SUNGROW

User Manual

SH5K-20

Grid-Connected Hybrid Inverter

SH5K-20-UEN-Ver13-201805 Version：1.3

About This Manual

Applicability

This manual is applicable to the inverter type SH5K-20.

Target Group

This manual is intended for:

- qualified personnel who are responsible for the installation and commissioning of the inverter; and
- inverter owners who will have the ability to interact with the inverter via the LCD display.

How to Use The Manual

Read the manual and other related documents before any work on the inverter is carried out. Documents must be stored carefully and be available at all times.

Content may be periodically updated or revised due to product development. The information in this manual is subject to change without notice. The latest manual can be acquired at www.sungrowpower.com.

Symbols

Safety instructions will be highlighted with the following symbols.

Symbol	Explanation
	Indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk that, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a situation that, if not avoided, could result in equipment or property damage.

Symbol	Explanation
	Indicates additional information, emphasized contents or tips that may be helpful, e.g. to help you solve problems or save time.

Contents

1 Safety

General Safety

The inverter has been designed and tested strictly according to international safety regulations. Read all safety instructions carefully prior to any work and observe them at all times when working on or with the inverter.

Incorrect operation or work may cause:

- injury or death to the operator or a third party; or
- damage to the inverter and other properties belonging to the operator or a third party.

DANGER

Lethal voltage!

- **PV strings will produce electrical power when exposed to sunlight and can cause a lethal voltage and an electric shock.**
- **Only qualified personnel can perform the wiring of the PV panels.**

NOTICE

All electrical connections must be in accordance with local and national standards.

Only with the permission of the utility grid, the inverter can be connected to the utility grid.

Inverter

A warning label and a nameplate are pasted on the side of the inverter.

Tab. 1-1 Symbols on the Inverter

Symbol	Explanation
	Disconnect the inverter from all the external power sources before service!
	Do not touch live parts until 10 minutes after disconnection from the power sources.

Symbol	Explanation
	There is a danger from a hot surface that may exceed 60°C.
	Danger to life due to high voltages! Only qualified personnel can open and service the inverter.
	Check the user manual before service!
	Regulatory compliance mark.
	Do not dispose of the inverter together with household wastes.
	The inverter does not have a transformer.
	TUV mark of conformity.
	CE mark of conformity.

DANGER

Danger to life from electric shock due to live voltage

- Do not open the enclosure when the inverter is working.
- When the enclosure lid is removed, live components can be touched which can result in death or serious injury due to electric shock.

Danger to life from electric shock due to damaged inverter

- Only operate the inverter when it is technically faultless and in a safe state.
- Operating a damaged inverter can lead to hazardous situations that can result in death or serious injuries due to electric shock.

WARNING

Risk of inverter damage or personal injury

Do not pull out PV connectors, AC connector or battery connectors while the inverter is running. De-energize from all power sources and verify that there is no voltage.

All the warning labels and nameplate on the inverter body:

- must be clearly visible; and
- must not be removed, covered or pasted.

CAUTION

Risk of burns due to hot components

Do not touch the hot parts (such as heat sink) during operation. Only the LCD panel and the DC switch can be touched.

NOTICE

Only qualified personnel can change the country setting.

Unauthorized alteration of the country setting may cause a breach of the type-certificate marking.

Inverter damage due to electrostatic discharge (ESD).

By touching the electronic components, you may damage the inverter. For inverter handling, be sure to:

- avoid any unnecessary touching; and
- wear a grounding wristband before touching any connections.

Batteries

DANGER

Batteries deliver electric power, resulting in burns or a fire hazard when they are short circuited, or wrongly installed.

Lethal voltages are present in the battery terminals and cables in the inverter. Severe injuries or death may occur if the cables and terminals in the inverter are touched.

WARNING

Provide sufficient ventilation for the battery system to prevent flames and sparks from the explosive hydrogen gas that the batteries release.

Due to the dangers of hydrogen gas and battery electrolyte:

- locate batteries in a designated area, complying with the local regulations;
- protect the enclosure against destruction;
- do not open or deform the battery;
- whenever working on the battery, wear suitable personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles;
- rinse acid splashes thoroughly with clear water for a long time and consider consulting a doctor.

NOTICE

Improper settings or maintenance can permanently damage the battery.

Incorrect inverter parameters will lead to the premature aging of battery.

Skills of Qualified Personnel

Qualified personnel must have the following skills:

- training in the installation and commissioning of the electrical system, as well as the dealing with hazards;
- knowledge of the manual and other related documents; and
- knowledge of the local regulations and directives.

2 System Solution

WARNING

The inverter must only be operated with PV strings of protection class II in accordance with IEC 61730, application class A. It is not permitted for the positive pole or the negative pole of the PV strings to be grounded.

Any use other than that described in this chapter is not permitted.

SH5K-20 is a single-phase hybrid inverter applicable to both on-grid and off-grid PV systems. With the Energy Management System (EMS) integrated, it can control and optimize the energy flow so as to increase the self-consumption of the system.

Inverter

The following figure shows the inverter appearance, which is for reference only. The actual product that you receive may differ.

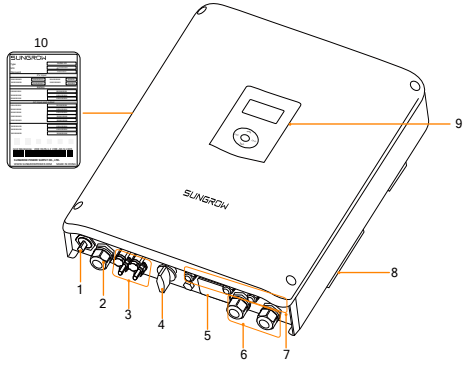


Fig. 2-1 Inverter Appearance

No.	Name	Description
1	AC-Grid	AC terminal to the utility grid.
2	Backup Ctrl	Two holes for the control cable and DI cable of the backup box STB5K-20.
3	PV connection	PV1+ , PV1- , PV2+ and PV2-.

No.	Name	Description
4	DC switch **(optional)**	To disconnect the DC current safely.
5	Wi-Fi terminal	To connect the Wi-Fi module.
6	Battery connection	BAT+ and BAT-.
7	Communication connection	RS485, Ethernet, CAN, AI, DO and DRM.
8	Second PE terminal	For reliable grounding.
9	LCD display panel	Human-computer interaction interface.
10	Nameplate	Clearly identify the product, including the SN, password, technical data, certifications, etc.

The following figure shows the dimensions of the inverter.

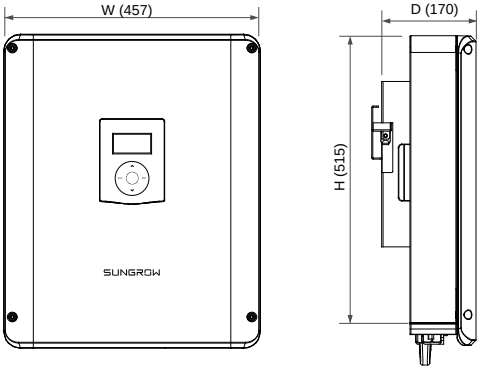


Fig. 2-2 Dimensions (unit: mm)

The LCD display panel with an indicator and four buttons is on the front of the inverter.

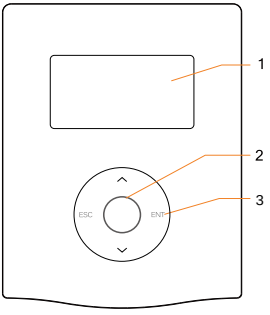


Fig. 2-3 LCD Display Panel

No.	Name	Description
1	Screen	To display the information.
2	Indicator	Green and red can be indicated via the indicator, from which user can know the current status. For detailed definition, see **Tab. 7-5**.
3	Buttons	User can operate the LCD menu via the four buttons. For detailed functions, see **Tab. 7-1**.

Energy Meter

The SUNGROW Energy Meter is installed next to the main switch to detect the electrical measured values at the grid-connected point. It communicates with the inverter via an RS485 connection. The dimensions are shown below.

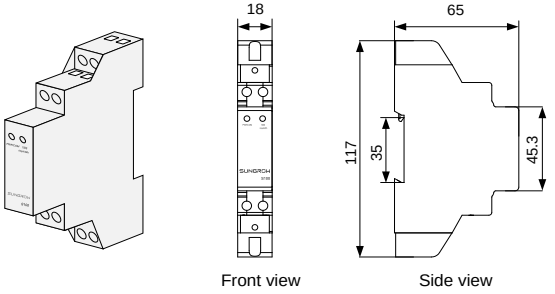


Fig. 2-4 single-phase Meter Dimensions (unit: mm)

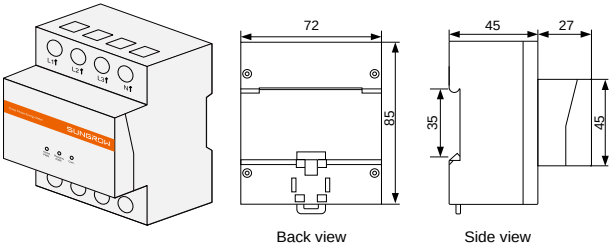


Fig. 2-5 Three-phase Meter Dimensions (unit: mm)

- The single-phase Energy Meter and the three-phase Energy Meter are alternative in the delivery. The meter figures in this document have been created for the single-phase Energy Meter unless otherwise specified.
- For details about the Energy Meter, please refer to the Quick Installation Guide for it.

2.1 On-grid System

With a battery module for the immediate storage of energy, the conventional PV system can be upgraded to be an Energy Storage System (ESS).

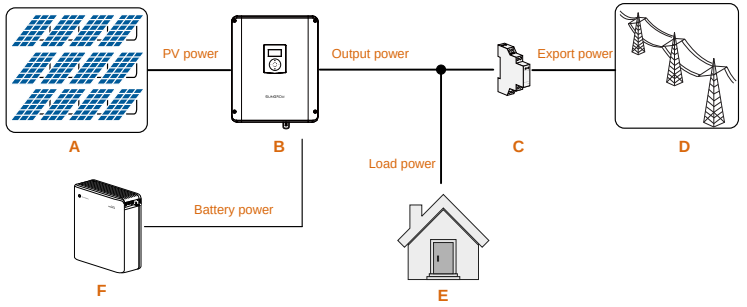


Fig. 2-6 PV Energy Storage System (PV ESS)

Tab. 2-1 System Compositions

Item	Description	Remark
A	PV strings	Monocrystalline silicon, polycrystalline silicon, and thin-film without grounding.
B	Inverter	SH5K-20.
C	SUNGROW energy meter (single-phase for example)	Measures the export power and communicate with the inverter via the RS485 port.
D	Utility grid	Grid grounding system types: TT, TN
E	Household load	Devices that consume energy.
F	Battery (optional)	A Li-ion battery or a lead-acid battery.

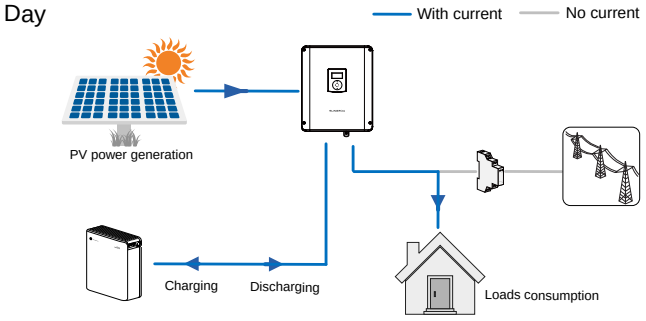
NOTICE

For the TT utility grid, the N line voltage to ground must be less than 30 V.

Energy Management during Daytime

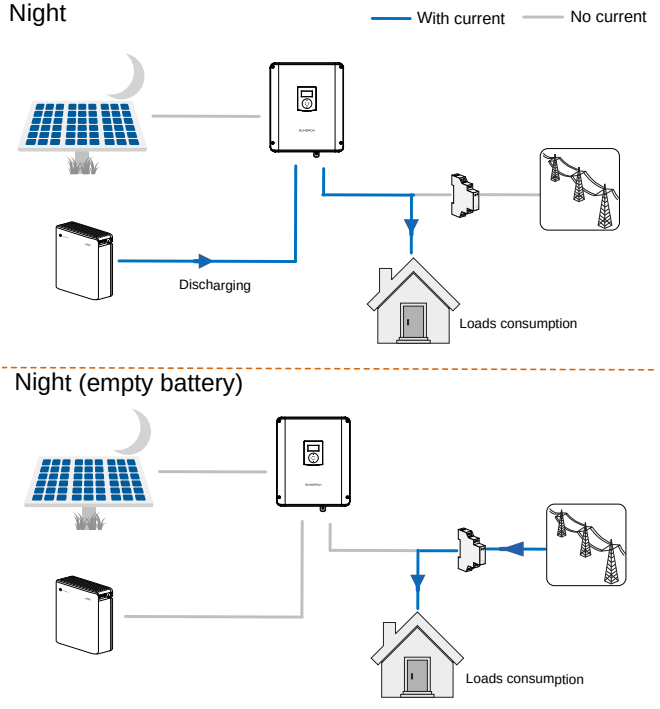
The energy management system (EMS) works in self-consumption by default. The PV power will go to the house first, then the battery. Then if the battery is fully charged the excess will go to the grid, the export power should be not more than the limit value in zero-export setting in initial commissioning.

If the PV power is less than the load power, the battery will discharge and provide the energy shortfall. The inverter will draw power from the mains if the power from the PV and battery is less than the load power.



Energy Management during Night

The battery discharges to provide energy to loads. If the battery is empty or there is not enough power from the battery system to supply active loads, the unmet power will be supplied by the grid.



If the meter is abnormal or not equipped:

- the inverter can run normally;
- the battery can be charged, but not allowed to discharge;
- the export power setting on the LCD display will be ineffective;
- the DO function of optimized mode will be disabled.

2.2 Off-grid System

NOTICE

The utility grid must be a TN system for the off-grid application.

The system is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

In an energy storage system with multiple hybrid inverters in parallel, the hybrid inverters cannot work in EPS mode.

With the backup box STB5K-20 connected into the PV ESS, the system is capable of operating as an off-grid system to ensure an emergency power supply for emergency appliances in the event of a grid interruption or blackout.

Also user may manually press the button on the STB5K-20 to switch a system from on-grid to off-grid.

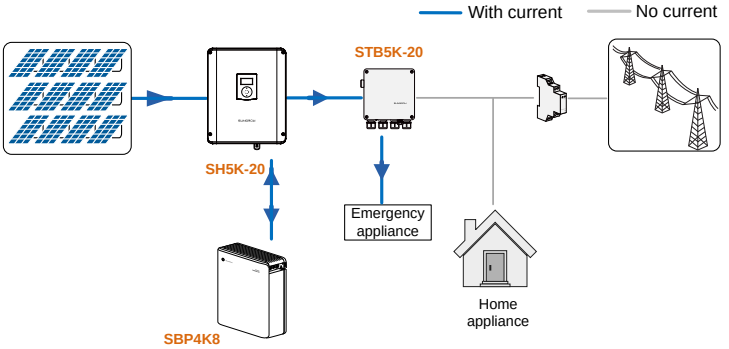


Fig. 2-7 Inverter Application in an Off-grid System

The grid interruption or blackout may be caused by grid islanding, under-voltage, over-voltage, under-frequency or over-frequency, of which the fault codes will be displayed on the LCD screen.

Refer to "**6.8 STB5K-20 Connection (EPS)**" for cable connections and "**10.4.2 Setting the EPS Function**" for the LCD settings.

2.3 Retrofitting the Existing PV System

The SH5K-20 hybrid inverter is compatible with any single-phase PV grid-connected inverters. An existing PV system can be retrofitted to be a PV ESS with the addition of SH5K-20.

The power generation from the existing PV inverter will be firstly provided to the loads and then charge the battery. With the energy management function of the SH5K-20, the self-consumption of the new system will be greatly improved.

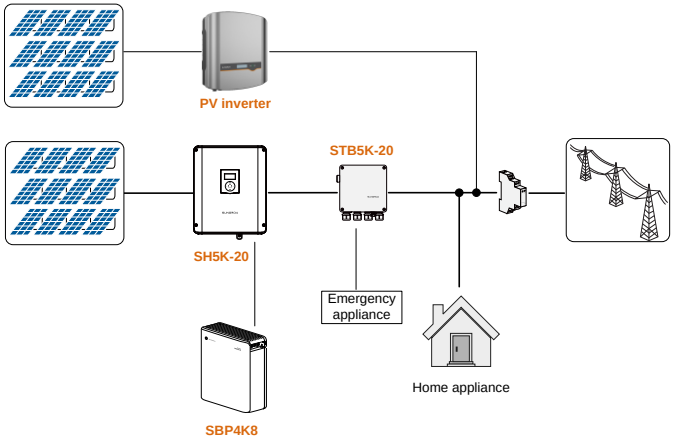
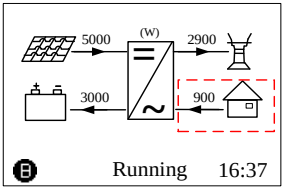


Fig. 2-8 Retrofitting the Existing PV System

* Just connect the STB5K-20 to provide the backup function for off-grid application.

The existing PV inverter provides power to the PV ESS, as the power flow shown on the main screen.



Refer to "**10.4.3 Adding the Existing System**" to set the rated power of the existing PV inverter. The output power of the existing PV inverter should be taken into consideration for export power setting. For detailed settings, see "**10.4.2 Setting the EPS Function**".

