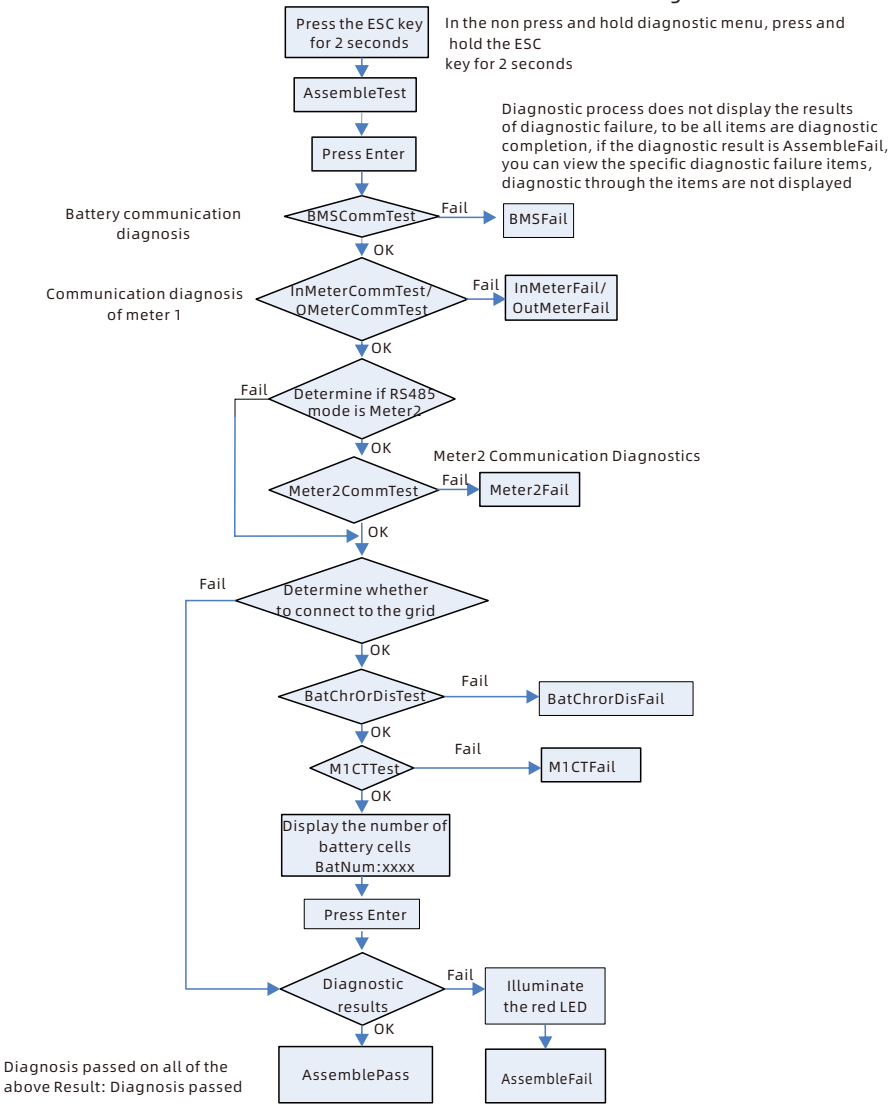


Figure 6. 18 One-click installation diagnostics settings

If there is a diagnostic failure for each of the above Result: Diagnostic failure, and you can view the diagnostic failure items.
BMSFail :Lithium battery communication failure
InMeterFail: Internal Meter Communication Failure
OutMeterFail: External meter communication failure
Meter2Fail: Meter 2 communication failure
M1CTFail:C T reversed
BatChrOrDisFail: Battery charge/discharge failure
AC No Connect!!!: Grid Connection Fail
Remarks: After exiting the installation diagnostics, the LEDs return to their original state.

Translated with DeepL.com (free version).

