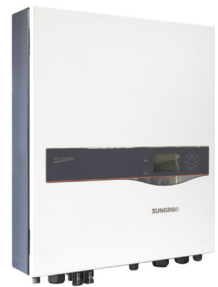# SUNGROW

User Manual

SH5K

Grid-Connected Hybrid Inverter

About This Manual

Applicability

This manual is applicable to the inverter type SH5K.

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.

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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
⚠ DANGER	Indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazard with a medium level of risk that, if not avoided, could result in death or serious injury.
⚠ CAUTION	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

There is a warning label on the inverter body.

⚠	Disconnect the inverter from all the external power sources before service!
⚡ 🕐 10 min	Do not touch live parts until 10 minutes after disconnection from the power sources.

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⚠ (hot surface symbol)	There is a danger from a hot surface that may exceed 60℃.
⚠ (high voltage symbol)	Danger to life due to high voltages! Only qualified personnel can open and service the inverter.
ℹ (read manual symbol)	Check the user manual before service!

⚠ 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 the PV connectors while the inverter is under AC loads! De-energize from all multiple 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.

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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 module;
- 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.

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2 System Solution

> ⚠️ **WARNING**
>
> **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 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.
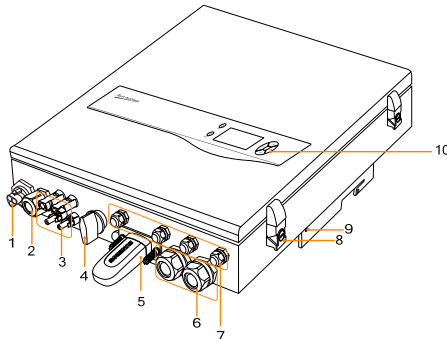
Fig. 2-1 Inverter Appearance

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.
3	PV connection	PV1+，PV1-，PV2+ and PV2-.
4	DC switch **(optional)**	To disconnect the DC current safely.
5	Wi-Fi terminal **(optional)**	To connect the Wi-Fi module.
6	Battery connection	BAT+ and BAT-.

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No.	Name	Description
7	Communication connection	RS485, Ethernet, CAN, AI, DO and DRM.
8	Hasp lock	To open/lock the enclosure lid.
9	Second PE terminal	For reliable grounding.
10	LCD display panel	Human-computer interaction interface.

The following figure shows the dimensions of the inverter.
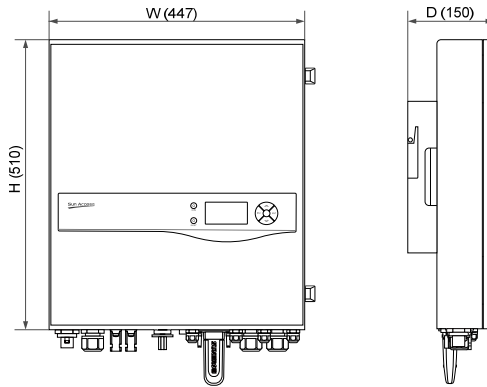
Fig. 2-2 Outline Dimensions (unit: mm)

The LCD display panel with two indicators and four buttons is on the front of the inverter.
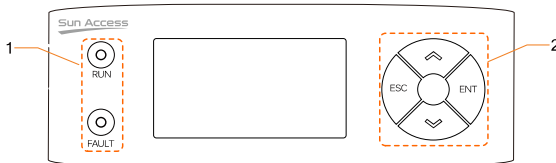
Fig. 2-3 LCD Display Panel

No.	Name	Description
1	LED indicators	"RUN" and "FAULT", from which user can know the current state. For detailed definition, see **Tab. 7-4**.
2	Buttons	User can operate the LCD menu via the four buttons. For detailed functions, see **Tab. 7-1**.

Meter

The SUNGROW single-phase energy meter is installed next to the main switch to measure the export power, grid voltage and current. It communicates with the inverter through an RS485 connection. The dimensions are shown below.

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18   65

BM15-11

117
35
45.3

Front view   Side view

Fig. 2-4 Meter Dimensions (unit: mm)
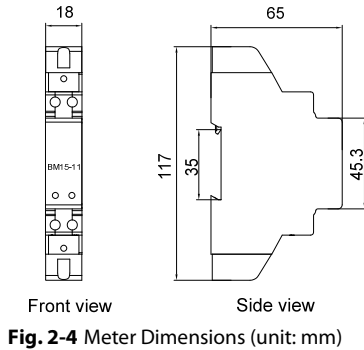
2.1   On-grid System

2.1.1   Conventional PV Grid-connected System

In a conventional Photovoltaic (PV) system, by setting the upper limit, the export power will always be within the specified range. For example, if the export power is set to zero, the system would be a zero-export system.

Export power   Output power   PV power

A   B   C   D

Load power

E
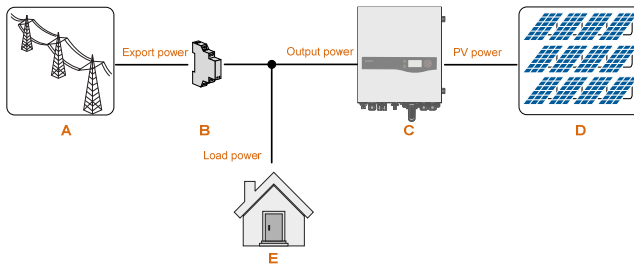
Fig. 2-5 Conventional PV System

Tab. 2-1 System Compositions

Item	Description	Remark
A	Utility grid	Grid earthing system types: TT, TN
B	SUNGROW single-phase energy meter	Measures the export power and communicate with the inverter via the RS485 port.
C	Inverter	SH5K.
D	PV strings	Monocrystalline silicon, polycrystalline silicon, and thin-film without grounding.
E	Household load	Devices that consume energy.

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> **NOTICE**
>
> **For the TT utility grid, the N line voltage to ground must be less than 30 V.**
>
> **Do not connect local loads (home appliances, lights, motor loads, etc.) between the inverter and the AC circuit breaker.**

2.1.2 PV Energy Storage System (PV ESS)

With a battery module for the immediate storage of energy, the conventional PV system can be upgraded to be a PV ESS.
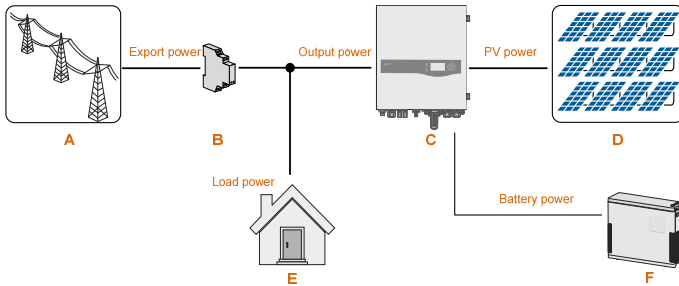
* Refer to **Tab. 2-1** for the descriptions of items *A, B, C, D* and *E*. The item *F* is a Li-ion battery or a lead-acid battery.