3 Function Description

3.1 Safety Function

3.1.1 Protection

The protective functions are integrated in the inverter, including short circuit protection, grounding insulation resistance surveillance, residual current protection, anti-islanding protection, DC overvoltage / over-current protection, etc.

3.1.2 Earth Fault Alarm

The inverter has integrated an earth fault dry-contact (DO2 relay) for the local alarm. The external alarm needs to be powered by the grid.

The additional equipment required is a light indicator and/or a buzzer. The recommended cross-section of the DO cable is 1 mm^2.

If an earth fault occurs,

- the DO2 dry-contact will switch on automatically to signal the external alarm;
- the buzzer inside the inverter will also beep; and
- the Ethernet communication port can be used for the remote alarm.

3.2 Energy Conversion and Management

The inverter converts the DC power from the PV strings or the battery to the AC power, which conforms to the grid requirements. It also transmits the DC power from the PV panel to the battery.

With the bidirectional converter integrated inside, the inverter can charge or discharge the battery.

Two string MPP trackers can be utilized to maximize the power from PV strings with different orientations, tilts, or module structures.

3.2.1 Power Derating

Power derating is a way to protect the inverter from overload or potential faults. In addition, the derating function can also be activated by the requirements of the utility grid. Situations requiring inverter power derating are:

- grid dispatching;
- over-temperature (including ambient temperature and module temperature);
- grid under-voltage;
- export power limit setting; and
- power factor.

Grid Dispatching Derating

Adjust the output power according to the remote scheduling instructions and the inverter operates with the power derating.

Over-temperature Derating

A high ambient temperature or poor ventilation will lead to a power derating of the inverter.

When the internal temperature or module temperature exceeds the upper limit, the inverter will reduce the power output until the temperature drops within the permissible range.

Grid Under-voltage Derating

When the grid voltage is too low, the inverter will reduce the output power to make sure that the output current is within the permissible range, as calculated by the following equation.

$$\text{When } V_{min} < V < 230\ V,\ P = Pn \times (V_{grid} / 230\ V)$$

Refer to “**12.3.1 Volt-watt Response**” for over-voltage curve. The following figure shows the under-voltage derating curve.

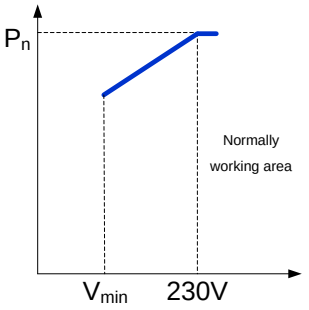


Fig. 3-1 Grid Under-voltage Derating

Export Power Limit Derating

When the meter detects that the export power is greater than the limit value on the LCD, the inverter will reduce the output power within the specified range.

Power Factor Derating

When the power factor PF<1.0, the inverter will reduce the output power within a specified range. The following figure shows the power factor derating curve.

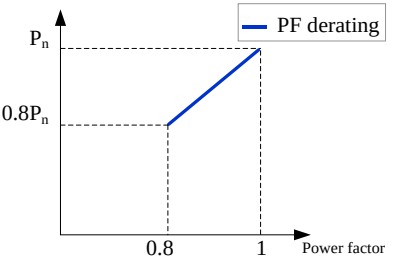


Fig. 3-2 Power Factor Derating

3.2.2 External Demand Response

The inverter provides a terminal block for connecting to a demand response enabling device (DRED). The DRED asserts demand response modes (DRMs). The inverter detects and initiates a response to all supported demand response commands within 2s. For the connections, see "**12.1 Demand Response Modes**".

The following table lists the DRMs supported by the inverter.

Tab. 3-1 Demand Response Modes (DRMs)

Mode	Explanation
DRM0	The inverter is in the state of “Turn off”.
DRM1	The import power from the grid is 0.
DRM2	The import power from the grid is no more than 50 % of the rated power.
DRM3	The import power from the grid is no more than 75 % of the rated power.
DRM4	The import power from the grid is 100 % of the rated power, but subject to the constraints from other active DRMs.
DRM5	The export power to the grid is 0.
DRM6	The export power to the grid is no more than 50 % of the rated power.
DRM7	The export power to the grid is no more than 75 % of the rated power.
DRM8	The export power to the grid is 100 % of the rated power, but subject to the constraints from other active DRMs.

The DRED may assert more than one DRM at a time. The following shows the priority order in response to multiple DRMs.

Multiple Modes	Priority Order
DRM1…DRM4	DRM1 > DRM2 > DRM3 > DRM4
DRM5…DRM8	DRM5 > DRM6 > DRM7 > DRM8

3.2.3 Reactive Power Regulation

The inverter is capable of operating in reactive power regulation modes for the purpose of providing support to the grid. These various operating modes can be enabled or disabled via the LCD menu. For details, see “**12.2 Reactive Power Regulation**”.

- ***PF***: Fixed power factor mode.
- ***Qt***: Fixed reactive power mode.
- ***Q(p)***: The PF of the inverter output varies in response to the output power of the inverter.
- ***Q(u)***: The reactive power output of the inverter varies in response to the grid voltage.

3.2.4 Active Power Response

The inverter supports two power quality response modes, which can be set via the LCD menu. For details, see “**12.3 Active Power Response**”.

- Volt-watt:

  Define the response curve with four grid reference voltages. The inverter power output or input will vary in response to the grid voltages.

- Volt-watt (Charging):

  When the power from the grid is required to charge the energy storage system, the import power from the grid varies in response to the grid voltages. The response curve is defined by the voltage reference values and the corresponding power consumption from the grid for charging energy storage.

- Frq-watt:

  Define the response curve with a start grid frequency and an end grid frequency. The inverter power output or input will vary in response to the increase or decrease in grid frequency.

3.2.5 Load Control

The inverter provides a load control dry-contact (DO1 relay), which can control the load via a contactor. Refer to "**6.9 DO Connection"** for the cable connection.

User may set the control mode according to individual demand. Refer to "**10.4.10 Setting Load Control**" for LCD settings.

Timer: Set the starting time and end time. The DO function will be enabled during the interval.

ON/OFF: The DO function will be enabled if ***ON*** or disabled if ***OFF***.

Optimized: Set the starting time, end time, and the optimized power. During the interval, when the export power reaches to the optimized power, the DO function will be enabled.

3.3 Battery Management

The following kinds of batteries are compatible with the PV ESS.

- Li-ion battery from Sungrow, LG Chem, GCL, Pylon and BYD.
- Lead-acid batteries which require manual configuration.

To maximize the battery life, the inverter will perform battery charge, discharge, and maintenance management basing on the battery state.

State Definition

In order to avoid overcharging or deep discharging of the battery, distinguish four battery states according to different voltage ranges, as shown in the following table.

Tab. 3-2 Battery State Definition

Type	Port Voltage/SOC			
	Damaged	Empty	Normal	Full
Sungrow (new system)	< 28 V	SOC < 0 %	0 %–100 %	SOC = 100 %
Sungrow (retrofitting system or with the forced charge function enabled)	< 28 V	SOC < 5 %	5 %–100 %	SOC = 100 %
LG	< 30 V	SOC < 5 %	5 %–100 % (by default)	SOC = 100 %
GCL	< 30 V	SOC < 15 %	15 %–95 % (by default)	SOC > 95 %
Pylon (US2000B)	< 30 V	SOC < 20 %	20 %–100 % (by default)	SOC = 100 %
BYD	< 30 V	SOC < 10 %	10 %–100 % (by default)	SOC = 100 %
Other lead-acid	< 30 V	Configured by the customer		

* The SOC limits of Li-ion batteries except Sungrow batteries can be modified via the Webserver. For details about the Webserver, see "**11 Appendix II: Visiting and Configuring the Webserver**".

3.3.1 Charge Management

Emergency Charge Management

The emergency charge management function is to protect the battery from the damage caused by long time excessive discharge. The inverter cannot respond to discharge command during emergency charge. The following tables describe the emergency charge conditions for different types of batteries.

Tab. 3-3 Emergency Charge Management for Li-ion Battery

Status	Conditions
Trigger	Either of the following conditions is met: • SOC ≤ (Min. SOC) – 3% (valid only when the Min. SOC is ≥ 3 %). • A battery under-voltage warning is triggered. • An emergency charge command is reported to the inverter. (only for Sungrow and BYD batteries)

Status	Conditions
Finish	All the following conditions are met: • SOC ≥ (Min. SOC) – 1% (valid only when the Min. SOC is ≥ 3 %). • No battery under-voltage warning is triggered. • No emergency charge command is reported to the inverter. (only for Sungrow and BYD batteries)

Tab. 3-4 Default SOC Conditions for Li-ion Battery Emergency Charge

Type	Trigger SOC	Finishing SOC
Sungrow (new system)	Triggered by BMS	Triggered by BMS
Sungrow (retrofitting system)	SOC ≤ 2 %	SOC ≥ 4 %
LG	SOC ≤ 2 %	SOC ≥ 4 %
GCL	SOC ≤ 12%	SOC ≥ 14 %
Pylon (US2000B)	SOC ≤ 17 %	SOC ≥ 19 %
BYD	SOC ≤ 7 %	SOC ≥ 9 %

Tab. 3-5 Emergency Charge Management for Lead-acid Battery

Status	Conditions
Trigger	The battery voltage is under the lower limit (42 V by default).
Finish	The battery voltage rises to the final discharge voltage.

Normal Charge Management

When the battery voltage is within the normal range, the inverter could charge the battery if the PV power is higher than the load power and could ensure that the battery is never over-charged.

The maximum allowable charge current is limited to the smaller one of:

- the maximum charge current of the inverter 65 A; and
- the maximum / recommended charge current from the battery manufacturer.

The charge power is also limited to the smaller current of the above and may not reach the nominal power.

- If the PV voltage is higher than the upper limit value of MPP voltage 560 V, the battery cannot charge.
- The hybrid system will start to charge the battery when the export power value exceeds a threshold value of 70 W.

3.3.2 Discharge Management

Discharge management can effectively protect the battery from deep discharging.

The maximum allowable discharge current is limited to the smaller one of:

- the maximum discharge current of the inverter 65 A; and
- the maximum / recommended discharge current from the battery manufacturer.

The discharge power is also limited to the smaller current of the above and may not reach the nominal power.

- If the PV voltage is higher than the upper limit value of MPP voltage 560 V, the battery cannot discharge.
- The hybrid system will start to discharge the battery when the import power value exceeds a threshold value of 70 W.

3.3.3 Maintenance Management

To maximize the lead-acid battery life, the inverter will maintain the lead-acid battery every six months, no matter whether the PV power is sufficient or not. Generally, the maintenance management is only suitable for a lead-acid battery.

The maintenance process is as follows.

1. Charge the battery with a constant current of 0.165 C, in which C is the nominal capacity specified by the manufacturer and is indicated in Ah.
2. Charge the battery with a trickle current when the battery voltage is stabilized at the average charge voltage.
3. When the trickle current decreases to 3 A, end the maintenance.

3.3.4 Battery Temperature Sensor (PT1000)

SH5K-20 has integrated a PT1000 temperature sampling port for lead-acid batteries. With the external PT1000 installed, SH5K-20 can sample the temperatures of the external environment or the battery cabinet. The system uses the sensor input to perform power derating, battery over-temperature and under-temperature protection.

The sampling temperature of PT1000 ranges from -25°C to +60°C, with a sampling accuracy of ±2°C. The protective temperature of lead-acid battery ranges from -25°C to +60°C and the values could be set on the LCD or the Webserver.

The temperature sampling function of the sensor PT1000 for lead-acid batteries is disabled by default. Refer to “**10.4.14 PT1000 Switch Setting**” to enable the function via LCD menu.

3.4 Communication and Configuration

The inverter provides various ports for device and system monitoring, including RS485, Ethernet, Wi-Fi, and CAN; provides various parameter configurations for optimal operation; records running information and displays error information on the LCD screen.

4 Unpacking and Storing

4.1 Unpacking and Inspecting

The inverter is thoroughly tested and strictly inspected before delivery. Damage may still occur during shipping. Therefore, the first thing you should do after receiving the device is to conduct a thorough inspection.

1. Check the packaging for any visible damage.
2. Check the delivery contents for completeness according to the packaging list.
3. Check the inner contents for any visible damage.

Contact SUNGROW or the distributor in case of any damaged or missing components.

It is the best choice to store the inverter in the original packaging. So, do not dispose of it.

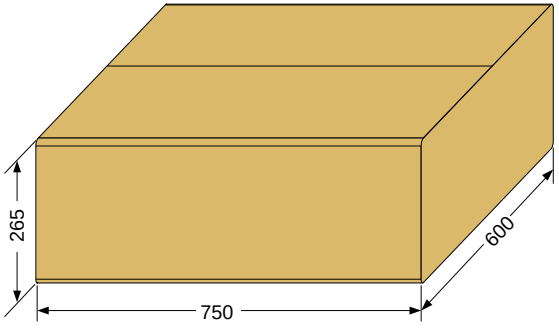


Fig. 4-1 Single Inverter in Original Packaging Carton (unit: mm)

4.2 Delivery Contents

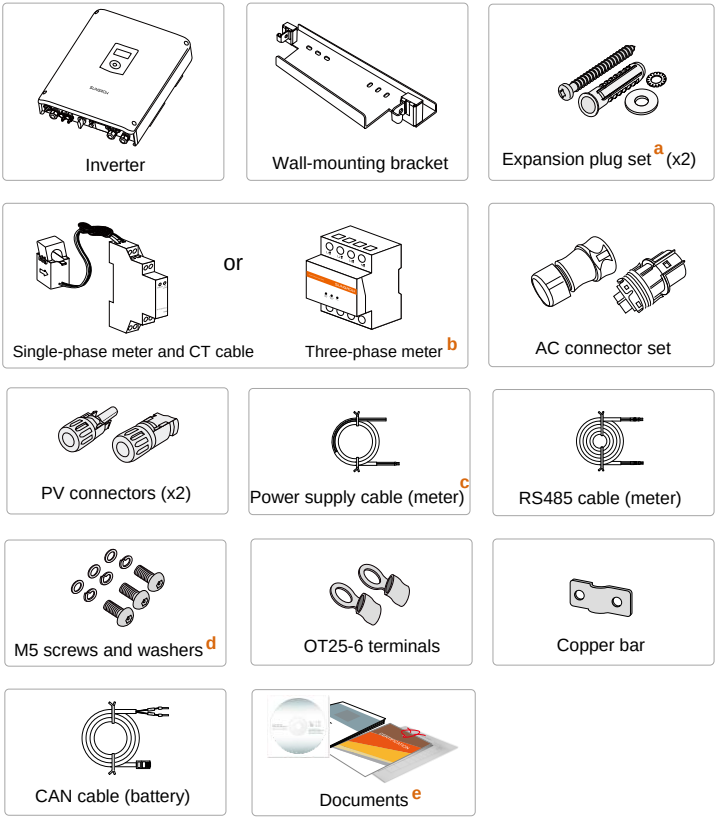


Fig. 4-2 Delivery Contents

a) Each set includes a self-tapping screw, a spring washer, a fender washer, and an expansion tube.

b) If user purchases the three-phase Energy Meter, it will be delivered separately.

c) The power supply cable is only delivered for the single-phase Energy Meter.

d) One is for external grounding and the other two are for securing the inverter.

e) The documents include the Quick User Manual, 1 CD, quality certificates, packaging list and product test reports.

4.3 Storing the Inverter

If you do not install the inverter immediately, choose an appropriate location to store it. Instructions for storage are:

- The device must be stored in the original packaging.
- The storage temperature should be always between -30°C and +85°C, and the storage relative humidity should be always between 0 and 100 %.

The following figure shows the storage of the inverter.

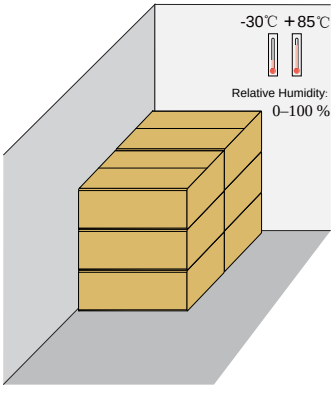


Fig. 4-3 Example of Inverter Storage

NOTICE

The packaging should be upright.

If there is more than one inverter to be stored, the maximum stacked layers are 5.

5 Mechanical Mounting

DANGER

In order to avoid electric shock or other injury, be sure there is no electricity or plumbing installations before drilling holes.

CAUTION

Risk of injury due to improper handling

- The weight can cause injuries, serious wounds, or bruise.
- Always follow the instructions when moving and positioning the inverter.

System performance loss due to bad ventilation

The inverter requires good ventilation during operation. Keep it upright and nothing covering the heat sink.

NOTICE

Wear gloves to avoid scratches when mounting the inverter.

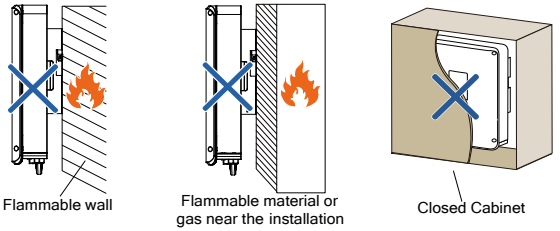
5.1 Location Requirements

The inverter with IP65 can be installed indoors or outdoors.