M. Check the firmware version, region, country/area, and energy quality response mode.

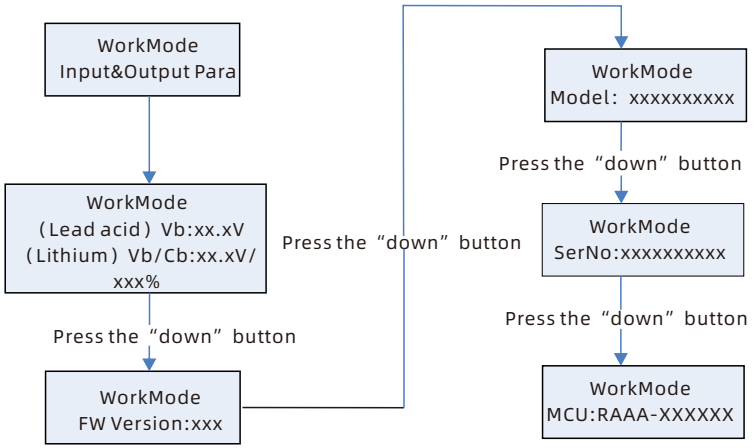


Figure 6. 19 Other settings

6.2 Datalogger Settings

1. Ensure the datalogger has been reliably connected.
2. Please use the Growatt datalogger, such as Wi-Fi-X/Shinelink-x/Shinewilan-X2.
3. Connect to the remote monitoring system. First download the APP, and proceed as prompted. For details, refer to the datalogger's manual.

Note:
1. You need to use Growatt ShineServer/ShinePhone for data monitoring.
2. After connecting the datalogger, upon initial battery power-on, no monitoring data would be available in the first 20 minutes as the SPH is establishing communication with SPH, uploading information such as the battery SN.

Specifications 7

Model / Specifications	SPH 3000 TL -HU	SPH 3600 TL-HU	SPH 4000 TL-HU	SPH 4600 TL-HU	SPH 5000 TL-HU	SPH 6000 TL-HU
Input data (PV)						
Max. recommended PV power(for module STC) 6000W	6000W	7200W	8000W	9200W	10000W	12000W
Max. PV voltage*1	600V					
Full load MPP Voltage Range	187.5V-470V	225V-470V	250V-470V	287.5V-470V	312.5V-470V	375V-470V
Start voltage	100V					
Nominal voltage	370V					
MPPT work voltage range	100V-560V					
Number of independent MPP trackers	2					
No. of PV strings per MPP tracker	1					
Max. input current per MPP tracker	16A					
Max. short-circuit current per MPP tracker	24A					
AC input /output data						
Rated output/input power	3000W	3680 W	4000 W	4600W	5000W	6000W
Rated output/input apparent power	3000VA	3680VA	4000VA	4600VA	5000VA	6000VA
Nominal AC voltage/range	230V; 180Vac-260Vac					
Nominal Frequency /range	50/60Hz; 45~55Hz/55~65 Hz					
Rated input / output current	13/ 13 A	16/16 A	17.3/17.3 A	20/20 A	21.7A/21.7A	26A/26A
Max. input / output current	16/16 A	16/16 A	22/22 A	22/22 A	27/27 A	27/27 A
Phase factor (@ rate power)	1					

Model / Specifications	SPH 3000 TL -HU	SPH 3600 TL-HU	SPH 4000 TL-HU	SPH 4600 TL-HU	SPH 5000 TL-HU	SPH 6000 TL-HU
Adjustable power factor	0.8leading...0.8lagging					
THDI	<3%					
AC connection	Single phase					
EPS output date						
Rated output apparent power	3000VA	3680VA	4000VA	4600VA	5000VA	6000VA
Nominal voltage	230V					
Nominal Frequency	50/60Hz					
Rated output current	13A	16A	17.3A	20A	21.7A	26A
THDv	3%					
Switch time	≤15ms					
Efficiency						
Bat Online CEC weighted efficiency	93.4%					
PV Online CEC weighted efficiency	96.6%					
MPPT efficiency	≥99.5%					
BAT data (DC)						
Battery voltage range	42~59V					
Minimum full load voltage	46V	46V	46V	48V	48V	48V
Rated charging and discharging current	66/66 A	75/75 A	85/85 A	96/96 A	105/105 A	125/125 A
Continuous charging / discharging power	3000 W	3680 W	4000 W	4600 W	5000 W	6000 W
Type of Battery	lithium /Lead-acid					
Protection devices						
Overvoltage category	PV:II Bat:II AC:III					

Model / Specifications	SPH 3000 TL -HU	SPH 3600 TL-HU	SPH 4000 TL-HU	SPH 4600 TL-HU	SPH 5000 TL-HU	SPH 6000 TL-HU
Inverter topology	Non-isolated					
Operating temperature range[*2]	-25°C ... +60°C (-13...+140°F) with derating above 45°C /113°F					
Storage temperature range	-25°C ... +60°C (-13...+140°F)[2]					
Safety level	Class I					
Ingress protection	IP66					
AFCI	Integrated					
PV Switch	Integrated					
Bat Breaker	Integrated					
PV Surge protection	Type II					
Insulation resistance monitoring	Integrated					
AC surge protection	Type III					
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	605*458*186					
Weight(KG)	32					
Noise emission (typical)	≤ 25 dB(A)					
Altitude	3000m					
Self-Consumption	< 10 W					