Energy Management in a PV ESS

During daytime:

- The PV power generation provides electricity to the loads.
- The inverter starts to charge the battery once the output power is above zero.
- When the energy demand of the active loads exceeds the current power of the PV system, the battery will discharge and provide the energy shortfall.

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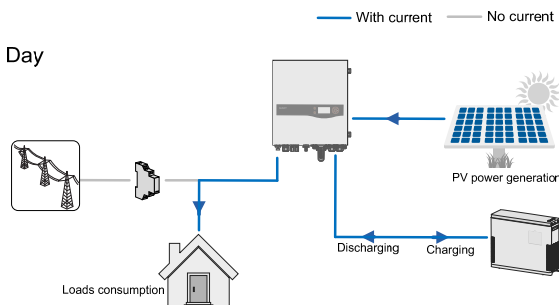
During night:

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

Night

With current — No current

Loads consumption

Discharging

Night (empty battery)

Loads consumption
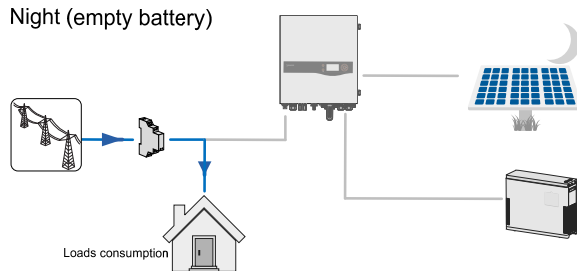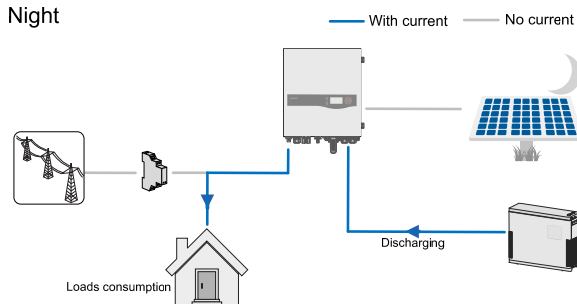
When the meter or battery is abnormal:

- the inverter can run normally;
- the export power monitoring will be performed by the inverter instead of the meter;
- the DO function of optimized mode will be disabled;
- the battery can be charged if its SOC is normal, but not allowed to discharge.

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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.**

With the backup box STB5K 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 to switch the system from on-grid to off-grid.
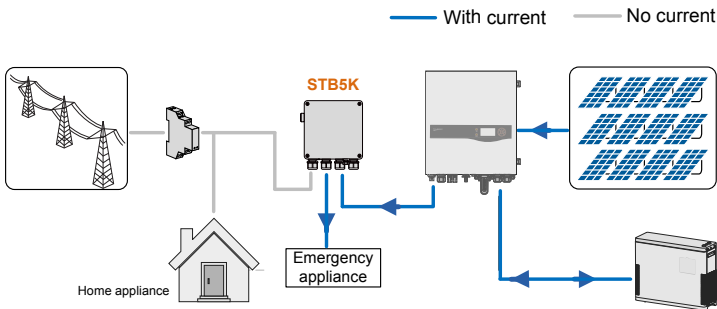
Fig. 2-6 Inverter Application in an Off-grid System

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 "**6.7 STB5K Connection (Off-grid)**" for cable connections and "**10.7.4 Setting Off-grid Backup SOC**" for the LCD settings.

2.3   Retrofitting the Existing PV System

The SH5K 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.

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, the self-consumption of the new system will be greatly improved.
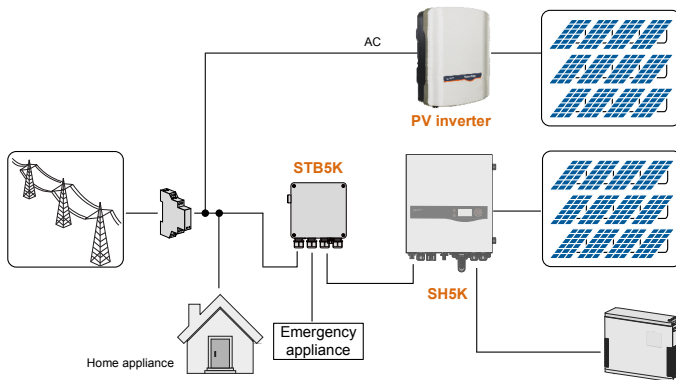
Fig. 2-7 Retrofitting the Existing PV System

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

The existing PV inverter provides power to the SH5K PV ESS, as the power flow shown on the main screen.

Refer to "**10.7.11 Adding the Existing System**" to set the rated power of the existing PV inverter.
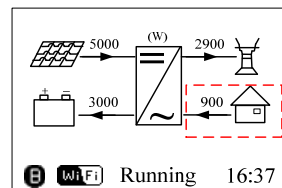
The output power of the existing PV inverter may be taken into consideration for export power setting. For detailed settings, see "**10.7.3 Setting the Zero-export Function**".

3 Function Description

3.1 Safety Function

3.1.1 Protection

The basic protective functions can be grouped as follows.

- short circuit protection;
- insulation resistance detection;
- inverter output voltage monitoring;
- inverter output frequency monitoring;
- residual current monitoring;
- DC injection of AC output current surveillance;
- anti-islanding protection;
- environment temperature monitoring;
- DC over-voltage protection;
- DC over-current protection; and
- power module over-temperature protection.

3.1.2 Earth Fault Alarm

The inverter has integrated an earth fault dry-contact (DO2 relay) for the local alarm. The 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.

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3.2 Energy Conversion and Management

The inverter circuit inside converts the DC power from the PV array 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.

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$$P_{[Vmin...266V]} = Pn \times (Vgrid/230V)$$

The following figure shows the under-voltage derating curve.
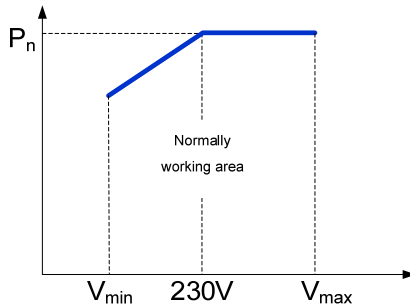
Fig. 3-1 Grid Under-voltage Derating

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.
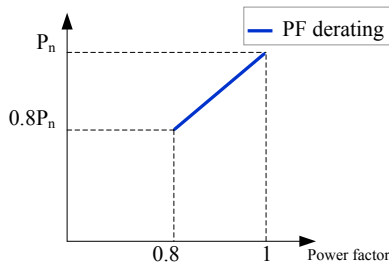
Fig. 3-2 Power Factor Derating

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**".

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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 "Key-stop".
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 reference voltage values. The inverter power output or input will vary in response to the voltage curve.