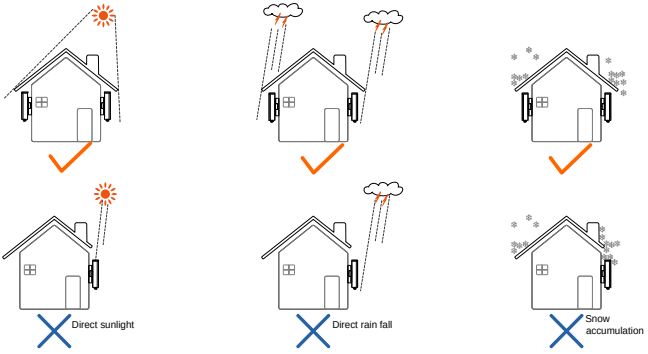
Selecting an optimal location for the inverter is critical for its operating safety as well as the expected efficiency and service life. Considerations for the location include:

1. The concrete wall should be suitable for the weight and dimensions of the inverter.
2. Install the inverter where it is convenient for installation, cable connection and service.
3. The location should be not accessible to children.
4. The max. power output will reduce when the ambient temperature exceeds 45°C. The following figure shows the ambient temperature and relative humidity limits.

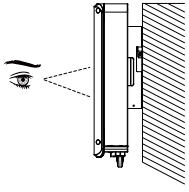
5. The location should be away from flammable materials or gas, and not enclosed.



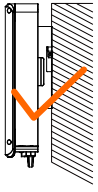
6. The shaded side of the building would be better to prevent the inverter from exposure to the sun, rain, and snow.



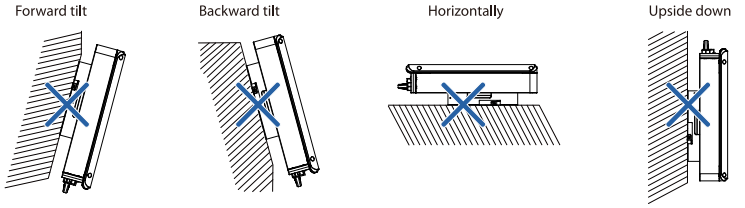
7. Place at eye level for easy operation and reading:



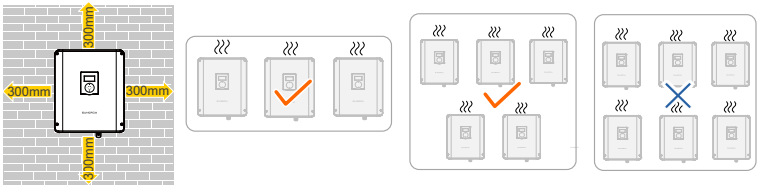
8. Install vertically for good heat dissipation.



9. Never install the inverter horizontally, or with a forward tilt or with a backward tilt or even with upside down. The horizontal installation could result in damage to the inverter.



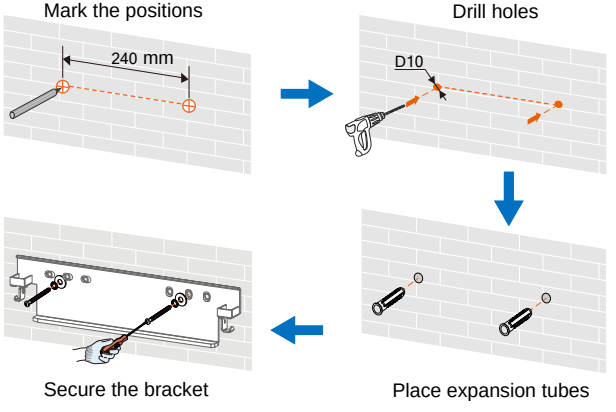
10. Clearance requirement and multiple installation:



5.2 Installing the Inverter

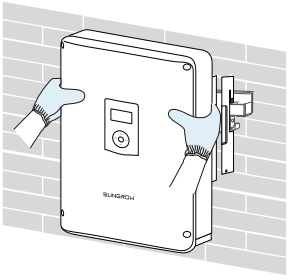
Install the inverter on the wall by means of the wall-mounting bracket and expansion plug sets as follows:

1. Install the wall-mounting bracket.

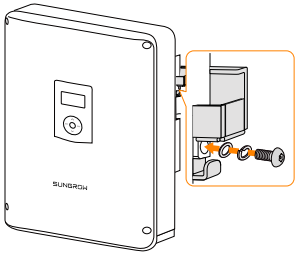


Note that the depth of the holes should be about 70 mm. Be sure to adhere to the screw assembly sequence: self-tapping screw, spring washer, fender washer and bracket.

2. Mount the inverter to the bracket.

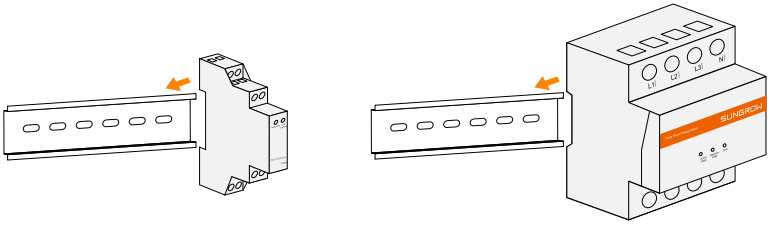


3. Secure the inverter with two M5 screws and washers. (3.0 N·m)



5.3 Installing the Energy Meter

The SUNGROW Energy Meter should be installed between the grid and the load. It supports a 35 mm DIN-rail installation, as shown in the following figure.



Single-phase Energy Meter

Three-phase Energy Meter

Fig. 5-1 Installing the Meter to the Rail

6 Electrical Connection

This chapter mainly describes the cable connections on the inverter side.

DANGER

Danger to life due to a high voltage inside the inverter

- **Make sure that the cables are not live before electrical connection.**
- **Do not turn on the AC circuit breaker until all the electrical connections are completed.**

WARNING

All cables must be firmly attached, undamaged, properly insulated and adequately dimensioned.

NOTICE

All electrical connections must be in accordance with local and national standards.

Before fastening the lid, be sure that:

- Seal the unused terminals with waterproof plugs.
- The rubber strip is fully filled with air.

6.1 Terminal Description

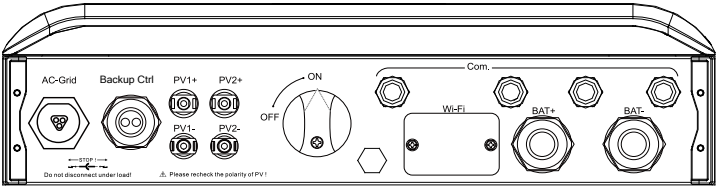


Fig. 6-1 Terminals at the Bottom of the Inverter

Label	Description
AC-Grid	AC terminal to the utility grid.
Backup Ctrl	Two holes for the control cable and DI cable of the backup box STB5K-20.
PV1+, PV1-, PV2+, PV2-	Terminals for the DC cables.
ON, OFF	DC switch.
Com.	Cable glands for Ethernet, RS485, PT1000, CAN, DO and DRM.
Wi-Fi	Terminal for the Wi-Fi module.
BAT+ , BAT-	Cable glands for the battery power cables.

Connection terminals on the inner configuration circuit board are shown below:

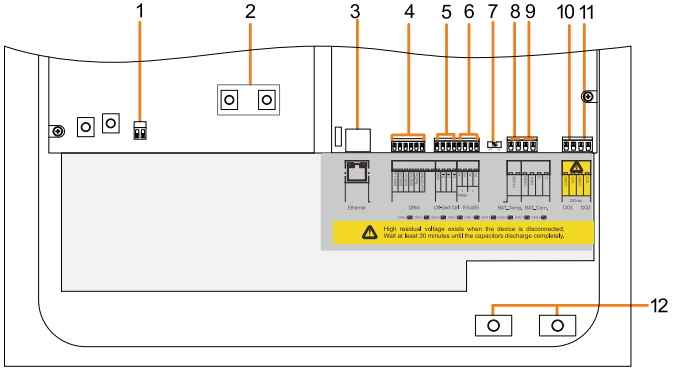


Fig. 6-2 Configuration Circuit Board Inside the Inverter

No.	Label	Connection	Tool Requirements
1	C1, C2	Backup box STB5K-20	Flat-head screwdriver with an open end of 3 mm
2	Copper	PV (for parallel mode)	Phillips screwdriver
3	Ethernet	Communication	-
4	DRM	Demand response enabling device (DRED)	Flat-head screwdriver with an open end of 2 mm
5	DI	Backup box STB5K-20	
6	RS485	A1, B1 reserved, A2, B2 for the meter	
7	120 Ohm	RS485	-
8	BAT_Temp.	Temperature sensor PT1000	Flat-head screwdriver with an open end of 3 mm
9	BAT_Com. (CANH, CANL)	Battery communication	
10	DO1	Power management	

No.	Label	Connection	Tool Requirements
11	DO2	Earth fault alarm	
12	BAT+, BAT-	Battery	Phillips screwdriver

6.2 Grounding the Inverter

A second protective earth (PE) terminal is equipped at the side of the inverter. Be sure to connect this PE terminal to the PE bar for reliable grounding and ensure that the grounding resistance should be less than 10 Ohm.

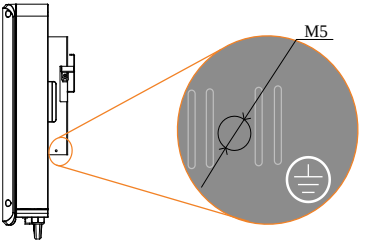
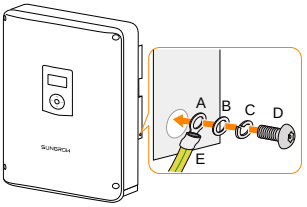


Fig. 6-3 Second PE Terminal

WARNING

In no case shall the second PE connection substitute for the PE connection to the terminal block of AC connector. Be sure to connect both PE terminals for reliable grounding. The loss of any or all the warranty rights may follow if otherwise.

Proceed as follows for second PE connection.

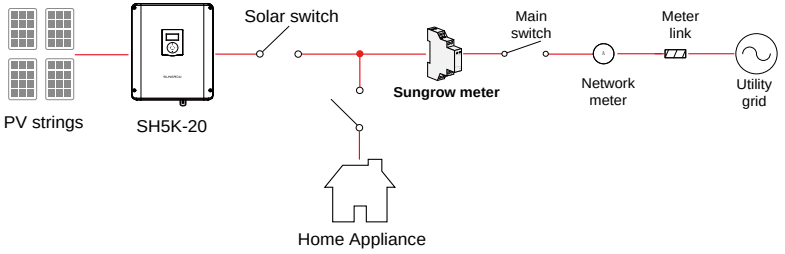


Item	Description	Specification
A	Cable socket	-
B	Washer	-
C	Spring washer	-
D	Screw	M5 × 12 mm (3.0 N·m)
E	Yellow-green cable	6–10 mm^2 copper wire or 10–16 mm^2 aluminum wire

6.3 Meter Connection

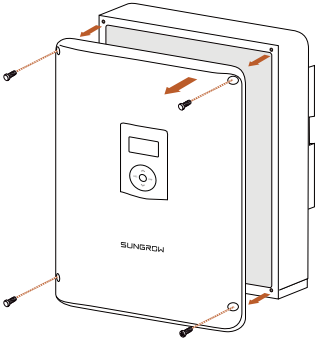
The SUNGROW energy meter should be installed next to the main switch.

This section mainly describes the cable connections on the inverter side. Refer to the quick guide delivered with the SUNGROW meter for the connections on the meter side.

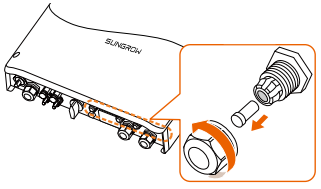


Proceed as follows to connect the RS485 wires to the inverter.

1. Unscrew four screws and remove the enclosure lid. Retain the screws for later use.



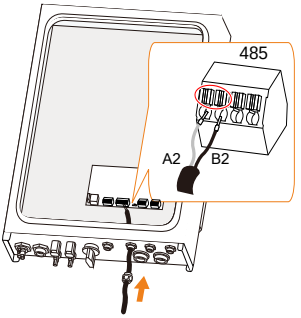
2. Unscrew the swivel nut from any **Com.** Port.



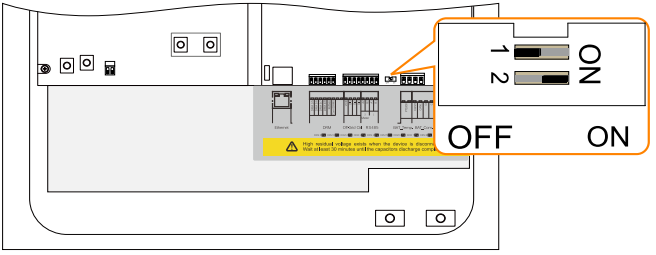
3. Lead the cable through the cable gland.
4. Plug the wires into terminals **A2** and **B2** on the inverter without tool tightening.

   Note:

   For reconnection, press the part as shown in the red circle so as to pull out the cable.



5. When the length of RS485 cable is longer than 100 m, push the 120 Ohm **(2)** switch to "**ON**" to ensure stable communication, as shown below.



6.4 Grid Connection

Residual Current Device

With an integrated universal current-sensitive residual current monitoring unit inside, the inverter will disconnect immediately from the mains power as soon as a fault current with a value exceeding the limit has been detected.

However if an external residual current device (RCD) is mandatory, the switch must be triggered at a failure current of 300 mA or higher.

Cable Requirements

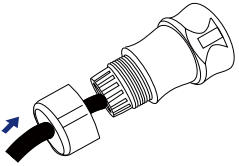
Cross-section: 4 mm^2, cable diameter: 11 mm to 14 mm

All the AC cables should be equipped with correctly colored cables for distinguishing. Please refer to related standards about the wiring color.

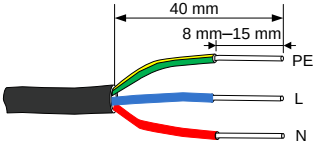
6.4.2 Assembling the AC Connector

Take out the AC connector parts from the packaging.

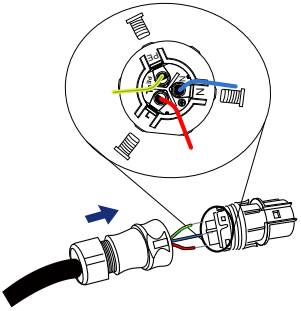
1. Lead the AC cable through the cable gland and the housing.



2. Remove the cable jacket by 40 mm, and strip the wire insulation by 8 mm–15 mm.



3. Fully insert the conductors to the corresponding terminal and tighten the screws with the torque 0.8 N·m. Pull cables outward to check whether they are firmly installed.

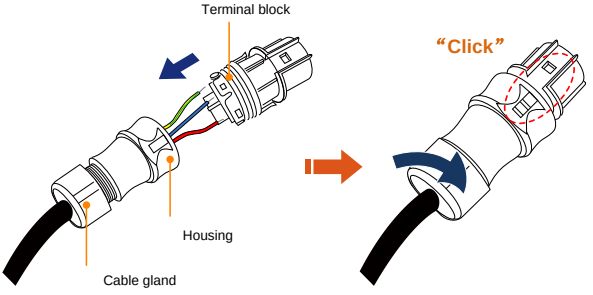


NOTICE

Observe the terminal layout of terminal block.

Do not connect the phase lines to "PE" terminal, otherwise the inverter will not function properly and the loss of any or all the warranty rights may follow.

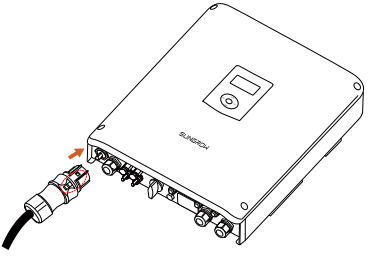
4. Assemble the housing, the terminal block and cable gland. Make sure that the rib of the terminal block and the groove on the housing engage perfectly until a "Click" is heard or felt.



6.4.3 Installing the AC Connector

Procedure:

1. Install an AC circuit breaker (recommended specification 32 A) at the AC output of the inverter.
2. Disconnect the AC circuit breaker and secure it against reconnection.
3. Align the AC connector and the AC terminal and mate them together by hand until a “Click” is heard or felt.



4. Connect the other ends. Connect “PE” conductor to the grounding electrode. Connect “L” and “N” conductors to the AC circuit breaker.
5. Pull all the lines outward to check whether they are firmly installed.

6.5 PV Connection

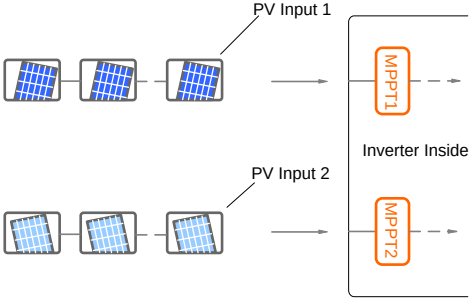
WARNING

Before connecting the PV strings to the inverter, ensure that the impedances between the positive terminals of the PV string and Earth, and between the negative terminals of the PV string and Earth are larger than 200 kOhm.

6.5.1 PV Input Configuration

Independent Mode

The two PV inputs work independently, each with its own MPPT. The two PV inputs can be different from each other in PV module types, numbers of PV panels in PV strings, tilt angles and orientation angles of PV modules. The following figure details the need for a homogenous PV string structure for maximum power.