Model / Specifications	SPH 3000 TL -HU	SPH 3600 TL-HU	SPH 4000 TL-HU	SPH 4600 TL-HU	SPH 5000 TL-HU	SPH 6000 TL-HU
Cooling concept	Natural					
Relative humidity	100%					
Features						
PV connection	MC4					
AC connection	connector					
BAT connection	connector					
Display	LCD					
Interfaces: RS485/ USB /CAN/WiFi/GPRS /ShineWiLan	yes /opt					
Warranty: 10 years	yes					
Certificates and approvals	CE, IEC62109, IEC61000, AS4777.2:2020, CEC					
Place of production	Made in China					

Note:

1. The maximum operating voltage for the inverter's PV input is 560V. If it exceeds 560V, the system will not work or will stop operating. The maximum input voltage is 600V, and exceeding this voltage poses a risk of damage. When the PV panel voltage is too high, the machine will derate for protection. The overvoltage derating curve is shown in the figure below:

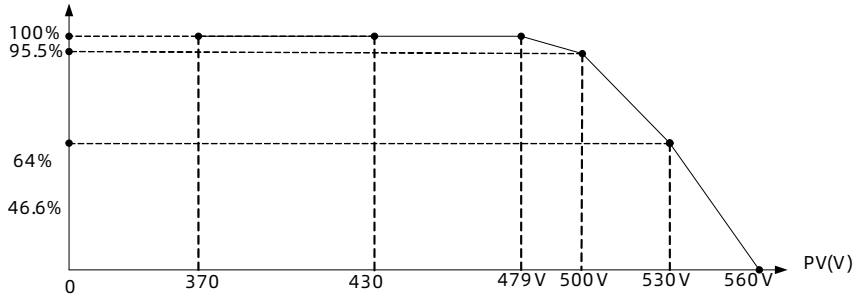


Figure 7. 1 SPH 3-6KTL-HUB PV side HV derating curve

Troubleshooting 8

All Growatt products undergo rigorous testing before leaving the factory. If you encounter any difficulties during installation, please visit www.ginverter.com and refer to the troubleshooting suggestions.
In case that the SPH inverter becomes faulty, please notify Growatt promptly and provide information about the SPH. To provide you with better support, please have the following information ready:

- Serial number
- Model number
- Info displayed on the LCD
- Brief description of the issue Battery voltage
- PV input voltage and power per string
- Grid voltage and frequency
- Can you describe the process of fault occurrence? What were the conditions?
- Has this issue occurred previously?
- When did this fault occur? During the first installation?
- Name and model of the battery manufacturer
- Battery capacity
- Battery output voltage
- When did you purchase the battery and how frequently is it used?

8.1 SPH Fault 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 if the distance between SP-CT and inverter is within the specified range. 3. Restart the inverter after confirming that the cable is properly connected.
Warning 203	PV1 or PV2 Circuit short	1. Check if the positive and negative poles of the PV input are reversed. 2. Reconnect the PV connectors. Please contact Growatt support if the problem persists.
Warning 506	Battery temperature out of specified range for charge or discharge	Check if the ambient temperature of the battery is beyond the specified range.

Error Message	Description	Suggestion
AC V Outrange	Grid voltage fault. Please refer to the local grid standard for more details of the grid voltage	1. Check if the AC voltage is within the specified range. 2. Check the grid connection.
AC F Outrange	Grid frequency fault. Please refer to the local grid standard for more details for the grid frequency	1. Check if the AC frequency is within the specified range. 2. Restart the inverter. 3. Contact Growatt support if the problem persists after restart.
PairingTime Out	Communication fault	1. Check if the distance between SP-CT and inverter is within the specified range. 2. Restart inverter and SP-CT, reconnect.
CT LN Reversed	LN Reversed	1. Check whether the L line and N line of SP-CT is reversed or not. 2. Check the connection of the SP-CT's PE wire.
BMS COM Fault	Communication fault	1. Check if the lithium battery has been turned on. 2. Check the connection between the lithium battery and the inverter.
BAT NTC Open	Battery terminals reversedNTC open (only for lead-acid battery)	1. Check if the lead-acid battery NTC has been installed. 2. Check if the lead-acid battery NTC is properly connected.
Battery Open	Battery terminal open(only for lithium battery)	1. Check the battery connection. 2. Check if the switches between the battery and the inverter have been turned on.
Over Load	EPS output overload warning. If this warning occurred three times, the off-grid function will be locked for one hour.	Please reduce the load connected to the EPS output port.
No AC Connection	No Utility	1. Check if the grid goes down. 2. Check the grid connection. 3. Check if the switches have been turned on.