- *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 frequency and an end 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 "**6.8 DO Connection"** for the cable connection.

User may set the control mode according to individual demand. Refer to "**10.7.7 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 SH5K PV ESS.

- Li-ion battery from Samsung, LG Chem, GCL or Pylon.

- Lead-acid battery from Narada (which has a pre-set setting) or others (which require manual configuration, and can be selected by the customer).

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

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State Definition

In order to avoid overcharging or deep discharging of the battery, distinguish four battery states according to different voltage ranges. Each battery of different types can configure the status according to its own requirements, e.g. state of charge (SOC), as shown in the following table.

Tab. 3-2 Battery State Definition

Type	Port Voltage/SOC			
	Damaged	**Empty**	**Normal**	**Full**
Samsung (BM3K)	<30 V	SOC<20%	20%...99% (by default)	SOC>99%
LG (RESU G1/G2)	<30 V	SOC<15%	15%...95% (by default)	SOC>95%
GCL	<30 V	SOC<15%	15%...95% (by default)	SOC>95%
Pylon (US2000A/US2000B)	<30 V	SOC<20%	19%...97% (by default)	SOC>99%
BlueSun	<30 V	SOC<15%	15%...100% (by default)	SOC=100%
Narada lead-acid	<30 V	30 V–40 V	40 V–56.4 V	>56.4 V
Other lead-acid	<30 V	Configured by the customer		

3.3.1 Charge Management

Emergency Charge Management

To avoid the damage caused by long time excessive discharge, the inverter will enter emergency charge management and cannot respond to discharge during emergency charge.

For the lead-acid battery, if the battery voltage is under the lower limit, the system will enter emergency charge management.

The following table describes the emergency charge of different types of batteries.

Tab. 3-3 Emergency Charge Description

Type	Trigger Condition	Finishing Condition
Samsung (BM3K)	The battery management system (BMS) initiates the request of emergency charge.	The battery voltage is ≥42 V.
LG (RESU G1/G2)	SOC≤7%	SOC≥9%
GCL	SOC≤12%	SOC≥14%
Pylon (US2000A/US2000B)	SOC≤10%	SOC≥15%

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Type	Trigger Condition	Finishing Condition
BlueSun	SOC≤8%	SOC≥12%
Lead-acid	The battery voltage is lower than the lower limit of under-voltage. (42 V by default)	The battery voltage rises to the setting value of under-voltage protection value.

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.

> ℹ️ If the PV voltage is higher than the upper limit value of MPP voltage 560 V, the battery cannot charge or discharge.

3.3.2 Discharge Management

Discharge management can effectively protect the battery from deep discharging.

The maximum allowable discharge current of battery is mainly limited to the following factors:

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

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.

Follow the steps to complete the maintenance.

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 2 A, end the maintenance.

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3.3.4 Battery Temperature Sensor (PT1000)

SH5K has integrated a PT1000 temperature sampling port for lead-acid batteries. With the external PT1000 installed, SH5K 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℃ to +60℃, with a sampling accuracy of ±2℃. The protective temperature of lead-acid battery ranges from -25℃ to +60℃ 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 "**10.7.14 PT1000 Switch Setting**" to enable the function via LCD menu.

3.4 Communication and Configuration

- Communication interfaces

The inverter provides various ports for device and system monitoring, including RS485, Ethernet, Wi-Fi, and CAN.

- Parameter configuration

The inverter provides various parameter configurations for optimal operation.

- Data storage and display

The inverter stores running information and fault records. They are displayed 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.
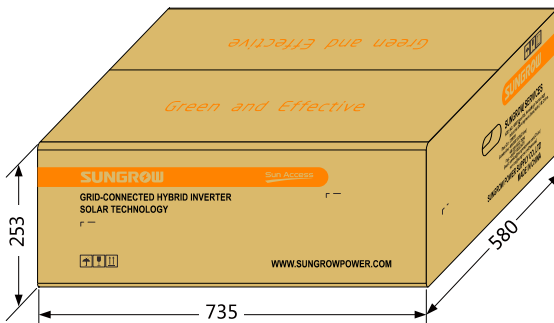
Fig. 4-1 Single Inverter in Original Packaging Carton (unit: mm)

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4.2   Delivery Contents
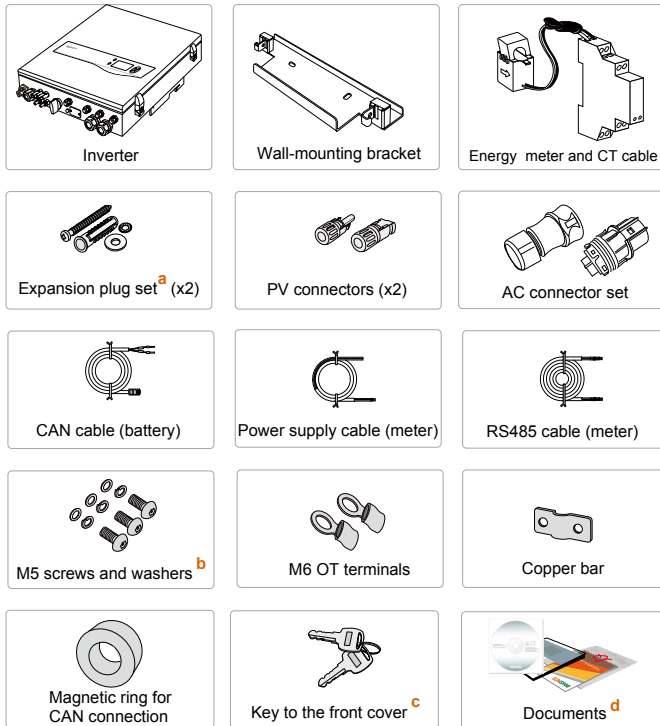
Fig. 4-2 Delivery Contents

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

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

c)   Only qualified personnel are allowed to use the key.

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

4.3   Identifying the Inverter

The nameplate clearly identifies the product. It is located on the side of the enclosure.
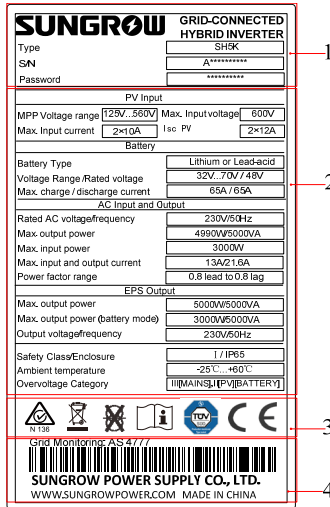
Fig. 4-3 Inverter Nameplate

Item	Description	Item	Description
1	SUNGROW logo and product type	3	Marks of certification institutions
2	Technical data	4	Barcode, grid standard, company name, website and origin

Tab. 4-1 Description of Icons on Nameplate

Icon	Description
	C-tick mark of conformity.
	Do not dispose of the inverter together with household waste.
	The inverter does not have a transformer.
	Refer to the corresponding instructions.