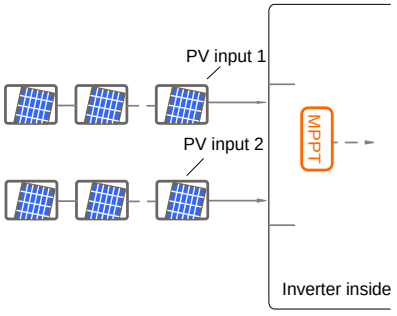


Prior to connecting the inverter to PV inputs, the specifications in the following table should be met:

Area	DC Power Limit for Each Input	Total DC Power Limit	Open-circuit Voltage Limit for Each Input	Short circuit Current Limit for Each Input
DC1	5600 W	6500 W	600 V	12 A
DC2				

Parallel Mode

Both PV strings should have the same type, the same number of PV panels, identical tilt and identical orientation. Two trackers are configured in parallel to handle power and/or current levels higher than those a single tracker can handle.



Prior to connecting the inverter to PV inputs, the specifications in the following table should be met:

Total DC Power Limit for Inverter	Open-circuit Voltage Limit for Each Input	Short circuit Current Limit for Total Input
6500 W	600 V	24 A

To avoid the power unbalance of two inputs or input load-restriction, ensure the two PV input cables are of the same type.

6.5.2 Connecting the Inverter to the PV Strings

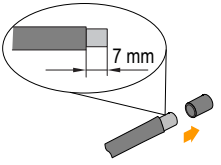
All DC cables are equipped with water-proof direct plug-in connectors, which match the DC terminals at the bottom of the inverter.

Cable Requirements

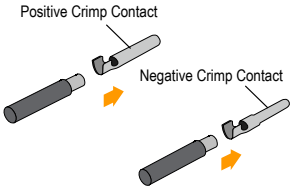
Cross-Section	Cable Diameter	Max. Withstand Voltage	Max. Withstand Current
4 mm^2–6 mm^2 AWG12–AWG10	6 mm–9 mm	600 V	Same as short circuit current.

Assembling the PV Connector

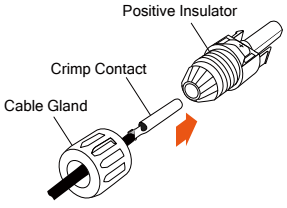
1. Strip the insulation from the cables by 7 mm–8 mm.

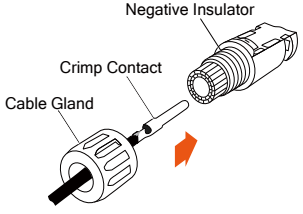


2. Assemble the cable ends by crimping pliers.



3. Lead the cable through the cable gland to insert into the insulator until it snaps into place. Then tighten the cable gland (torque 2.5 N·m–3 N·m).





4. Make sure that the cable polarities of the PV string are correct.

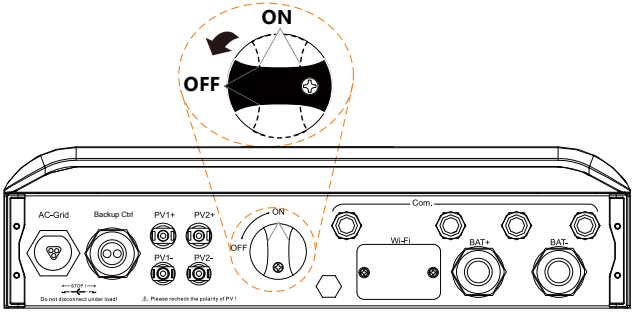
NOTICE

The inverter will not function properly if the PV polarities are reversed.

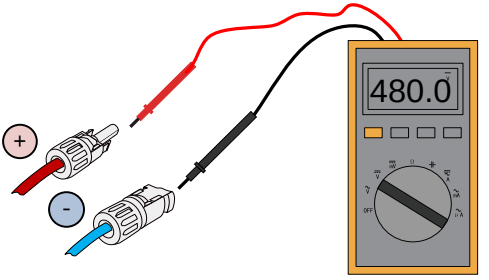
If the PV connectors are not assembled into place, it may cause an arc or overheat. The loss caused by this issue will void the warranty.

Installing the PV Connector

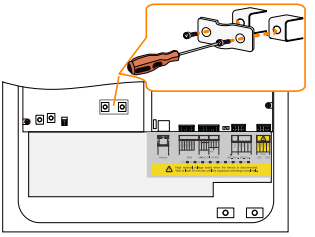
1. **(Optional)** Rotate the DC switch at the bottom to the “OFF” position.



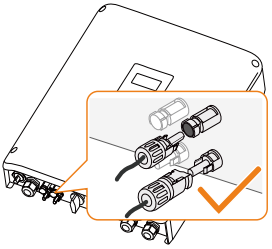
2. Check the cable connection of the PV strings for the correct polarity and that the open circuit voltage does not exceed the inverter input limit of 600 V, even under the lowest operating temperature. Refer to the module specification supplied by the module manufacturer for detailed information.



3. **(Optional)** Install the copper for the parallel mode.



4. Plug the connectors into corresponding terminals.



5. Seal unused DC terminals with the terminal caps.

6.6 Communication Connection

There are four ports and a Wi-Fi terminal on the bottom of the inverter, as shown in the following figure.

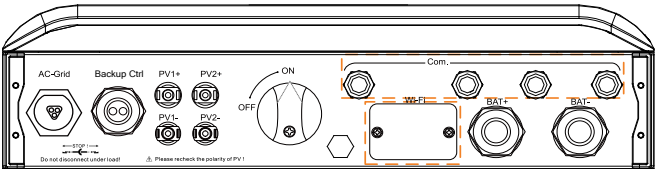


Fig. 6-4 Communication Ports and Terminal

Ethernet function:

- Through the Modbus TCP/IP protocol, the EMS or the Control Box from the third party can fully control the on/off, derating, charging and discharging of the inverter.
- The inverter operation information can be transferred via **Ethernet** port. Visit the Webserver and you can view the information.
- The inverter operation information can be transferred to the SolarInfo Bank server via the router.

Wi-Fi function:

With the SolarInfo Wi-Fi module installed, visit the SolarInfo Moni APP to view the inverter information.

6.6.1 Ethernet Connection

Connect the inverter to the PC through the **Ethernet** port to set up the Ethernet communication. The following figure shows the Ethernet connection without a router using the Webserver Explorer.

Fig. 6-5 Ethernet Connection without a Router

The following figure shows how the Ethernet connection may work with a router.

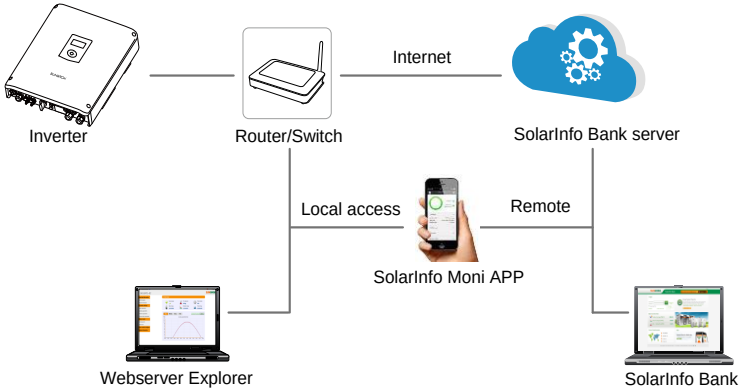


Fig. 6-6 Ethernet Connection with a Router

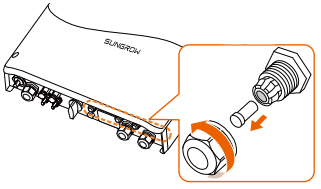
Cable Requirements

Use a TIA/EIA 568B standard network cable with a diameter of 3 mm–5.3 mm.

Refer to the switch/router's manual for the definition of the communication port.

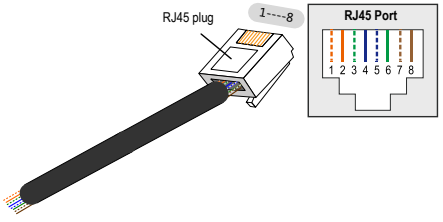
Procedure:

1. Unscrew the swivel nut from any **Com.** port.



2. Lead the cable through the cable gland and remove the cable jacket by 8 mm–15 mm.

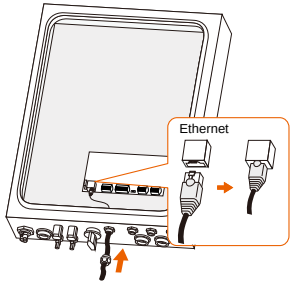
3. Use the Ethernet crimper to crimp the cable and connect the cable to RJ45 plug according to TIA/EIA 568B, as shown below.



Corresponding Relationship Between Cables and Pins:

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. Install the RJ45 plug to the **Ethernet** port.
5. Fasten the swivel nut and connect the other end to the socket of the switch or the router.



6.6.2 Wi-Fi Connection

1. Unscrew the waterproof lid from the Wi-Fi terminal.
2. Install the Wi-Fi module. Slightly shake it by hand to determine whether it is installed firmly, as shown below.
3. Refer to the **Quick User Manual** delivered with the Wi-Fi module to configure the Wi-Fi.

6.7 Battery Connection

This section mainly describes the cable connections on the inverter side. Refer to the instructions supplied by the battery manufacturer for the connections on the battery side.

WARNING

Only use properly insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, use electrical tape to cover the entire exposed metal surfaces of the available tools except their tips.

6.7.1 Connecting the Power Cable

A fuse with the specification of 150 V/125 A (type: Bussmann BS88 125LET) is integrated to the **BAT-** terminal.

NOTICE

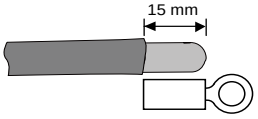
A two-pole DC circuit breaker with over-current protection (voltage rating not less than 100 V and current rating not less than 100 A) should be installed between the inverter and the battery.

Cable Requirements

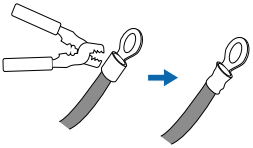
Cross-section: 16 mm^2–25 mm^2, OT25-6, cable diameter: 13 mm–16 mm.

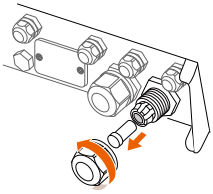
Procedure:

1. Remove the battery cable jacket, as shown below.

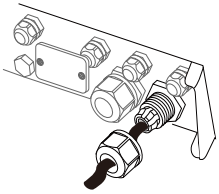


2. Crimp the OT terminal and install the heat shrinkable casing, as shown below.

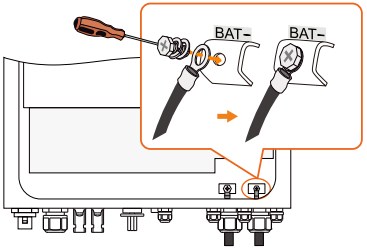




3. Unscrew the swivel nut from the **BAT+** and **BAT-** ports.



4. Lead the cable through the cable gland, as shown below.



5. Loosen and remove the screw sets on the **BAT+** and **BAT-** terminal blocks.

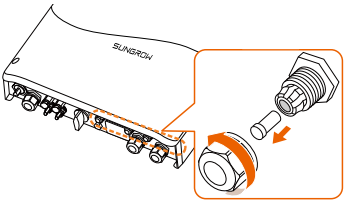
6. Fasten the cables to the corresponding terminals (torque 2.5 N·m).

Be sure to adhere to the following screw assembly sequence: screw head, spring washer, fender washer, OT terminal.

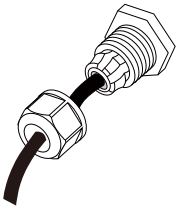
6.7.2 Connecting the CAN Cable

The CAN cable enables the communication between the inverter and the Li-ion battery from LG, Sungrow, GCL, Pylon (US2000B) or BYD.

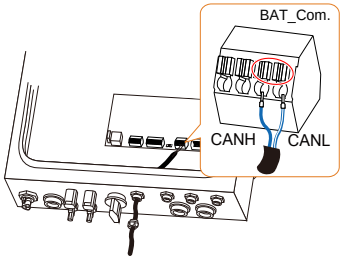
Procedure:



1. Take out the CAN cable (terminal marks **CANH** and **CANL**) from the packaging.
2. Unscrew the swivel nut from any **Com.** port.



3. Lead the cable through the cable gland, as shown below.



4. Plug the wires into the corresponding terminals according the marks without tool tightening.

   CANH: blue (pin 4)

   CANL: white-blue (pin 5)

   Note:

   For reconnection, press the part as shown in the red circle so as to pull out the cable.
5. Fasten the swivel nut and connect the other end to the battery.

6.7.3 Connecting the Temperature Sensor

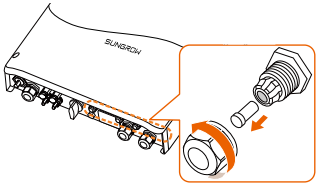
When the system is equipped with a lead-acid battery, it is recommended to connect the PT1000 temperature sensor to the inverter. This is to sample the battery temperature or the external environment temperature of the battery.

Cable Requirements

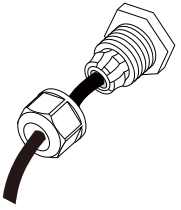
Cross-section: 1.0 mm², cable diameter: 3 mm–5.3 mm

Procedure:

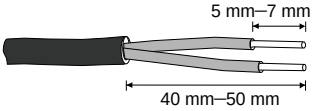
1. Unscrew the swivel nut from any **Com.** port.



2. Lead the cable through the cable gland, as shown below.



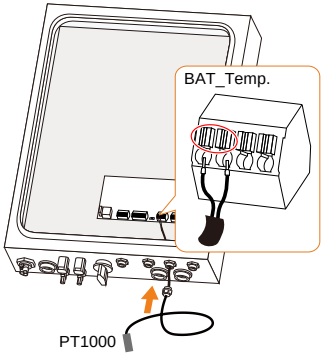
3. Remove the cable jacket and strip the wire insulation.



4. Plug the wires into **BAT_Temp.** terminal without tool tightening.

   Note:

   For reconnection, press the part as shown in the red circle so as to pull out the cable.

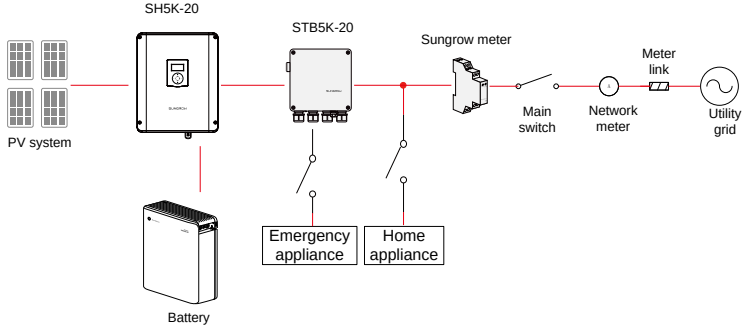


5. Fasten the swivel nut and place the temperature sensor next to the lead-acid battery.

6.8 STB5K-20 Connection (EPS)

The backup box is installed between the SUNGROW meter and the hybrid inverter SH5K-20. If the backup box is installed, you should enable the EPS function and set the reserved capacity for Li-ion batteries via the LCD. For details, see "**10.4.2 Setting the EPS Function**".

For the installation and the cable connection of STB5K-20, see the Quick Installation Guide delivered with the STB5K-20 module.



6.8.1 Connecting the Power Cables

WARNING

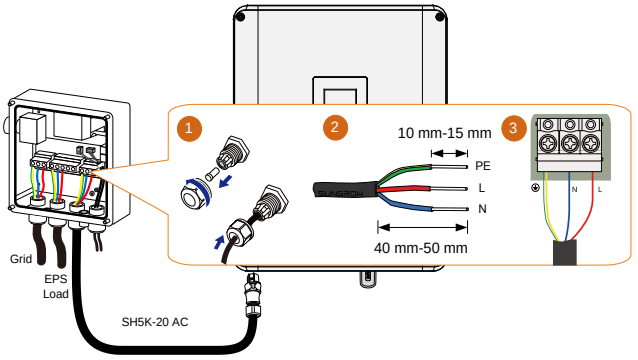
Risk of inverter damage due to incorrect cable connection. Do not connect the grid power wires to LOAD terminals.

A residual current device (RCD) should be required on the LOAD port of the backup box STB5K-20.

The neutral lines for the grid, the EPS and the inverter AC terminals are all inter-connected inside the STB5K-20. And it is the same for the PE lines.

Connect terminals L1, N1 and PE to the grid, and connect terminals L4, N4 and PE to the AC connector and then to the AC terminal on the SH5K-20.

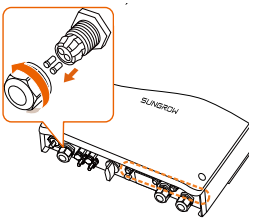
Cross-section: 4 mm², cable diameter: 11 mm–14 mm



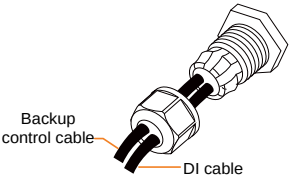
6.8.2 Connecting the Control Cable and DI Cable

The control cable (with end marks **C1** and **C2)** and the DI cable (with end marks **DI1**, **DI2**, **DI3** and **VDD)** are equipped in the backup box STB5K-20 before delivery.

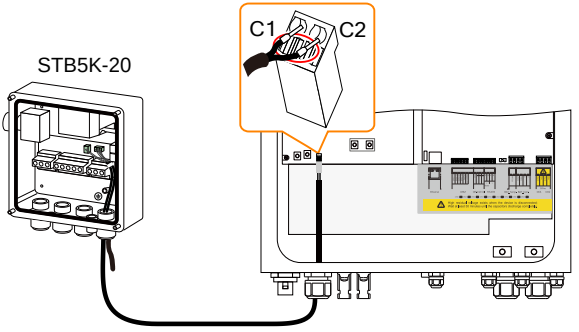
1. Unscrew the swivel nut from **Backup Ctrl** port.