Error Message	Description	Suggestion
Output High DCI	High DC component in the output power. Please refer to the local grid standard for disconnection time when the output DC current is too high.	1. Restart the inverter. 2. Please contact Growatt support if the problem persists after restart.
Bat Voltage High	Battery Voltage higher than 60V	1. Check if the battery voltage is within the specified range. 2. Check the battery connection. If the actual battery voltage is higher than 60V, please disconnect the battery and check the inverter.
Bat Voltage Low	Battery Voltage lower than 42 V	1. Check if the battery voltage is within the specified range. 2. Check the connection between the battery and the inverter.
BMS Warning:XXX	BMS report warning	1. Check the warning information referring to the lithium battery user manual. 2. Please contact Growatt support if the problem persists after restart.
BMS error:XXX	BMS report error	1.Check the warning information referring to the lithium battery user manual. 2. Please contact Growatt support if the problem persists after restart.
EPS Volt Low	EPS output voltage low	1. Check the power of the load connected to the EPS output port. If overload occurs, please reduce the load. 2. Restart the inverter.

Error message		
Error Message	**Description**	**Suggestion**
Error 411	Internal communication failed	1. Restart the inverter. 2. Please contact Growatt support if the problem persists after restart.
Error 417	Sampling error	1. Restart the inverter. 2. Please contact Growatt support if the problem persists after restart.
Error 418	DSP and COM firmware version unmatched, system fault.	1. Read the DSP and COM firmware versions via the LCD or ShineBus. 2. Check if the firmware is correc
Error 303	Inverter L N reversed or ground fault	1. Check if the L line and N line are reversed. 2. Check if the PE cable is properly connected.
Error 405	Relay fault	1. Restart the inverter. Please contact Growatt support if the problem persists after restart.
Error 123	Auto test failed (only in Italy)	1. Restart the inverter. Please contact Growatt support if the problem persists after restart.
PV Isolation Low	PV isolation too low	1. Check the wiring of the PV panels. Check if the inverter's PE cable is properly connected.
OP Short Fault!	EPS Output Short Fault	1. Check the load connected to the EPS port. 2. Check if the EPS output is short-circuited.
NTC Open	Internal temperature failed	Please contact Growatt support.
Residual I High	Leakage current too high	1. Check the inverter wiring. Then restart the inverter. 2. Please contact Growatt support if the problem persists after restart.

Error message		
Error 408	Temperature over range	Check if the temperature is within the specified range.
PV Voltage High	PV voltage higher than the specification	Check if the PV input voltage is within the specified range.

8.2 Decommissioning

8.2.1 Preparation

- Prepare safety gloves, a cross-head screwdriver, socket wrench, and other tools.
- Power off the SPH system.

1. If the battery system is powered on, press the power button once to turn it off. Before performing maintenance on the battery, ensure to turn off the circuit breaker and confirm again that the battery system is powered off. Follow the installation and wiring procedures described above.
2. Turn off the circuit breaker that connects the inverter to the grid.
3. Turn off the PV-side isolation switch.
4. Ensure that SPH is completely powered off, with the LCD screen turned off.

- Disconnect the wires in the system.

8.2.2 Remove the Inverter

1. Power off the system, referring to Section 5.2.
2. Disconnect all cables connected to the SPH.
3. Remove screws securing the SPH.
4. Remove the SPH.

Note:
After powering off the SPH inverter, do not open the cover until 5 minutes later as residual voltage exists, and it takes about 20 minutes for the inverter to cool down.

8.2.3 Pack the Inverter

Please handle the SPH inverter and the battery with care during transportation. Keep them level and try to keep the batteries at approximately 50% SOC (State of Charge) during handling.

8.2.4 Dispose of the Inverter

Do not dispose of the SPH inverter together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site.

8.3 Alarm Notifications

The remote communication function enables sending alarm notifications to designated contact person via e-mail over the network. The datalogger uploads the error to the OSS web, which then notifies the user via e-mail.