Icon	Description
	TUV mark of conformity.
	CE mark of conformity.

4.4   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℃ and +85℃, and the storage relative humidity should be always between 0% and 100%.

The following figure shows the storage of the inverter.
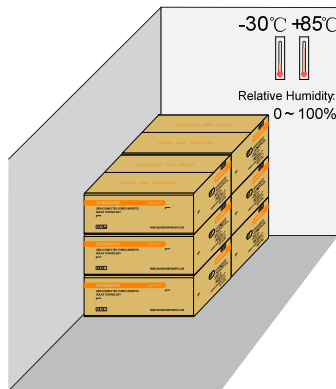
Fig. 4-4 Example of Inverter Storage

> **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

5.1 Safety and Location Requirements

> **⚠ 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.**

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℃. The following figure shows the ambient temperature and relative humidity limits.

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Max. +60°C   Min. -25°C   Max. RH +100%
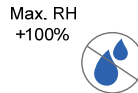
5.   The location should be away from flammable materials or gas, and not enclosed.

Flammable wall   Flammable material or gas near the installation   Closed Cabinet
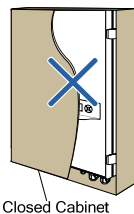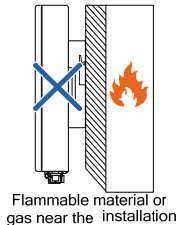
6.   The shaded side of the building would be better to prevent the inverter from exposure to the sun, rain, and snow.

Direct sunlight   Direct rain fall   Snow accumulation
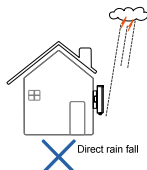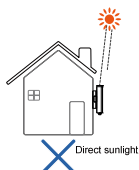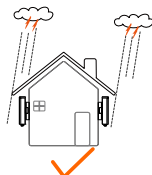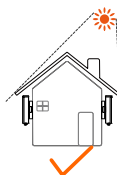
7.   Place at eye level for easy operation and reading:

8.   Install vertically for good heat dissipation.
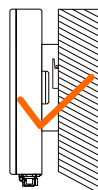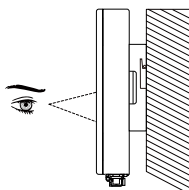
9.   Never install the inverter horizontally, or with a forward tilt or with a backward tilt or even with upside down. The horizontal installation could result in damage to the inverter.

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Forward tilt   Backward tilt   Horizontally   Upside down
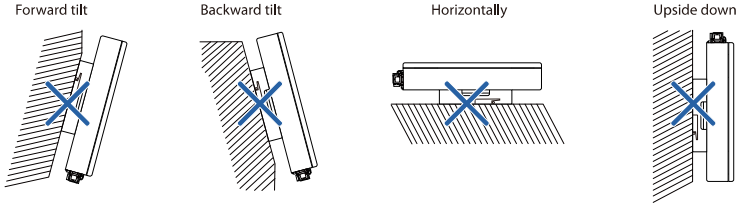
10.   Clearance requirement and multiple installation:

300mm
300mm   300mm
300mm
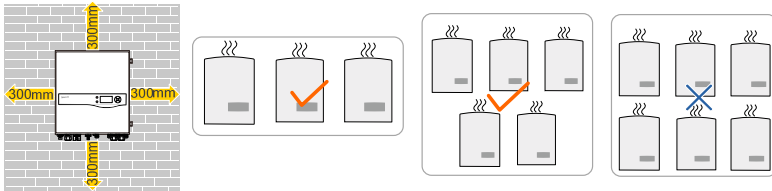
5.2 Installing the Inverter

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.

Mark the positions   Drill holes

240 mm   D10
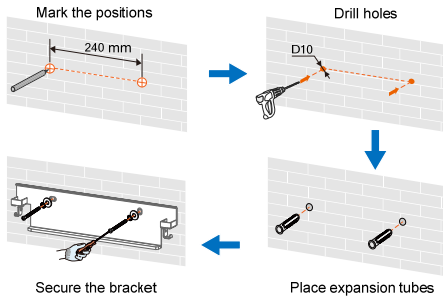
Note:

(1) The depth of the holes should be about 70 mm.

(2) Be sure to adhere to the following screw assembly sequence: self-tapping screw, spring washer, fender washer, bracket.

Secure the bracket   Place expansion tubes

2.   Mount the inverter to the bracket.

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

SUNGROW
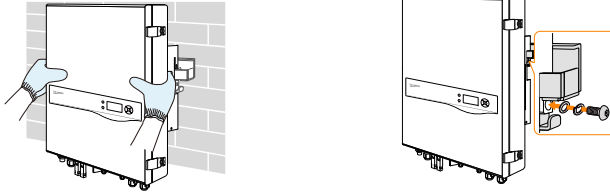
5.3   Grounding the Inverter

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.
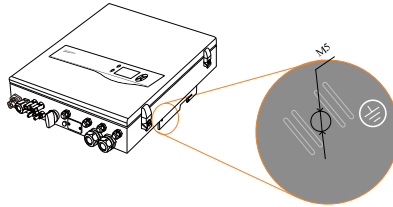
Fig. 5-1 Second PE Terminal

⚠️ 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 rights may follow if otherwise.

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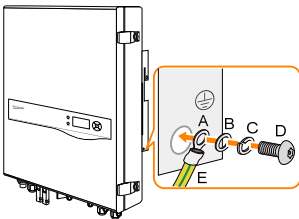
Item	Description	Specification
A	Cable socket	-
B	Washer	-
C	Spring washer	-
D	Screw	M5×12 mm (3.0 N·m)
E	Yellow-green cable	6–10 mm^2 copper wire or 10–16 mm^2 aluminum wire

5.4   Installing the Meter

The SUNGROW meter should be installed between the grid and the load. It supports a 35 mm DIN-rail installation, as shown in the following figure.
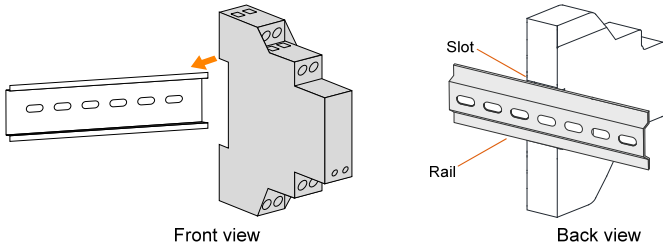
Fig. 5-2 Installing the Meter to the Rail

6 Electrical Connection

This chapter mainly describes the cable connections of the system.