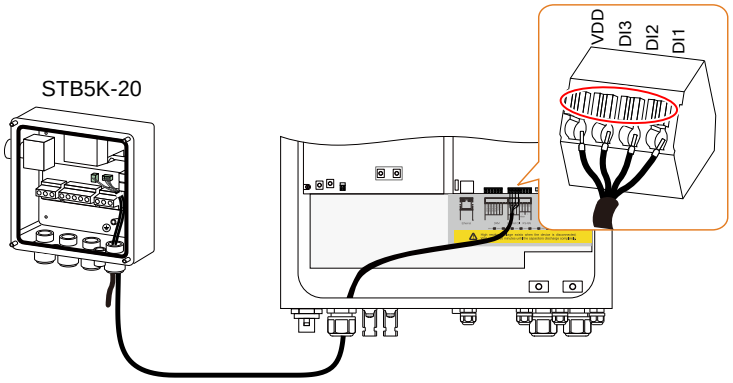
2. Lead the cable through the left hole.



3. Plug the wires of the control cable into terminals **C1** and **C2** without tool tightening.



4. Plug the wires of the DI cable into terminals **DI1**, **DI2**, **DI3** and **VDD** according to the marks without tool tightening, as shown below.



Note:

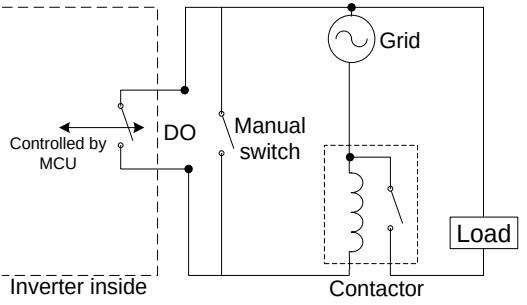
For reconnection, press the part as shown in the red circle so as to pull out the cable.

6.9 DO Connection

The inverter has two DO relays with different functions as follows:

- DO1: Consumer load control. Please choose the appropriate contactor according to the load power, e.g. the contactor types of the 3TF30 series from SIEMENS (3TF30 01-0X).
- DO2: Earth fault alarm

Relay	Trigger condition	Description
Consumer load control	The load control mode has been set via the LCD menu.	The relay is activated once the conditions of the control mode are satisfied. See "**10.4.10 Setting Load Control**".
Earth fault alarm	The earth fault occurs.	Once the inverter receives the earth fault signal, the relay closes the contact. The relay remains triggered until the fault is removed.



NOTICE

An AC contactor must be installed between the inverter and appliances. It is forbidden to connect the load directly to the DO port.

The current of the DO dry contact should not be larger than 3 A.

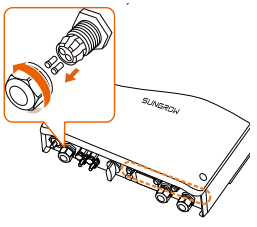
The DO node is not controlled once the inverter is powered off. Connect the AC contactor by the manual switch, so as to control the loads.

Cable Requirements

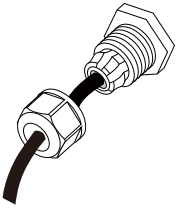
Cross-section: 1.0 mm², cable diameter: 3 mm–5.3 mm

Procedure:

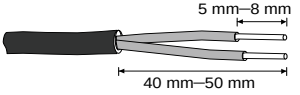
1. Unscrew the swivel nut from any **Com.** port.



2. Lead the cable through the cable gland.



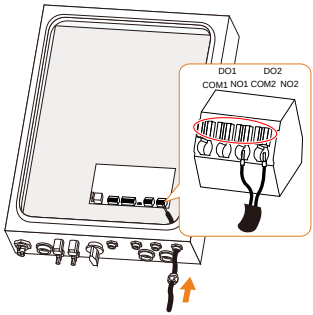
3. Remove the cable jacket and strip the wire insulation.



4. Plug the wires into **DO** terminals without tool tightening.

   Note:

   For reconnection, press the part as shown in the red circle so as to pull out the cable.



5. Fasten the swivel nut and connect the other end of the cable to the original edge of the AC contactor.

7 Commissioning

Commissioning is essential for the system, which can protect it against fires, injury and electric shock.

7.1 Inspection before Commissioning

Check the following items before starting the system:

1. All the installation sites are convenient for operation, maintenance and service.
2. Check and confirm that all devices are firmly installed.
3. Space for ventilation is sufficient for one inverter or multiple inverters.
4. Nothing is left on the top of the inverter or battery.
5. The inverter and accessories are correctly connected.
6. Cables are routed in a safe place or protected against mechanical damage.
7. The selection of the AC circuit breaker is optimal.
8. The terminals that are not used underneath the inverter are sealed.
9. Warning signs and labels are suitably affixed and durable.
10. For EPS application, check the cable connections of STB5K-20. Risk of inverter damage if the grid power wires are wrongly connected to the EPS LOAD terminals.

7.2 Button Introduction

The inverter offers four buttons for operation. Please refer to the following table before any operation of the inverter.

Tab. 7-1 Button Functions

Button	Description
▲	For navigating up or increasing the setting value.
▼	For navigating down or decreasing the setting value.
ESC	For navigating to the left, quitting the menu or canceling the settings.
ENT	For navigating to the right or confirming a selection or settings.

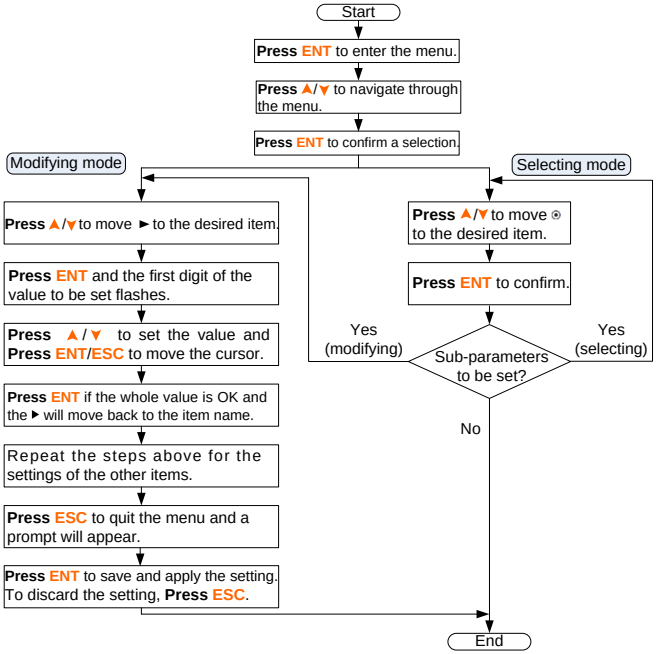
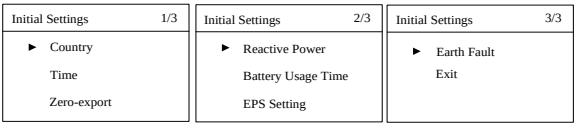


Fig. 7-1 Button Operations

7.3 Powering on the System

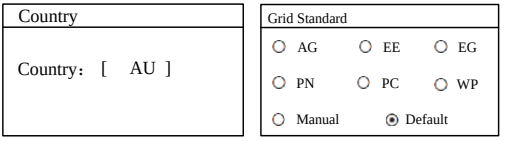
If all the items mentioned in section **7.1** are OK, proceed as follows to start the inverter for the first time.

1. Connect the AC circuit breaker.
2. Connect the DC circuit breaker between the inverter and the battery pack.
3. **(Optional)** Power on the battery pack manually if a battery is equipped.
4. Rotate the DC switch to “ON”. The DC switch may be integrated in the SH5K-20 or installed by the customer.
5. The LCD screen will be activated 5s later and enter the initial settings.



7.4 LCD Initial Settings

1. Set the country code. For the code “AU”, select the grid standard as shown in the following figures.



Tab. 7-2 Grid Standard Description

Grid company Code	Company
AG	AusGrid, NSW
EE	Ergon Energy, QLD
EG	Energex, QLD
PN	SA Power Networks,SA
PC	Powercor,VIC
WP	Western Power,WA
Default	Company not mentioned above

The values listed in the following table are for your reference only. Please follow the requirements of local grid standard.

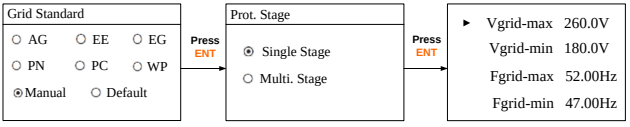
Tab. 7-3 Parameters of Grid Standards in Australia

Parameter	Default	AG	EE	EG	PN	PC	WP
Over-voltage							
1-V_{max} (V)	260.0	260.0	260.0	260.0	260.0	260.0	260.0
1-Time (s)	2.0	1.80	1.80	1.80	1.80	1.80	1.80
2-V_{max} (V)	265.0	265.0	265.0	265.0	265.0	265.0	265.0
2-Time (s)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Under-voltage							
1-V_{min} (V)	180.0	200.0	180.0	180.0	180.0	180.0	180.0
1-Time (s)	2.0	1.80	1.80	1.80	1.80	1.80	1.80
2-V_{min} (V)	180.0	200.0	180.0	180.0	180.0	180.0	180.0
2-Time (s)	2.0	1.80	1.80	1.80	1.80	1.80	1.80
Over-frequency							
1-F_{max} (Hz)	52.00	52.00	52.00	52.00	52.00	52.00	51.50
1-Time (s)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
2-F_{max}(Hz)	52.00	52.00	52.00	52.00	52.00	52.00	51.50
2-Time (s)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Under-frequency *							
1-F_{min} (Hz)	47.00	48.00	47.00	47.00	47.00	47.00	47.00
1-Time (s)	1.50	1.50	1.50	1.50	1.50	1.50	1.50
2-F_{min}(Hz)	47.00	48.00	47.00	47.00	47.00	47.00	47.00
2-Time (s)	1.50	1.50	1.50	1.50	1.50	1.50	1.50

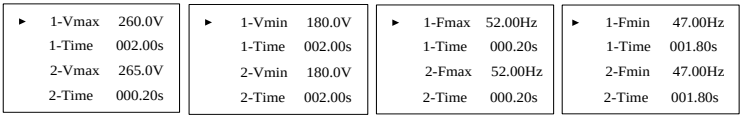
Parameter	Default	AG	EE	EG	PN	PC	WP
10-min voltage	255.0	255.0	255.0	257.0	258.0	255.0	258.0

* In New Zealand, the default value for under-frequency protection is 45.00 Hz, the others are the same as in Australia. Refer to **Tab. 10-5** for the parameter explanations.

Set the protective parameters if you choose “Manual” (single stage):



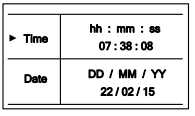
The multiple stage parameters are as follows.



2. Set the system time, which is very important and directly affects data logging.

   DD, MM, and YY stand for day, month, and year respectively.

   hh, mm, and ss stand for hour, minute, and second respectively.

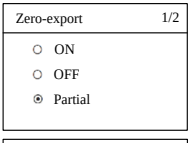


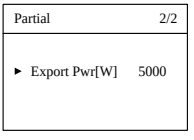
3. Zero-export setting

   ON: no power could be exported to the grid.

   OFF: all inverter output power could be exported to the grid.

   Partial: partial of the output power could be exported to the grid.





   Export power range:

   When the existing system is disabled: 0–5000 W

   When the existing system is enabled,

   − the lower limit is the rated power of the existing system; and
   − the upper limit is (5000 W + [rated power of the existing system]).
   − the value will synchronize with the settings for retrofitting an existing system described in section “**10.4.3 Adding the Existing System**”.

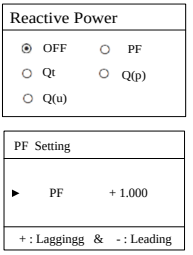
4. Reactive Power Regulation

OFF: The reactive power regulation function is disabled. The power factor (PF) is limited to +1.000.

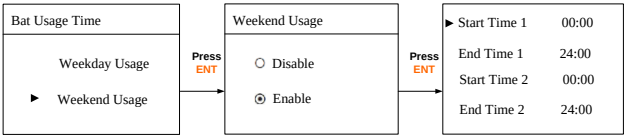
"**PF**" mode: The inverter is capable of operating with fixed power factor. The PF ranges from 0.8 leading to 0.8 lagging.

Leading: the inverter is sourcing reactive power to the grid.

Lagging: the inverter is sinking reactive power from the grid. For the explanations of other modes, see "**12.2 Reactive Power Regulation**".



5. Battery Usage Time

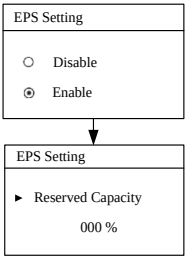


6. EPS Setting

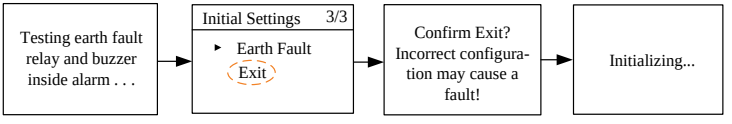
The off-grid function is disabled by default.

If the backup box STB5K-20 is installed, enable this function and set the reserved capacity for Li-ion batteries.

The reserved capacity is the on-grid minimum battery discharge level. The reserved battery capacity will be supplied to the emergency loads in the off-grid system.

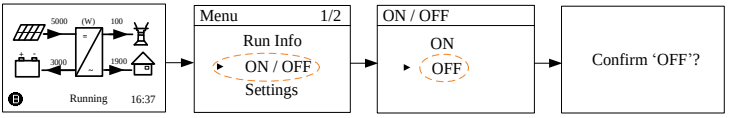


7. Test earth fault alarm and then automatically return to initial menu after 3 s. After successful commissioning, the LCD will enter the main screen.

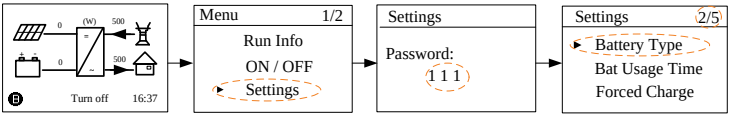


8. **(Optional)** For lead-acid batteries, you should manually set the battery type.

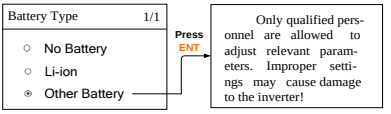
– Turn off the inverter via the LCD menu.



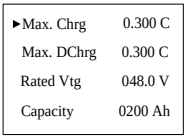
– Set the battery type to "Other Battery".



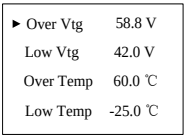
– Press ▲ / ▼ to select "Other Battery" and **Press ENT** to confirm.



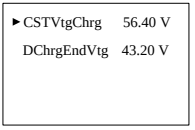
Max. Chrg / Max. DChrg:
Make sure that the charge or discharge current is not beyond the upper limit (65 A) to protect the battery from overcharging or deep discharging.
The unit ***C*** is the "capacity". If the max. charge or discharge is set to more than 65 A (e.g. C = 600 Ah, 0.3C = 180 A), then the inverter will limit the charge and discharge current to 65 A.



If the battery voltage or temperature is beyond the allowable range, the related error codes will be triggered and the protection function will be activated to stop charging or discharging.



DChrgEndVtg:
Stop discharging at a voltage not lower than DChrgEndVtg, so as to protect the battery from deep discharging.
The ***DChrgEndVtg*** setting value should be higher than the ***Low Vtg*** setting value.



Tab. 7-4 Parameter Description for Other Battery

Parameter	Description	Range
Max. Chrg	The upper limit of the charging current	0.05C to 2C
Max. DChrg	The upper limit of the discharging current	0.1C to 2C
Rate Vtg	The rated voltage of the equipped battery	30 V to 60 V
Capacity	Capacity of the battery tray	10 Ah to1000 Ah
Over Vtg	The upper limit of battery voltage when charging	48 V to 70 V
Low Vtg	The lower limit of battery voltage when discharging	32 V to 48 V

Parameter	Description	Range
Over Temp	The upper limit of battery temperature	20℃ to 70℃
Low Temp	The lower limit of battery temperature	-30℃ to 10℃
CSTVtgChar	The voltage of constant-voltage charging.	40 V to 63 V
DChrgEndVtg	The voltage at which the discharging is stopped	30 V to 53 V

*C is the “capacity”, which refers to the maximum amount of charge that a battery can store. Refer to the manufacturer’s specifications for details.

9. Check the icons on the main screen. Refer to **Tab. 10-1** for the explanations.
10. Check the state of the LED indicator.

Tab. 7-5 State Descriptions of the LED Indicator

Color	Status	Description
Green	On	The inverter is running normally.
	Blinking	The inverter is in the process of starting.
	Off	Other states except Running and Starting. (Refer to **Tab. 10-1** for state descriptions.)
Red	On	Permanent fault or upgrade failure.
	Blinking	Other system faults or main alarms.
	Off	No fault occurs.

11. Visit www.solarinfobank.com or SolarInfo Moni App to view inverter information. Get the related manuals at www.sungrowpower.com.

If the inverter commissioning fails, **Press** ▼ to view the current faults. Remove the existing malfunctions and then repeat starting up the inverter according to the procedure detailed in this section.