8.3.1 Requirements for Remote Communication

To enable the remote communication, you need to install a Growatt datalogger to connect to the Internet and upload data to the Growatt monitoring platform OSS. The requirements are listed below:
The datalogger has been properly commissioned and can operate normally.
Communication has been successfully established between the inverter and the datalogger.
The system has been added to your OSS account on the website oss.growatt.com.

If a fault is detected, fault notifications will be sent to designated contacts once an hour until the fault is cleared.

8.3.2 Setting up Remote Reporting

- Once the energy storage system has been successfully added on the OSS, please follow steps below:

a) Open OSS, select your PV System, and navigate to “Settings”.

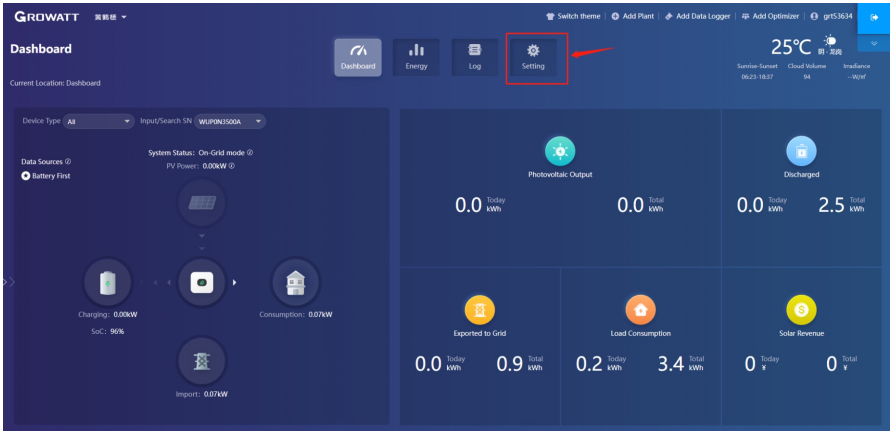


Figure 8. 1 OSS interface

b) Click “Add” under “E-mail Setting” section.

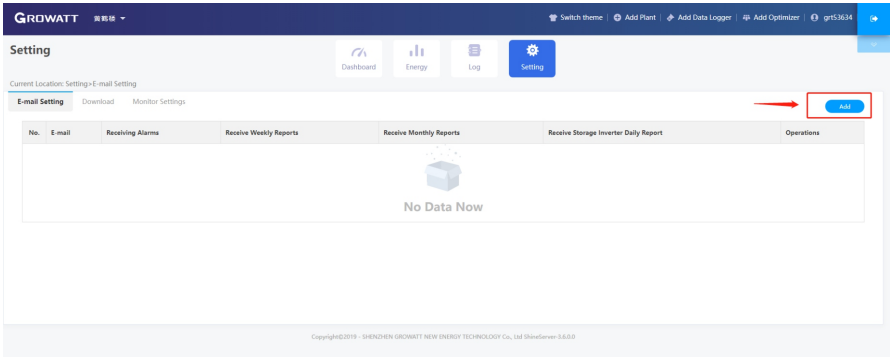


Figure 8. 2 Add the E-mail address

c) Enter the email address in the “E-mail” field, tick “Receiving Alarms”, and click “Yes”.

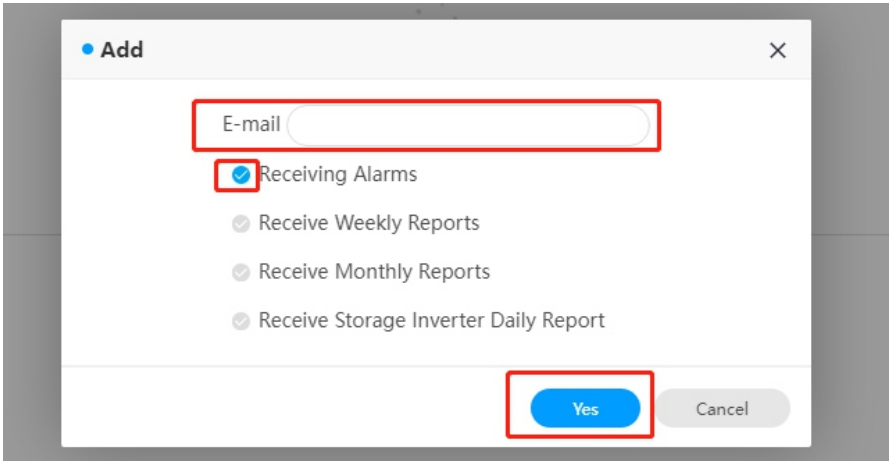


Figure 8. 3 Set E-mail notifications

d) Verify if the e-mail address has been successfully added.