> ⚠ **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
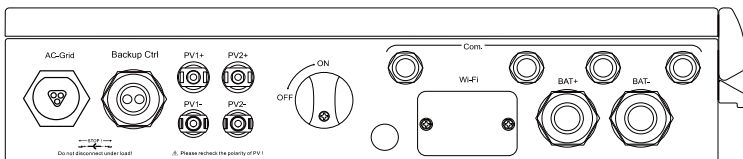
Fig. 6-1 Terminals at the Bottom of the Inverter

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.
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:
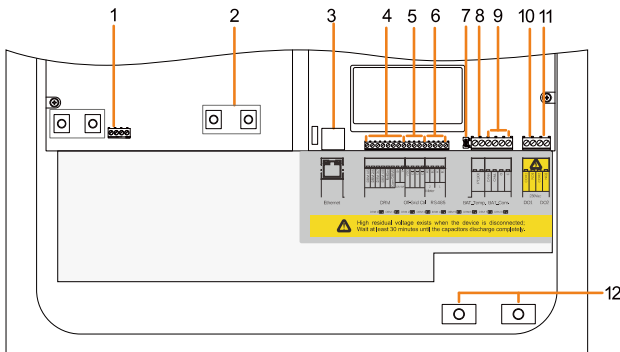
Fig. 6-2 Configuration Circuit Board Inside the Inverter

No.	Label	Connection	Tool Requirements
1	C1, C2	Backup box STB5K	Flat-head screwdriver with an open end of 3 mm
2	Copper	PV (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	
6	RS485	A1, B1 for the battery, 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	
11	DO2	Earth fault alarm	
12	BAT+, BAT-	Battery	Phillips screwdriver

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6.2 Meter Connection

The SUNGROW single-phase energy meter should be installed next to the main switch.
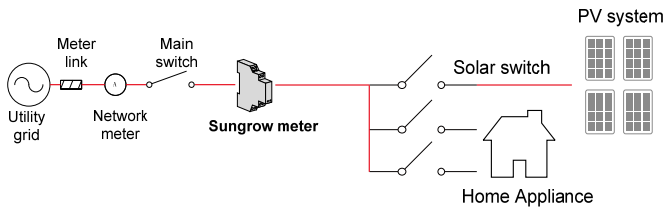
Procedure

1. Take out the meter (with 1-phase sensor) and the cables from the packaging.

Power supply cable   RS485 cable
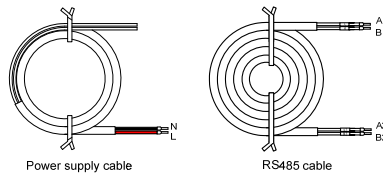
2. Connect the cables to the meter.

    (a) Tighten the power supply wires to terminal **3 (L)** and terminal **6 (N)**.

    (b) Tighten the RS485 wires to terminal **2** and terminal **5**.

    (c) Place the 1-phase sensor around the phase wire (**L**) from the main switch.
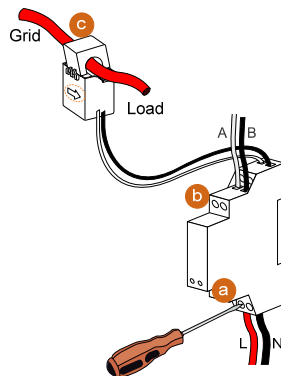
NOTICE

Make sure that the 1-phase sensor is installed in the right direction: the arrow on the sensor must point away from the grid towards the load.

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

1. Open the enclosure lid.
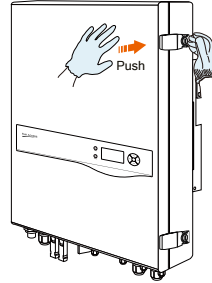
2. Unscrew the swivel nut from any **Com.** Port.
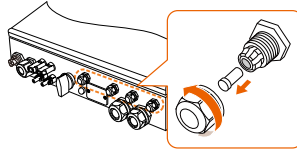
3. Lead the cable through the cable gland.

4. Connect the wires to terminals **A2** and **B2** on the inverter.
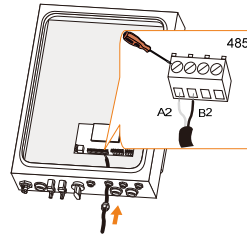
5. When the length of RS485 cable is longer than 100 m, push the 120ohM **(2)** switch to "**ON**" to ensure stable communication, as shown below.
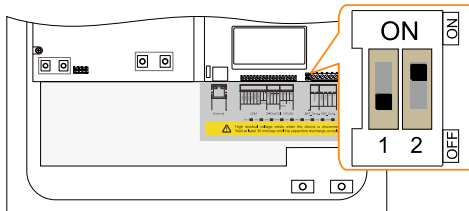
6.3   Grid Connection

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 mm², cable diameter: 10 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.

6.3.2 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.
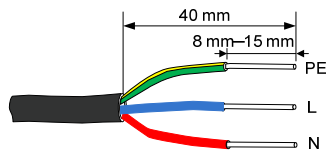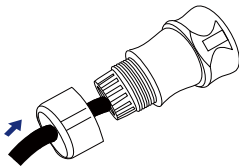
3.   Fully insert the conductors to the corresponding terminal and tighten the screws with the torque 1.2 N·m. Pull cables outward to check whether they are firmly installed.
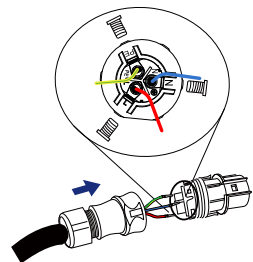
NOTICE

Observe the terminal layout of terminal block.

Do not connect the phase lines to "PE" terminal, otherwise the inverter will not function properly.

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.
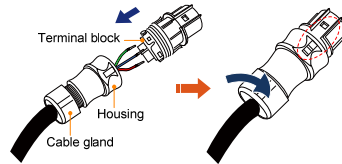
6.3.3 Installing the AC Connector

Procedure:

1. Install an AC circuit breaker (recommended specification 32 A) between the inverter and the AC grid.

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.
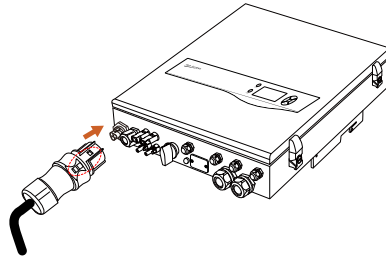
4. Connect the other ends. Connect "PE" conductor to the grounding electrode. Connect "L" and "N" conductors to the AC circuit breaker.

5. Connect the AC circuit breaker to the utility grid. Pull all the lines outward to check whether they are firmly installed.