NOTICE

In the case of commissioning failure, power off the system and wait 1 minute to commission the system again.

7.5 Result Verification

Check the meter installation and connection, battery information and system time. For details, see **chapter 3.4** in the quick user manual.

8 Troubleshooting and Maintenance

8.1 Troubleshooting

8.1.1 Troubleshooting of LED Indicators

See "**Tab. 7-5 State Descriptions of the LED Indicator**" for the definition.

Fault Type	Troubleshooting
The LED indicator and LCD screen cannot be lit.	1. Disconnect the AC circuit breaker. 2. Rotate the DC Switch to "OFF". 3. Check the polarities of the DC inputs.
The LED indicator goes out.	1. Disconnect the AC circuit breaker. 2. Rotate the DC Switch to "OFF". 3. Check the electrical connection. 4. Check whether the DC input voltage exceeds the start voltage of the inverter. 5. If all of the above are OK, please contact SUNGROW.
The LED indicator is lit red.	1. A fault is not resolved. 2. Perform troubleshooting according to the fault type on the LCD screen. See "**8.1.2 Troubleshooting of the** Errors". 3. If it cannot be resolved, please contact SUNGROW.

8.1.2 Troubleshooting of the Errors

When faults occur, the "Fault" state will be shown on the main screen. **Press** ▼ to view all the fault information. For the detailed troubleshooting, see the chapter "***Troubleshooting of the Errors***" in the quick user manual.

- For the battery error codes, if all the conditions are OK but the fault still occurs, contact the distributor or the battery manufacturer.
- We need the following information to provide you with the best assistance: inverter type (e.g. string, central, grid-connected, hybrid, transformerless, single phase, triple phase, single MPPT, multiple MPPTs), or product name, serial number of the inverter, error code/name, and a brief description of the issue.

8.2 Maintenance

8.2.1 Routine Maintenance

Item	Method	Period
General state of the system	• Visual check for any damage or deformation of the inverter. • Check any abnormal noise during the operation. • Check each operation parameter. • Be sure that nothing covers the heat sink of the inverter.	Every 6 months
Electrical connection	Check whether there is damage to the cables, especially the surface in contact with metal.	6 months after commissioning and then once or twice a year.

8.2.2 Replacing the Button Battery

DANGER

Disconnect the inverter from the grid first, then the PV strings and the battery before any maintenance work.

Lethal voltage still exists in the inverter. Please wait at least 10 minutes and then perform maintenance work.

There is a button battery on the inner PCB board of the LCD. Contact the SUNGROW Service Dept. for replacement when the relevant fault alarm occurs.

Check the fastener, appearance, voltage, and resistance quarterly and annually.

9 System Decommissioning

9.1 Decommissioning the Inverter

NOTICE

Please strictly follow the following procedure. Otherwise it will cause lethal voltages or unrecoverable damage to the inverter.

Powering off the Inverter

1. Stop the inverter via the LCD menu. For details, see "**10.3 Starting and Stopping the Inverter**".
2. Disconnect the AC circuit breaker and secure against reconnection.
3. Rotate the DC switch to "OFF". The DC switch may be integrated in the SH5K-20 or installed by the customer.
4. Disconnect the DC circuit breaker between the battery and the inverter.

⚠ CAUTION

Risk of burn injuries and electric shock!

Wait at least 10 minutes after disconnecting the inverter from the utility grid and the PV input before touching any inner live parts.

NOTICE

Don't power on the system again until 1 minute after this disconnection.

5. Wait for about **ten** minutes until the capacitors inside the inverter have completely discharged.
6. Measure and ensure that no voltage is present at the AC output on the inverter.
7. Refer to "**6.4 Grid Connection**", disconnect the AC connector from the inverter in reverse procedure.
8. Release the locking part of DC connectors by pressing on the ribbing of the locking hooks with nipper pliers and pull it outwards.
9. Use the multimeter to measure the port voltage of the battery. Disconnect the power cables after the voltage is zero.

Dismantling the Inverter

Refer to **Chapter 5** and **Chapter 6**, dismantle the cables in reverse procedure. Remove the wall-mounting bracket from the wall if necessary.

Disposing of the Inverter

Users should take the responsibility for the disposal of the inverter.

NOTICE

Some parts and devices of the inverter, such as, LCD displayer, batteries, capacitors, may cause environment pollution.

Users must comply with the related local regulations to avoid the potential pollution.

9.2 Decommissioning the Battery

Decommission the battery in the system after the inverter is decommissioned, following the steps for a Li-ion battery or lead-acid battery below.

Decommissioning Li-ion Battery

1. Disconnect the DC circuit breaker between the battery and the inverter.
2. Disconnect the communication cable between the battery and the inverter.
3. **(Optional)** If the LG Li-ion battery or Pylon Li-ion battery is equipped, turn off the switch on the battery.
4. Wait about 1 minute and use the multimeter to measure the port voltage of the battery.
5. If the battery port voltage is zero, disconnect the power cables between the battery and the inverter.

Decommissioning Lead-acid Battery

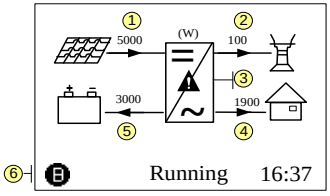
1. Disconnect the DC switch between the battery and the inverter.
2. Turn off the switch on the battery.
3. Disconnect all the cables between the battery and the inverter.

10 Appendix I: LCD Operation

Refer to **Fig. 7-1** for button operations when setting parameters.

10.1 Main Screen

After successful commissioning, the LCD screen will enter the main screen.



No.	Description
1	Current PV input power
2	Current export power
3	Warning information
4	Total load consumption
5	Battery charge/discharge power
6	System status bar

: The inverter and the SolarInfo Bank server are successfully connected.

Running: The inverter is in its normal running state.

16:37: Current system time.

Neither the grid power nor the load power will be displayed on the main screen in case of no SUNGROW meter installed.

If there is no button operation for:

- 1 minute, the LCD backlight is OFF;
- 2 minutes, system returns to the default menu (main screen).

Tab. 10-1 State Descriptions

State	Description
Running	After being energized, the inverter tracks the PV strings' maximum power point (MPP) and runs with the combination of the energy management system. This mode is the normal mode.
Maintain	The system is running normally, with the battery in maintenance process. (Only for lead-acid battery)

State	Description
Forced	The system is running normally, with the EMS in forced mode.
Ext. EMS	The system is running normally and is controlled by external EMS.
Standby	The inverter waits for sufficient sunlight or battery level, then the DC voltage recovers. The standby time can be set on the Webserver. Refer to **Chapter 11** for the introductions.
Turn off	The inverter will stop running by manual "OFF" through the LCD menu or with the DRM0 command from the DRED. Set to "ON" if you want to restart the inverter.
Startup	The inverter is initializing and synchronizing with the grid.
Upgrade	The DSP or LCD software is in its upgrading process.
Error	If an error occurs, the inverter will automatically stop operation, trigger the AC relay and show "Error" on the LCD with the indicator lit. Once the error is removed in recovery time, the inverter will automatically resume running. The recovery time can be set on the Webserver. Refer to **Chapter 11** for the introductions.
Off-grid	The system is disconnected from utility grid and runs as a stand-alone system.

NOTICE

If the device is in standby mode for more than 10 minutes, please check:

- **Whether the insolation is sufficient and the PV connection is correct.**
- **Whether the battery level is sufficient and the cable connection is correct.**
- **If no anomaly is found, disconnect the DC switch and the main switch to restart.**
- **If it still does not work, contact SUNGROW.**

10.2 LCD Menu

Abbreviations

Abbreviation	Complete	Abbreviation	Complete
Csmp	Consumption	Exp	Export
Chrg	Charge	Tot	Total
Bat	Battery	Tmp	Temperature
SOC	State of Charge	SOH	State of Health
Vtg	Voltage	Curr	Current
Stt	State	Inv	Inverter

Abbreviation	Complete	Abbreviation	Complete
Pwr	Power	Frq	Frequency
Cap	Capacity	DRM	Demand respond mode
Ver.	Version	Ref.	Reference
CSTVtgChrg	Constant charging voltage	MDCV	Max. discharging current value
DChrg	Discharge	MCCV	Max. charging current value
Prot.	Protection	Multi.	Multiple
Comm.	Communication	DChrgEndVtg	Final discharg voltage
Sys	System	En.	Enable

The following figure shows the menu of the LCD display.

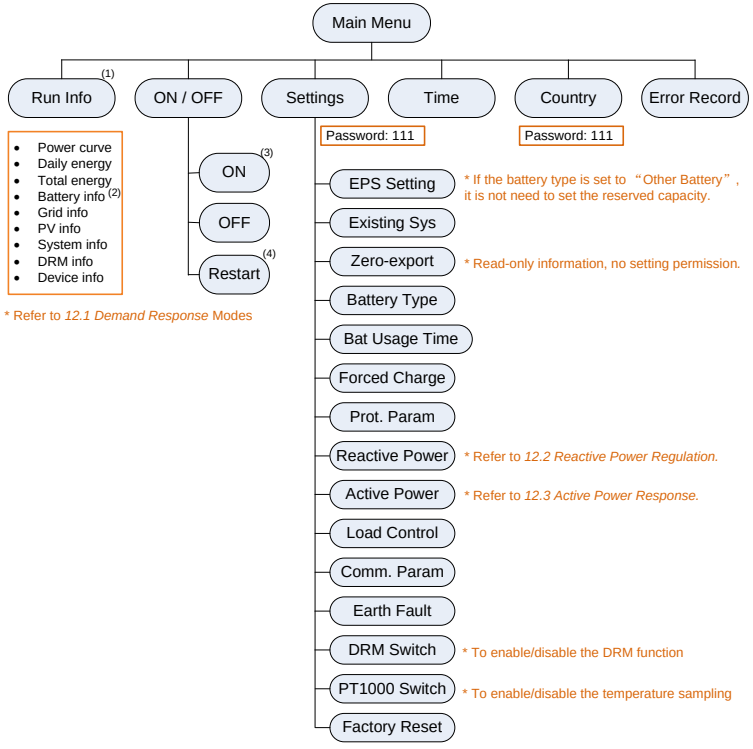


Fig. 10-1 LCD Menu Tree

(1) The power value indicated represents the average value during the time interval. The energy yields displayed are indicative only. For the actual

yields, please refer to the electric energy meter.

(2) The value of battery SOH will be displayed as "--" for GCL batteries that do not have this parameter. The SOC value for lead-acid batteries is for reference only.

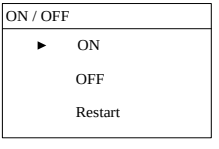
(3) The DRM0 state will prohibit the "ON".

(4) The "Restart" option will appear only if an unrecoverable fault occurs.

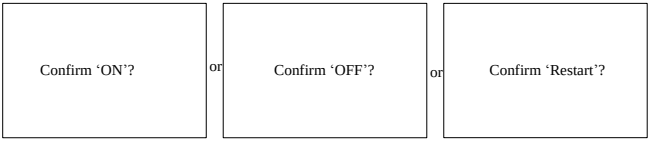
The demand response mode (DRM), reactive power settings about Qt, Q(p), Q(u), and power derating settings are valid only for Australia.

10.3 Starting and Stopping the Inverter

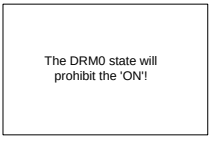
Notice:
The Restart item will appear only if an unrecoverable fault occurs.



Confirm your choice by pressing **ENT**.



When the DRM state is DRM0, the "ON" option will be prohibited.

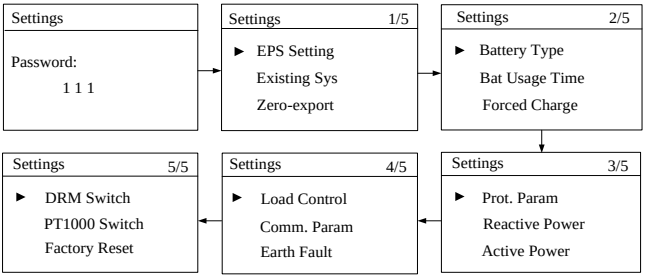


10.4 Advanced Settings

10.4.1 Inputting Password

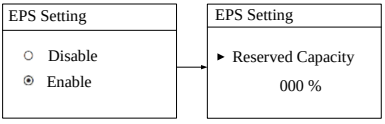
The parameter settings are protected with a password. If you want to set the inverter's parameters, you have to input the correct password.

Press ▲ to add the value and **Press ENT** to move the cursor to input the password **111**. **Press ENT** to confirm the password and enter the submenu.



10.4.2 Setting the EPS Function

The reserved capacity is the on-grid minimum battery discharge level. The reserved battery capacity will be supplied to the emergency loads in the off-grid system.



If the battery type is set to “Other Battery”, it is not need to set the reserved capacity.

If the EPS function is enabled, the buzzer inside the inverter will beep intermittently for 20 s when the battery level is lower than the threshold value specified in the following table.

Tab. 10-2 Threshold Values of Different Batteries

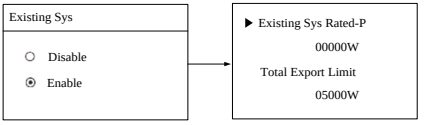
Battery Type	SOC Threshold
Sungrow (retrofitting system) / LG	≤ 6 %
BYD	≤ 11 %
GCL	≤ 16 %
Pylon (US2000B)	≤ 21 %
Lead-acid	≤ 45 V

10.4.3 Adding the Existing System

Existing Sys Rated-P: rated power of the existing system.

Total Export Limit: export power upper limit of the new system

- The lower limit is the rated power of the existing PV system.
- The upper limit is ([rated power of the hybrid inverter] + [rated power of the existing PV system]).

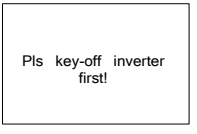


For example, retrofit an existing PV system (rated power: 3000 W) with SH5K-20 hybrid inverter (rated power: 5000 W). The total export limit can be set from 3000 W to 8000 W. The export power limit setting and zero-export setting are from the same source. If one is changed, the other will synchronize the value.

10.4.4 Setting the Battery Type

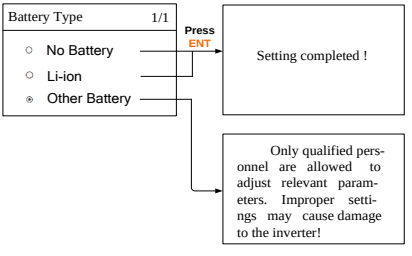
For Li-ion batteries, the type can be automatically identified and set to "Li-ion" on the LCD. Manually set the type to "Other Battery" for lead-acid batteries. Proceed as follows to modify the settings.

Refer to "**10.3 Starting and Stopping the Inverter**" to stop the inverter before modifying the battery type. Otherwise the warning screen will prompt.



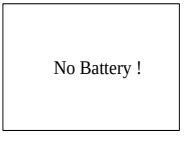
Press ▲/▼ to select and **Press ENT** to confirm.

For the parameters explanations for lead-acid batteries, see **Tab. 7-4**.



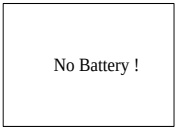
10.4.5 Setting the Battery Usage Time

When there is no battery equipped in the system, a prompt will appear.
For details, see **step 5** in **7.4 LCD Initial Settings**.

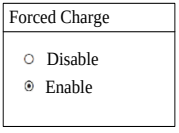


10.4.6 Setting Forced Charge

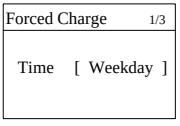
In the system without a battery, a prompt will appear.



Enable the function for the system with a battery.

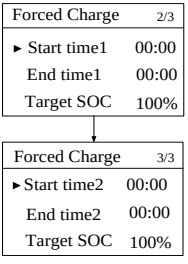


When there is no PV power, the import power from the grid charges the energy system during the time period until the target SOC is reached.



It is recommended to set the time period in off-peak tariff time. The time period 1 is in priority to the time period 2 if two periods overlap.

The charging energy comes from the excess PV energy in priority to the energy from the grid. The inverter will sink the charging power from the grid in the case of PV energy shortage.

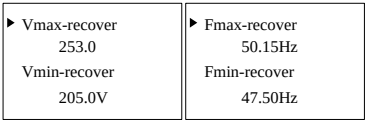


10.4.7 Setting the Protective Parameters

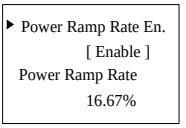
Protective parameters are designed for the threshold values that can trigger the protective function of the inverter. The threshold values are compliant with the requirements of local safety standards and the utility grid.

If the protection function is triggered, the inverter will automatically disconnect from the grid. In this case, the system can be automatically switched to off-grid running if the EPS setting has been enabled via the LCD menu. Otherwise the inverter will stop running with the ”Error” state displayed on the LCD main screen.

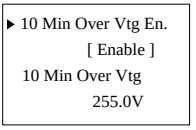
After the grid voltage or frequency recovers to the specified range, the corresponding error code displayed on the LCD will be cleared and the inverter will resume on-grid running.



Power Ramp Rate: the ramp up/down rate of power variation.
The power rate limit mode is enabled by default.
The default set-point is 16.67 % of rated power per minute.
Set to *Disable* to turn off the function.



The inverter will automatically disconnect from the grid within 3 s when the average voltage for a 10 min period exceeds the set-point of *10 Min Over Vtg*.
Set to *Disable* to turn off the function.