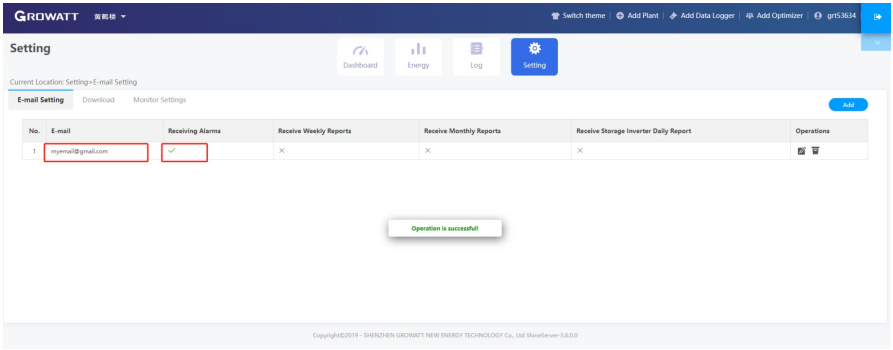


Figure 8. 4 E-mail setup succeeded

8.3.3 Check Historical Alarms

If an inverter error occurs (including the Earth Fault error), the system will automatically send alarm notifications to the e-mail address added in the previous step. Users can also check other historical alarms on the OSS by operating the following steps:

a) Open OSS, select the target system and navigate to “Log”.

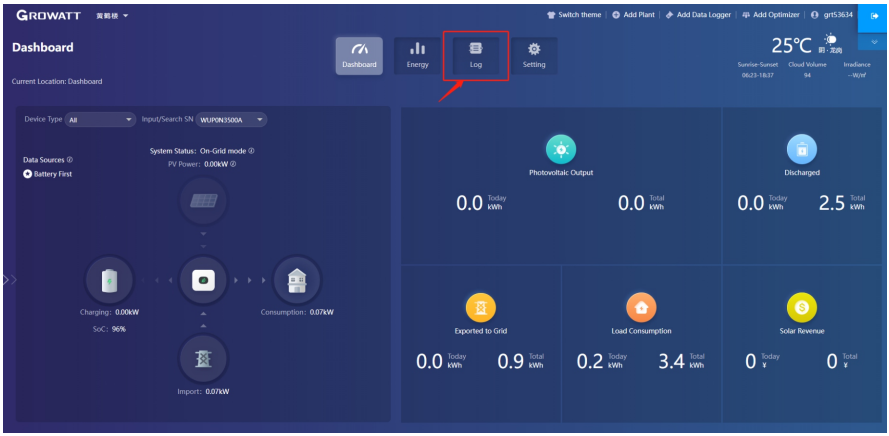


Figure 8. 5 Go to “Log”

b) Historical alarms will be shown in the arear marked with a red box below.

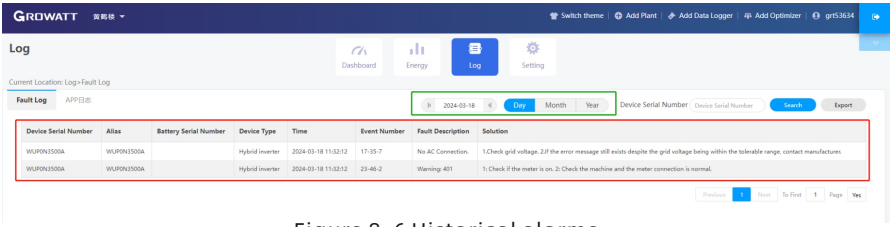


Figure 8. 6 Historical alarms

NOTE:

The historical alarms/messages (if any) are shown in the area marked with a red box. From the area marked with a green box, you can choose the date and to view the alarms by day/month/year.

9 Appendix

9.1 Other Optional Accessories

The following chart lists optional accessories for the inverter. To place orders, you can contact Growatt or your dealer. (P/N is for reference only and subject to change.)

Name	Description	GROWATT P/ N
Shine link-X	Used for data logging in EU	MR00 .0011200
	Used for data logging in Australia	MR00 .0011300
Shine WiFi-X	COM interface	MR00 .0011000
SPM-CT-E (Single-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 .0010801
TPM (Three-phase meter)	RS485 meter sensor (standard)	MR00 .0008300
	RS485 meter sensor (for Italy)	MR00 .0008400

9.2 Safety Standards

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

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