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6.4   PV Connection

> ⚠ **WARNING**
>
> **Before connecting the PV array to the inverter, ensure that the impedances between the positive terminals of the PV string and Earth, and between the negative terminal of the PV string and Earth are larger than 200 Kohm.**

6.4.1 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.
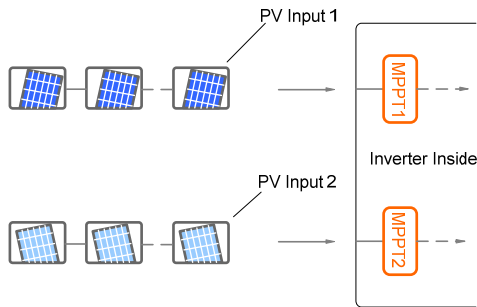
> ℹ To maximize the PV string power, PV strings connected to individual input area should have a homogenous structure, i.e. the same type, the same number, the same identical tilt and identical orientation.

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

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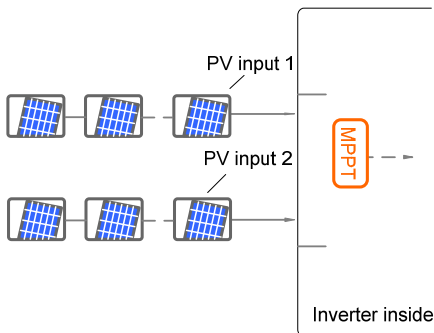
Prior to connecting the inverter to PV inputs, the specifications in the following table should be met:

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

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

6.4.2 Connecting the Inverter to the PV Array

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	3 mm–6 mm	600 V	Same as short circuit current.

SUNGR⊘W

Assembling the PV Connector

1.   Strip the insulation from the cables   2.   Assemble the cable ends by
        by 7 mm–8 mm.   crimping pliers.
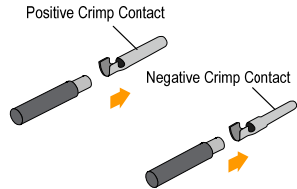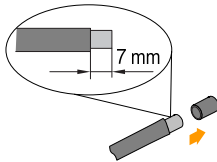
3.   Lead the cable through the cable gland to insert into the insulator until it
        snaps into place. Then tighten the cable gland (torque 2.5 N·m–3 N·m).
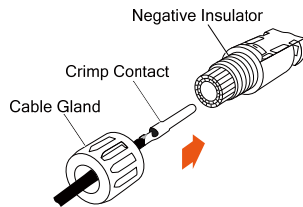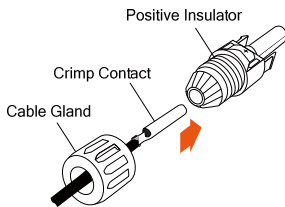
Installing the PV Connector

1.   **(Optional)** Rotate the DC switch at the bottom to the "OFF" position.
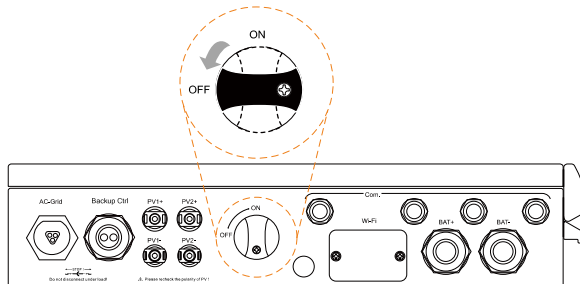
2.   Check the cable connection of the PV strings for the correct polarity and that
        the open circuit voltage does not exceed the inverter input limit of 600 V,
        even under the lowest operating temperature. Refer to the module
        specification supplied by the module manufacturer for detailed information.
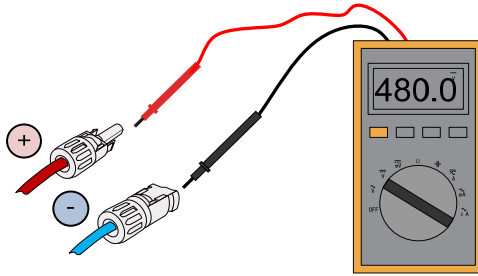
NOTICE

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

- **Check the positive and negative polarity of the PV cells.**
- **For the same MPPT, the reverse connection of a single string is prohibited. A permanent failure of the system or inverter may follow if otherwise.**

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

4. Plug the connectors into corresponding terminals.
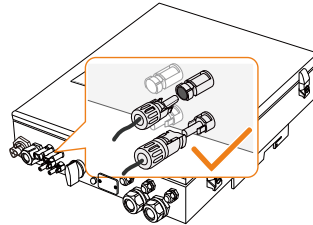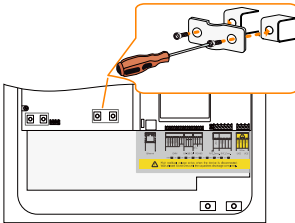
5. Seal unused DC terminals with the terminal caps.

6.5 Communication Connection

There are four ports and a Wi-Fi terminal on the bottom of the inverter, as shown in the following figure.
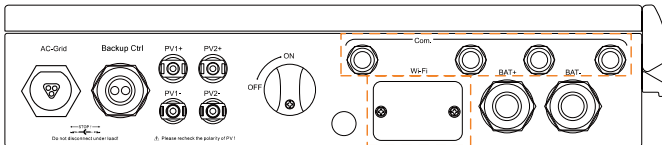
Fig. 6-3 Communication Ports and Terminal

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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.

6.5.1 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.

Inverter   Webserver Explorer
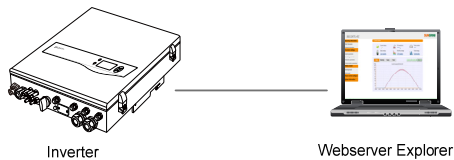
Fig. 6-4 Ethernet Connection without a Router

The following figure shows how the Ethernet connection may work with a router, via local access over Wi-Fi or remotely over the internet.
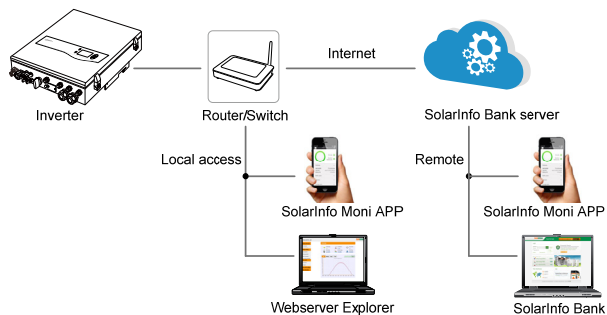
Fig. 6-5 Ethernet Connection with a Router

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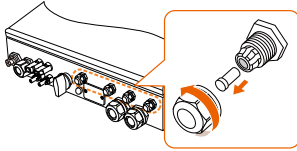
2. Lead the cable through the cable gland and remove the cable jacket by 8 mm–15 mm.