Tab. 10-3 Recovery Parameter Explanations

Parameter	Explanation	Default	Range
Vmax-recover	Recovery value for over-voltage fault. Inverter will start operating when the grid voltage falls below this value.	253.0 V	230.0 V–264.0 V
Vmin-recover	Recovery value for under-voltage fault. Inverter will start operating when the grid voltage is above this value.	205.0 V	184.0 V–230.0 V
Fmax-recover	Recovery value for over-frequency fault. Inverter will start operating when the grid frequency falls below this value.	50.15 Hz	50.00 Hz–53.00 Hz
Fmin-recover	Recovery value for under-frequency fault. Inverter will start operating when the grid frequency is above this value.	47.50 Hz	47.00 Hz–50.00 Hz
Power Ramp Rate	The ramp rate of power variation.	16.67 %	5 %–100 %
10 Min Over Vtg	Over-voltage protection value of 10-min average voltage	255.0 V / 248.0 V *	244.0 V–258.0 V

* The default value of 10 Min Over Vtg is 255.0 V for Australia (code “AU”) and 248.0 V for New Zealand (code “NZ”).

10.4.8 Setting Reactive Power Regulation

For details, see **step 4** in “**7.4 LCD Initial Settings**” and the section **“12.2 Reactive Power Regulation”**.

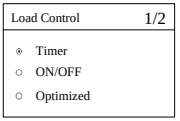
10.4.9 Setting Active Power Response

For details, see **“12.3 Active Power Response”**.

10.4.10 Setting Load Control

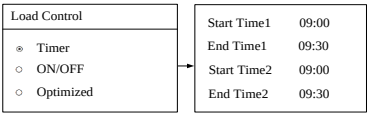
After connecting the load to the DO terminals, a relay control signal will be transmitted. Users can flexibly set the control mode via the LCD menu.

Press ▲/▼ to choose the control mode. **Press ENT** to confirm.



Timer Control

In this mode, set the Start time and End time, the system will control the load operation during the interval. Take 09:00 am–09:30 am as an example.



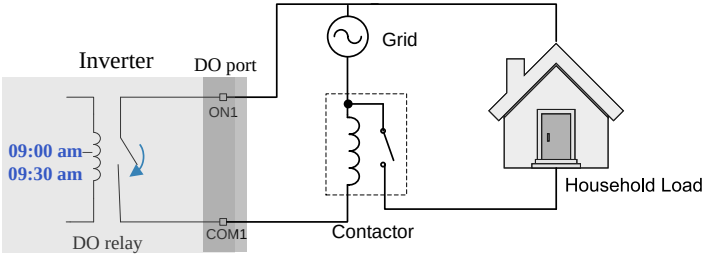
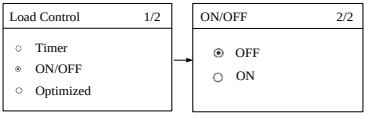


Fig. 10-2 DO Operation in Timer Control

ON/OFF Control

In this mode, the system will control the load operation according to the setting. Set to ***OFF*** in the following example.



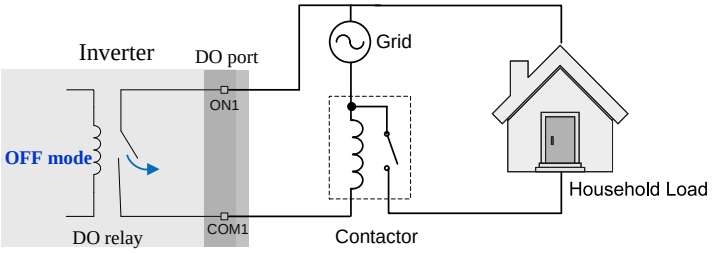
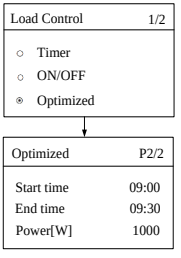


Fig. 10-3 DO Operation in ON/OFF Control

Optimized Control

The system will control the load operation according to the power optimization algorithm of energy management.

During the setting interval, the DO function will be enabled to power on the load if the excess PV energy exceeds the optimized power value.



Notice:

- The optimized mode is disabled in an off-grid system.
- When the existing system is enabled, the upper limit of optimized power is the sum of the rated power of the hybrid inverter and the rated power of the existing PV system.
- Once the optimized mode is enabled, the DO relay will not disconnect until 20 minutes after the DO connection.

Take 09:00 am–09:30 am and the optimized power of 1000 W as an example.

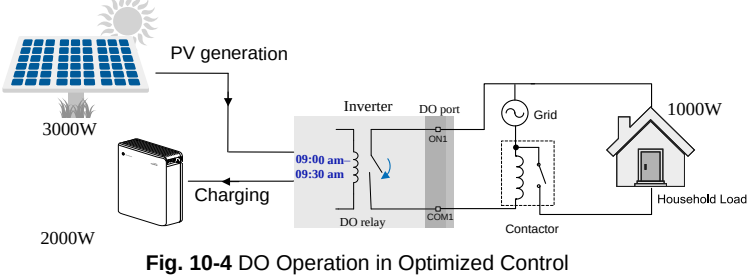
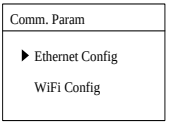


Fig. 10-4 DO Operation in Optimized Control

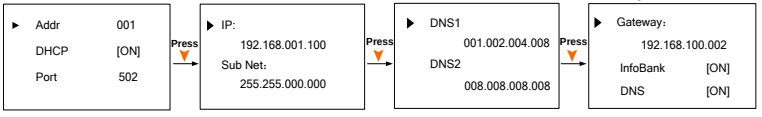
10.4.11 Setting the Communication Parameters

Ethernet:



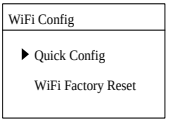
- The communication address ranges from 1 to 247.
- The IP, sub net, gateway, DNS1 and DNS2 can be modified only when the DHCP is set to OFF.

Acquire the IP, subnet mask, gateway, DNS1 and DNS2 from the network professional.



- Wi-Fi:

Quick Configuration: **Press ENT** to enable this function and then you can connect the inverter WiFi to your home router quickly with SolarInfo Moni APP.



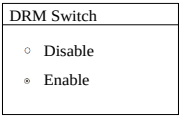
10.4.12 Testing Earth Fault

The DO2 relay will switch on automatically to signal the external alarm if a light indicator and/or buzzer is connected. The buzzer inside the inverter will also beep.

10.4.13 DRM Switch Setting

The DRM function to the DRED (demand response enabling device) is enabled by default.

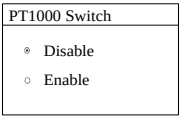
Set to *Disable* to turn off the function.



10.4.14 PT1000 Switch Setting

The temperature sampling function of the sensor PT1000 for lead-acid batteries is disabled by default.

Set to *Enable* to turn on the function.

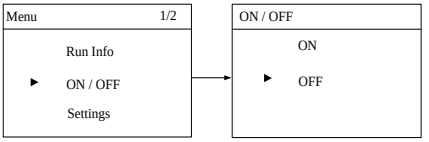


10.4.15 Factory Reset

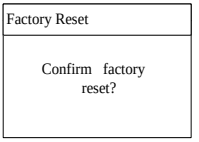
NOTICE

All history information will be irrecoverably cleared and all parameters will return to the default values except the protection parameters and time once the "Factory Reset" is performed.

Firstly, set the inverter to "OFF" via the LCD menu.



Enter the "Settings" menu and navigate to "Factory Reset". Press **ENT** to confirm.



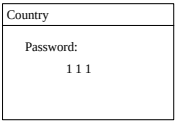
10.5 Setting the Time

For details, see **step 2** in "**7.4 LCD Initial Settings**".

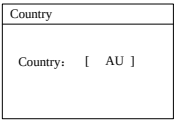
10.6 Setting the Country

The country setting is protected with a password. Each country code represents corresponding local protective parameters that have been preset before delivery.

Press ▲ and **Press ENT** to input the password **111**.
Press ENT to confirm the password.



Only the codes of GB, NL, BE, CN, SA, AU and NZ are supported. For the country code "AU", you should set the grid standard according to the description of **step 1** in "**7.4 LCD Initial Settings**".



Tab. 10-4 Descriptions of the country codes

Country Code	Full Name	Language
GB	Great Britain	English
DE	Germany	German
FR	France	French
IT	Italy	Italian
ES	Spain	English
AT	Austria	German
AU	Australia	English
CZ	Czech	English
BE	Belgium	French
DK	Denmark	English
GR_L	Greece Land	English
GR_IS	Greece Island	English
NL	Netherlands	English
PT	Portugal	English
CN	China	Chinese
SE	Sweden	English
US	America	English
SA	South Africa	English
NZ	New Zealand	English
Other	Country not included above	English

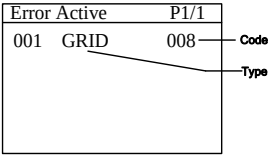
Tab. 10-5 Description of Multi. Stage Protective Parameters

Parameter	Explanation	Range
Max-V prot.	Over-voltage protection	
1-V_{max}	Grid over-voltage 1 (V>)	220 V–299 V
1-Time	Grid over-voltage 1 (V>) tripping time	0–600 s
2-V_{max}	Grid over-voltage 2 (V>>)	220 V–299 V
2-Time	Grid over-voltage 2 (V>>) tripping time	0–600 s
Min-V prot.	Under-voltage protection	
1-V_{min}	Grid under-voltage 1 (V<)	23 V–230 V
1-Time	Grid under-voltage 1 (V<) tripping time	0–600 s
2-V_{min}	Grid under–voltage 2 (V<<)	23 V–230 V
2-Time	Grid under–voltage 2 (V<<) tripping time	0–600 s
Max-F prot.	Over-frequency protection	
1-F_{max}	Grid over-frequency 1 (F>)	50.00 Hz–55.00 Hz
1-Time	Grid over-frequency 1 (F>) tripping time	0–600 s
2-F_{max}	Grid over-frequency 2 (F>>)	50.00 Hz–55.00 Hz
2-Time	Grid over-frequency 2 (F>>) tripping time	0–600 s
Min-F prot.	Under-frequency protection	
1-F_{min}	Grid under-frequency 1 (F<)	45.00 Hz–50.00 Hz
1-Time	Grid under-frequency 1 (F<) tripping time	0–600 s
2-F_{min}	Grid under-frequency 2 (F<<)	45.00 Hz–50.00 Hz
2-Time	Grid under-frequency 2 (F<<) tripping time	0–600 s

10.7 Viewing the Error Codes

Viewing Active Error

For the ⚠ icon or the "Error" state on the main screen, **press** ▼ to view the current faults. Refer to section **5.2** in the SH5K-20 quick user manual for error description and troubleshooting.

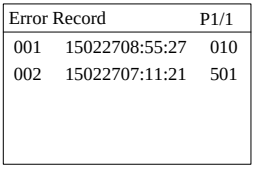


Refer to the following table for error type explanations.

Errer Type	Explanation
GRID	Grid faults (AC side)
PV	PV faults (DC side)
SYS	System errors (inverter)
PER	Permanent faults
WARN	Warnings
BDCF	Faults of battery charge/discharge circuit
BDCPF	Permanent faults of battery charge/discharge circuit
BATW	Battery warnings
BATP	Battery protection
BATF1	Battery faults
BATF2	

Viewing Error Record

Press ▲/▼ to turn pages and view all fault records.



11 Appendix II: Visiting and Configuring the Webserver

11.1 User and Authority

The Webserver provides user permission and installer permission:

The user permission (by default): the username is **user** and the password is **1111**.

Installer permission: Select the username **installer** through the drop-down list. The password is **2222**.

NOTICE

Abnormality may be caused if users make parameter modification with installer permission. This action will void any warranty rights.

Only one person can login to the Webserver at a time. Log out in time if you finish the visit. Wait until 4s later to log in again.

Follow the steps to login.

1. Query the inverter IP address according to the instructions in "**10.4.11 Setting the Communication Parameters**".
2. Open the browser. Input the inverter's IP address and press "Enter".
3. Select the username and input the corresponding password according to the visitor's role. Press "Sign in" or "Enter" to log in. The login window is shown below.

- If there is no operation for 10 minutes, the system will automatically return to the login interface.
- The figures in this chapter are all with an installer's permission.

11.2 Main Interface

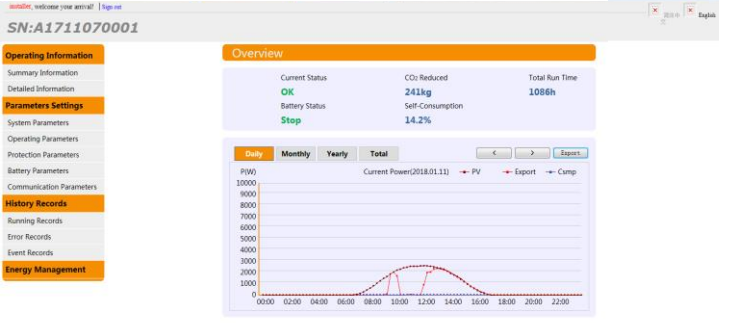


Fig. 11-1 Webserver Main Interface

11.3 Navigation Introduction

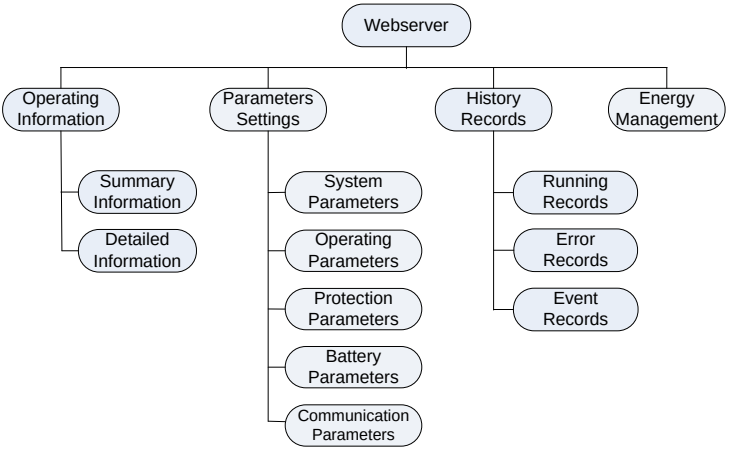


Fig. 11-2 Webserver Navigation

The default interface after login displays the read-only information. You can use the “Export” button to export data as a CSV file. The Serial Number (SN) of the running inverter is shown on the upper-left corner.

History records: 10 records in each page, 100 records at most.

Abbreviations

Abbreviation	Complete	Abbreviation	Complete
Vtg	Voltage	Ter-Vtg	Terminated voltage
Tmp	Temperature	Curr	Current
Chrg	Charge	Ter-Curr	Terminated current
Dischrg	Discharge	SOC	State of Charge
Bat	Battery	Max	Maximum
Emergcy	Emergency	Min	Minimum

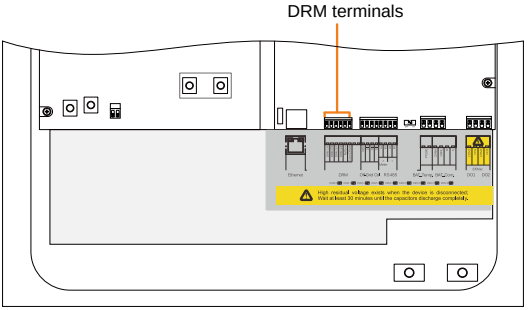
12 Appendix III: AS/NZS 4777 Compliant

The inverter supports the demand response modes, the reactive power regulation, and the power quality response, as specified in the standard AS/NZS 4777.

12.1 Demand Response Modes

12.1.1 Connecting the inverter to a DRED

The inverter has integrated a terminal block for connecting to a DRED. After the connection, the DRED assert DRMs by shorting together terminals as specified in **Tab. 12-1**.



The modes from DRM0 to DRM8 are supported by the inverter and the information is marked on the label located near the DRM terminals.

Tab. 12-1 Method of Asserting DRMs

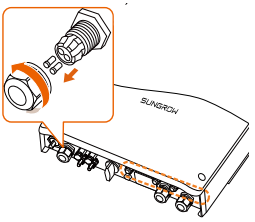
Mode	Asserted by Shorting Terminals
DRM0	RefGen or Com/DRM0
DRM1	1/5
DRM5	1/5 or RefGen
DRM2 / DRM6	2/6
DRM3 / DRM7	3/7
DRM4 / DRM8	4/8

The cable for connecting to the DRED is not included in the delivery.

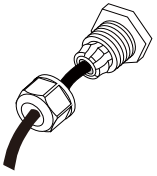
Use a TIA/EIA 568B standard network cable with a diameter of 3 mm–5.3 mm.

Procedure

1. Unscrew the swivel nut from any **Com.** port.



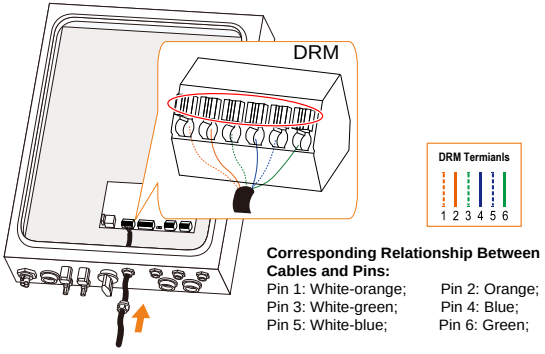
2. Lead the cable through the cable gland, as shown below.