3. Use the Ethernet crimper to crimp the cable and connect the cable to RJ45 plug according to TIA/EIA 568B, as shown below.
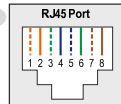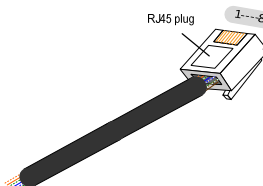
RJ45 plug   1---8   **RJ45 Port**   **Corresponding Relationship Between Cables and Pins:**
1 2 3 4 5 6 7 8   Pin 1: White-orange;   Pin 2: Orange;
Pin 3: White-green;   Pin 4: Blue;
Pin 5: White-blue;   Pin 6: Green;
Pin 7: White-brown;   Pin 8: Brown.

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.

Ethernet
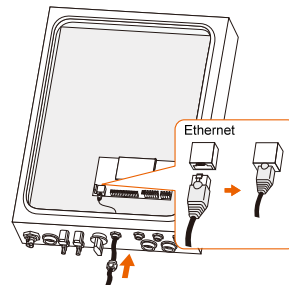
6.5.2 (Optional) Wi-Fi Connection

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.

SUNGROW
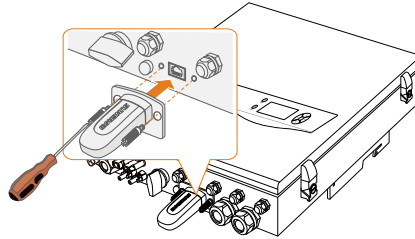
3.   Refer to the **Quick User Manual** delivered with the Wi-Fi module to configure the Wi-Fi.

6.6   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.

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

> ⚠️ **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.**

6.6.1 Connecting the Power Cable

Cable Requirements

Cross-section: 10 mm^2–16 mm^2, OT (M6), cable diameter: 11 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.
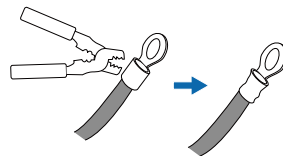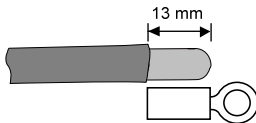
3.   Unscrew the swivel nut from the **BAT+** and **BAT-** ports.

4.   Lead the cable through the cable gland, as shown below.
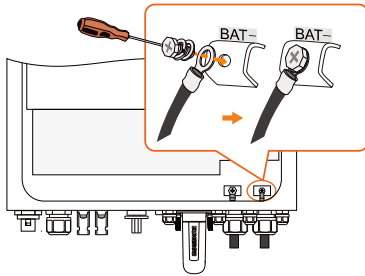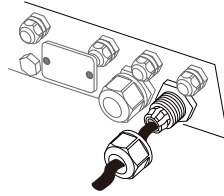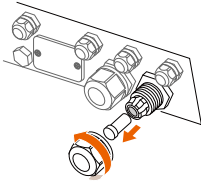
5.   Loosen and remove the screw sets on the **BAT+** and **BAT-** terminal blocks.

6.   Fasten the cables to the corresponding terminals (torque 2.6 N·m).

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

6.6.2 Connecting the CAN Cable

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

Procedure:

1.   Take out the CAN cable (terminal marks **CANH** and **CANL**) and the magnetic ring from the packaging.

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

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

SUNGROW
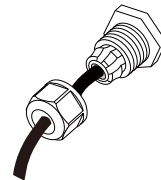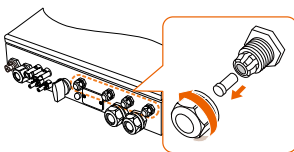
4.   Lead the CAN cable through the magnetic ring by approximately 500 mm and twine the cable round the ring for four circles.
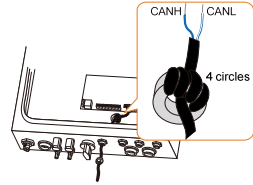
5.   Tighten the wires to the corresponding terminals according the marks.

   CANH: blue and green

   CANL: white-blue and white-green

6.   Fasten the swivel nut and connect the other end to the battery.
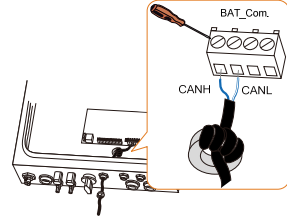
NOTICE

Pin 4 (blue) and pin 5 (white-blue) are used for the communication.

If the communication is not successful, please cut off the green (pin 6) and white-green (pin 3) wires from the CANH and CANL terminals.

6.6.3 Connecting the RS485 Cable

The RS485 cable connected to the RS485_1 enables communication between the inverter and the Pylon Li-ion battery US2000A.

Cable Requirements

Cross-section: 2*0.5 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.
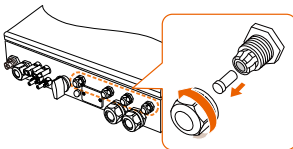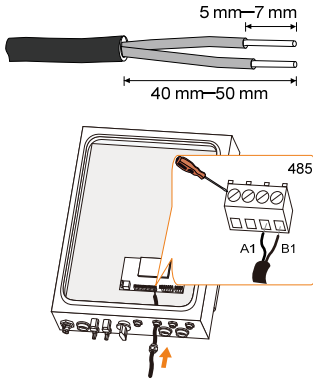
3.   Remove the cable jacket and strip the wire insulation.

4.   Tighten the wires to terminals **A1** and **B1**, as shown below.

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

6.6.4 (Optional) 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.

SUNGROW
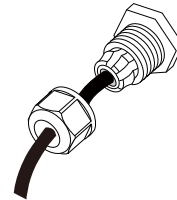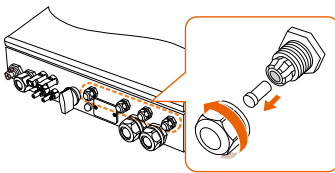
4.   Tighten   the   wires   to
      BAT_Temp....

5.   Fasten the swivel nut and
      place the temperature sensor
      next to the lead-acid battery.
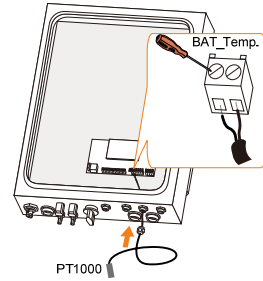
6.7 STB5K Connection (Off-grid)

The backup box is installed between the SUNGROW meter and the hybrid inverter SH5K.

> ℹ️ For the installation and the cable connection of STB5K, see the Quick Installation Guide delivered with the STB5K module.
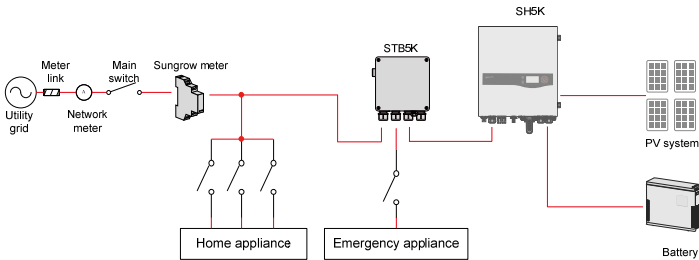
Connecting the Power Cables

⚠️ WARNING

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

A type B RCD is required on the LOAD port of the backup box STB5K.