3. Remove the cable jacket by 40 mm to 50 mm and strip the wire insulation by 5 mm–7 mm.
4. Plug the wires into the corresponding terminals without tool tightening, as shown below.

   Note:

   For reconnection, press the part as shown in the red circle so as to pull out the cable.



Corresponding Relationship Between Cables and Pins:

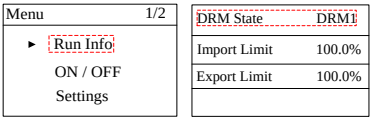
Pin 1: White-orange; Pin 2: Orange;
Pin 3: White-green; Pin 4: Blue;
Pin 5: White-blue; Pin 6: Green;

5. Fasten the swivel nut and connect the other end to the DRED.

12.1.2 Viewing the DRM State via LCD Menu

When the inverter is running with the demand respond commands, the DRM which is being performed by the inverter will be display on LCD screen.

In “Run Info” menu, **Press** ▲/▼ to turn to the page showing DRM information.



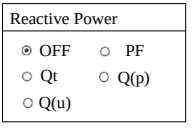
12.2 Reactive Power Regulation

NOTICE

Only qualified personnel can perform the power regulation settings.

All the parameter settings must comply with standard AS/NZS 4777.

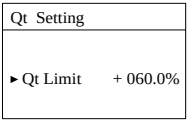
The submenu is as shown on the right.
Refer to “**10.2 LCD Menu**” for the navigation.
Press ▲/▼ to select the desired option and
Press ENT to confirm.



For the PF mode, see the reactive power regulation instruction in “**7.4 LCD Initial Settings**”.

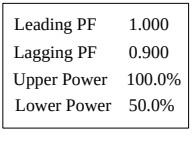
12.2.1 “*Qt*” Mode

Qt limit: the maximum ratio of reactive power to rated apparent power in %.
The Qt limit ranges from -60.0 % to +60.0 %.



12.2.2 “*Q(p)*” Mode

The PF of the inverter output varies in response to the output power of the inverter.



Tab. 12-2 “*Q(P)*” Mode Parameter Explanations

Parameter	Explanation	Default	Range
Leading PF	Power factor of the lower power point	1.000	0.900–1.000
Lagging PF	Power factor of the upper power point	0.900	0.900–1.000
*Lower Power**	Lower limit of the output power (in %)	50 %	0–50 %

Parameter	Explanation	Default	Range
*Upper Power**	Upper limit of the output power (in %)	100 %	50 %–100 %

*Lower Power <Upper Power

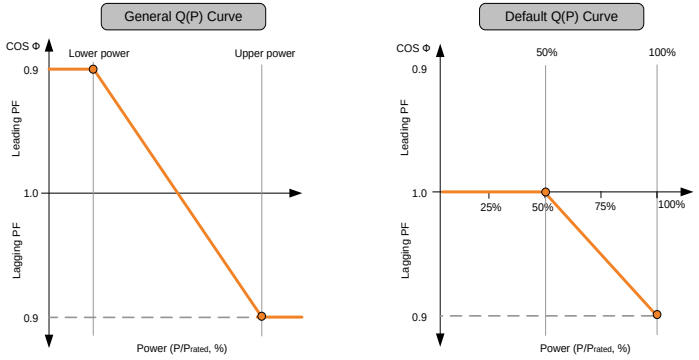
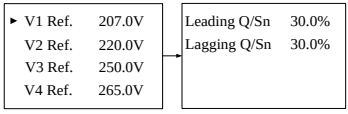


Fig. 12-1 Reactive Power Regulation Curve in Q(p) Mode

12.2.3 "*Q(u)*" Mode

The reactive power output of the inverter varies in response to the grid voltage.



Tab. 12-3 "Q(U)" Mode Parameter Explanations

Parameter	Explanation	Default		Range
		AU	NZ	
V1 Ref.	Grid voltage reference value 1	207.0 V	207.0 V	Not applicable
V2 Ref.	Grid voltage reference value 2	220.0 V	220.0 V	216 V–230 V
V3 Ref.	Grid voltage reference value 3	250.0 V	244.0 V	235 V–255 V
V4 Ref.	Grid voltage reference value 4	265.0 V	255.0 V	244 V–265 V
Leading Q/Sn	Q/Sn value of voltage *V1 Ref.*	30 %	30 %	0–60 %
Lagging Q/Sn	Q/Sn value of voltage *V4 Ref.*	30 %	30 %	0–60 %

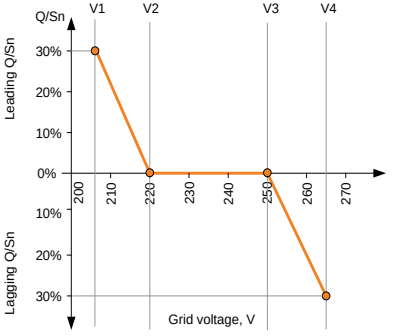
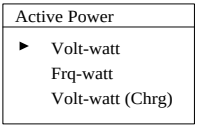


Fig. 12-2 Reactive Power Regulation Curve in Q(u) Curve ("AU" for example)

12.3 Active Power Response

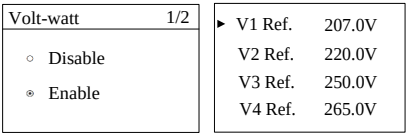
The submenu is as shown on the right.
Refer to "**10.2 LCD Menu**" for the navigation.

Press ▲/▼ to select the desired option and
Press ENT to confirm.



12.3.1 Volt-watt Response

The Volt-watt response mode is enabled by default. Set four grid voltage reference values. The output power of the inverter will vary in response to the grid voltages.



Tab. 12-4 "*Volt-Watt*" Mode Parameter Explanations

Parameter	Explanation	Default		Range
		AU	NZ	
V1 Ref.	Grid voltage reference value 1	207.0 V	207.0 V	Not applicable
V2 Ref.	Grid voltage reference value 2	220.0 V	220.0 V	216 V–230 V
V3 Ref.	Grid voltage reference value 3	250.0 V	244.0 V	235 V–255 V
V4 Ref.	Grid voltage reference value 4	265.0 V	255.0 V	244 V–265 V

The response curve is defined by the voltage reference values and corresponding power levels.

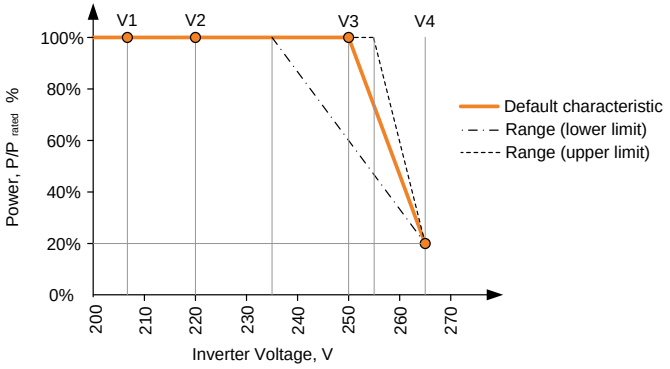


Fig. 12-3 Volt-Watt Response Curve (“AU” for example)

12.3.2 Volt-watt Response for Battery Charging

When the power from the grid is required to charge the energy storage system, the import power from the grid varies in response to the grid voltages. The response curve is defined by the voltage reference values and the corresponding power consumption from the grid for charging energy storage.

The Volt-watt response mode for battery charging is enabled by default.

Volt-watt (Chrg)	1/2
○ Disable	
◉ Enable	

Set four grid voltage reference values. The output power of the inverter will vary in response to the grid voltages. Refer to **Tab. 12-4** for the parameter explanations and ranges.

▸ V1 Ref.	207.0V
V2 Ref.	220.0V
V3 Ref.	250.0V
V4 Ref.	265.0V

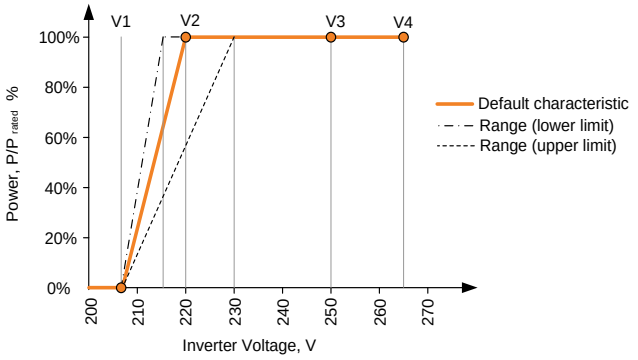


Fig. 12-4 Vtg-Watt Response Mode for Battery Charging Curve ("AU" for example)

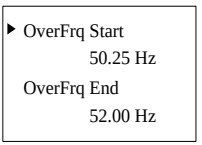
12.3.3 Frq-Watt Response

Tab. 12-5 Description of Frq-watt Parameters

Parameter	Description	Default	Range
OverFrq Start	The Start frequency value for over-frequency response	50.25 Hz	50.00 Hz–55.00 Hz
OverFrq End	The Stop frequency value for over-frequency response	52.00 Hz	50.00 Hz–55.00 Hz
UnderFrq Start	The Start frequency value for under-frequency response	49.75 Hz	45.00 Hz–50.00 Hz
UnderFrq End	The Stop frequency value for under-frequency response	49.00 Hz	45.00 Hz–50.00 Hz

Response to an increase in grid frequency:

When there is an increase in grid frequency which exceeds the Start value (*50.25 Hz*), the inverter will reduce the power output linearly with an increase of frequency until the End value (*52.00 Hz*) is reached.



When the frequency exceeds the End value, the inverter output shall be ceased (i.e. 0 W).

The output power will remain at or below the lowest power level reached in response to an over-frequency event between 50.25 Hz and 52 Hz. This is to provide hysteresis in the control of the inverter.

When the grid frequency has decreased back to 50.15 Hz or less for at least 60 s, the power level will be increased at a rate no greater than the power ramp rate limit, which can be set according to "**10.4.7 Setting the Protective Parameters**".

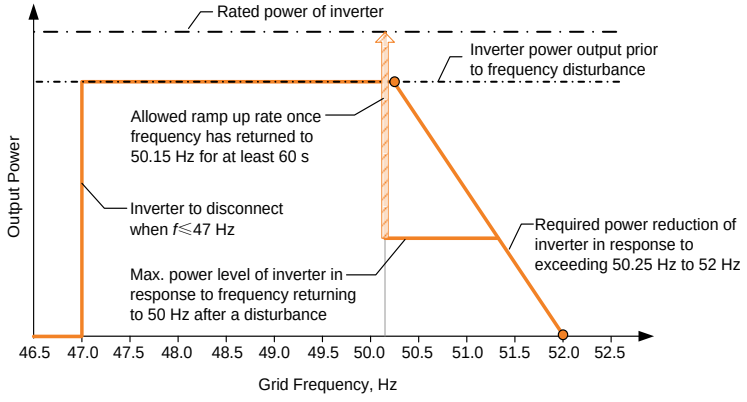
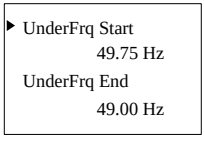


Fig. 12-5 Frq-Watt Mode for Over-frequency Conditions

Response to a decrease in grid frequency:



When there is a decrease in grid frequency which falls below the Start value (*49.75 Hz*), the inverter will reduce the sinking power from the grid linearly with a decrease of frequency until the End value (*49.00 Hz*) is reached.
When the frequency falls below the End value, the inverter should have ceased sinking power from the grid (i.e. 0 W).
The import power for charging the storage system will remain at or below the lowest charge rate reached in response to a low-frequency event between 49 Hz and 49.75 Hz. This is to provide hysteresis in the control of the inverter.
When the grid frequency has increased back to 49.85 Hz or more for at least 60 s, the charge rate of the storage system may be increased at a rate no greater than the power ramp rate limit, which can be set according to “10.4.7 **Setting the Protective Parameters**”.

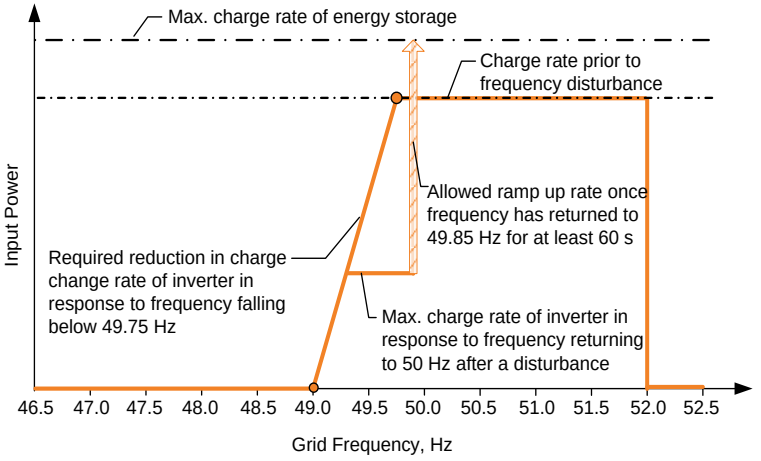


Fig. 12-6 Frq-Watt Mode for Under-frequency Conditions

13 Appendix IV: Technical Data

13.1 Inverter

PV Input Data	
Max. PV input power	6500 W
Max. PV input voltage	600 V
Startup voltage	125 V
Nominal input voltage	350 V
MPP voltage range	125 V–560 V
MPP voltage range for nominal power	240 V–520 V
No. of MPPTs	2
Max. number of PV strings per MPPT (DC1/DC2)	1/1
Max. PV input current (DC1/DC2)	22 A (11 A / 11 A)
Max. current for input terminals	24 A (12 A / 12 A)
Short circuit current of PV input	24 A (12 A / 12 A)
Max. inverter backfeed current to strings	0 A
Battery Data	
Battery type	Li-ion battery / Lead-acid battery
Battery voltage (rated voltage / range)	48 V (32 V–70 V)
Max. charging / discharging current	65 A / 65 A
AC Input and Output Data	
Nominal AC output power to grid	4990 W
Max. AC output apparent power to grid	5000 VA
Max. AC input power from grid	3000 W
Nominal AC output current	21.6 A
Max. AC output current	21.7 A
Max. inrush current (peak/duration)	10 A / 12 ms
Max. output fault current (peak/duration)	100 A / 3.2 ms
Max. output over-current protection	32 A
Nominal grid voltage	230 Vac
Grid voltage range	180 Vac–276 Vac (this may vary with grid standards)
Nominal grid frequency	50 Hz
Grid frequency range	45 Hz–55 Hz (this may vary with grid standards)

Total Harmonic Distortion (THD)	< 3 % (of nominal power)
DC current injection	< 0.5 % (of nominal current)
Power factor	> 0.99 at default value at nominal power (adj. 0.8 overexcited/leading–0.8 underexcited/lagging)
Protection	
Anti-islanding protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
DC fuse (battery)	Yes
DC switch (solar)	Optional
Over-voltage protection	III [Main], II [PV] [Battery]
System Data	
Max. efficiency	> 97.7 %
Max. European efficiency	> 97.2 %
Max. charge / discharge efficiency	> 94.0 %
Isolation method (solar)	Transformerless
Isolation method (battery)	HF
Ingress protection (IP) rating	IP65
Pollution degree outside/inside the enclosure	3 / 2
Operating ambient temperature range	-25℃ to 60℃ (derating when > 45℃)
Allowable relative humidity range	0–100 %
Cooling method	Natural convection
Max. operating altitude	2000 m
Display	Graphic LCD
Communication	2 x RS485, Ethernet, Wi-Fi, CAN
Power management	1 x Digital output
Earth fault alarm	1 x Digital output, email, buzzer inside
Analogue input	PT1000
DC connection type	MC4
AC connection type	Clamping yoke connector
Certification	AS4777, IEC 62109-1, IEC 62109-2, IEC 62477-1, IEC 62040-1, EN 61000-6-1/-3
Mechanical Data	
Dimensions (W x H x D)	457 mm x 515 mm x 170 mm
Mounting method	Wall-mounting bracket
Weight	22 kg

Backup Data	
Nominal voltage	230 Vac (± 2 %)
Total harmonic factor output	2 % (full resistive load)
Frequency range	50 Hz (±0.2 %)
Switch time to emergency mode	3 s
Power factor	0.8 overexcited/leading–0.8 underexcited/lagging
Max. output power	5000 W / 5000 VA
Max. output power (battery mode)	3000 W / 3000 VA

13.2 STB5K-20 (backup box)

Max. EPS power	5000 W
Max. output current for EPS port	25 A
Nominal AC voltage	230 Vac
AC voltage range	180 Vac–276 Vac
Nominal AC frequency	50 Hz
Operating ambient temperature range	-25℃ to 60℃
Power consumption	< 3 VA / 2 W
Dimensions (W x H x D)	220 mm x 230 mm x 90 mm
Mounting method	Wall-mounting bracket
Weight	2.6 kg

13.3 Energy Meter

Item	**Single-phase**	**Three-phase**
Nominal voltage	240 Vac	230 Vac / 400 Vac
Input voltage range	180 Vac–286 Vac	180 Vac–276 Vac
Power consumption	< 2 W (10 VA)	< 2 W (10 VA)
Max. operating current	100 A	65 A
Grid frequency	50 Hz	
Measurement accuracy	Class I	
Interface and communication	RS485	
Ingress protection rating	IP20	
Operating ambient temperature	-25℃ to 75℃	-25℃ to 70℃
Relative humidity	0–95 %	
Mounting method	35 mm DIN-rail	
Dimensions (W x H x D)	18 x 117 x 65 (mm)	85 x 72 x 72 (mm)

Weight	0.2 kg	0.4 kg

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