Cross-section: 4 mm², cable diameter: 10 mm–14 mm

Connect terminals L1, N1 and PE to the grid, and connect terminals L4, N4 and PE to the AC terminals on SH5K.
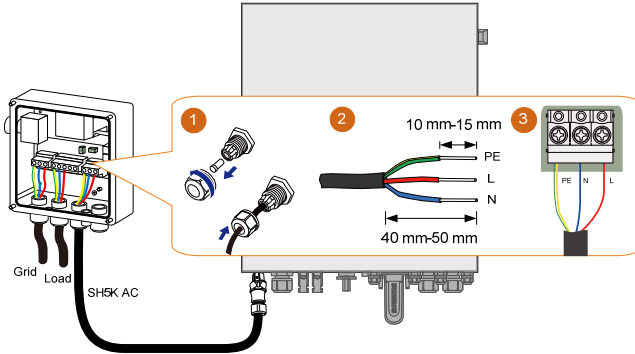
Connecting the Control Cable and DI Cable

The control cables (with end marks **C1** and **C2)** and the DI cable (with end marks **DI1**, **DI2**, **DI3** and **VDD)** are delivered with the backup box STB5K.

1.   Take out the cables from the packaging of STB5K.

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

3.   Lead the cable through the left hole.
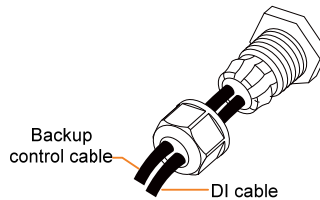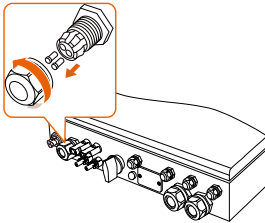
4.   **Digital output cable**:

Tighten the wires to terminals **C1** and **C2** according to the marks

SUNGROW
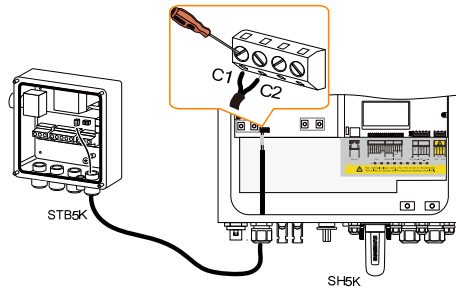
5.   **Digital input cable**: tighten the wires to terminals **DI1**, **DI2**, **DI3** and **VDD** according to the marks, as shown below.
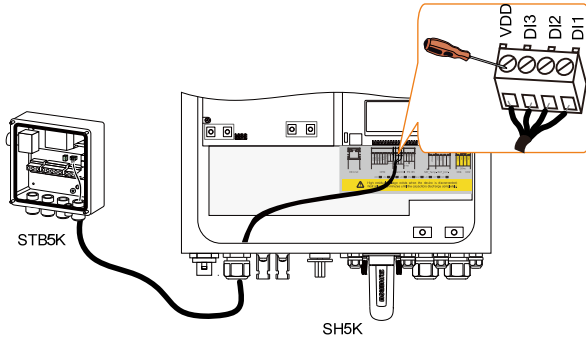
6.8   DO Connection

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 "**10.7.7 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.
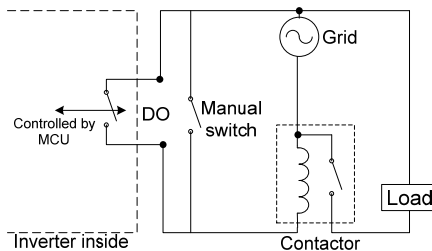
NOTICE

- **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.
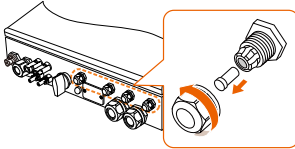
3. Remove the cable jacket and strip the wire insulation.	4. Tighten the wires to **DO** terminals.

5 mm–8 mm

40 mm–50 mm

DO1   DO2
COM1 NO1 COM2 NO2
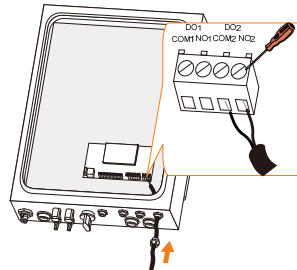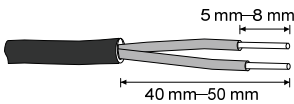
5. Fasten the swivel nut and connect the other end of the cable to the original edge of the AC contactor.

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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 the inverter is 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 pack.
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 off-grid application, check the cable connections of STB5K. Risk of inverter damage if the grid power wires are wrongly connected to the 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.
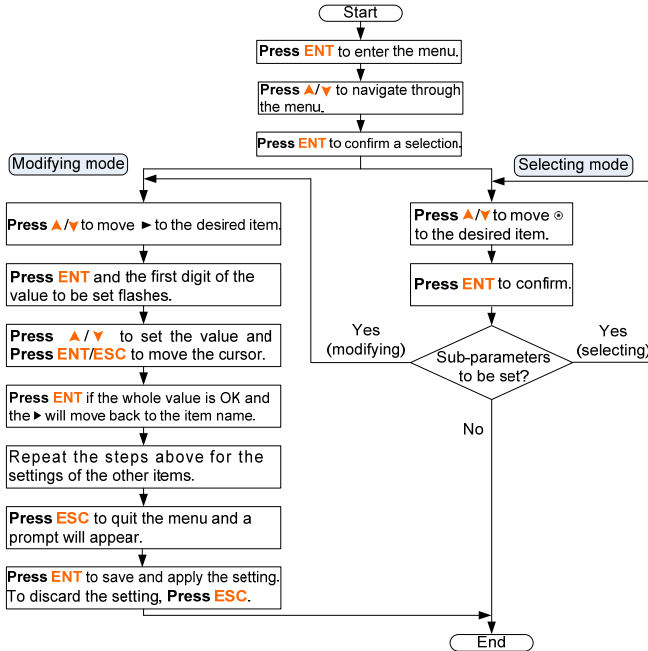
Fig. 7-1 Button Operations

7.3 Commissioning Procedure

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)** Turn on the switch on the battery pack manually if the battery is equipped with a switch (such as LG Li-ion battery, Pylon Li-ion battery and lead-acid battery).

4.   Rotate the DC switch to "ON". The DC switch may be integrated in SH5K or installed by the customer.

5.   The LCD screen will be activated 5s later and enter the initial settings.

Initial Settings 1/3	Initial Settings 2/3	Initial Settings 3/3
► Time	► Reactive Power	► Off-grid Setting
Country	Battery Type	Earth Fault
Zero-export	Battery Usage Time	Exit

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6.   Refer to **Fig. 7-1** for button operations and complete all initial settings according to the procedure in **Fig. 7-2**.
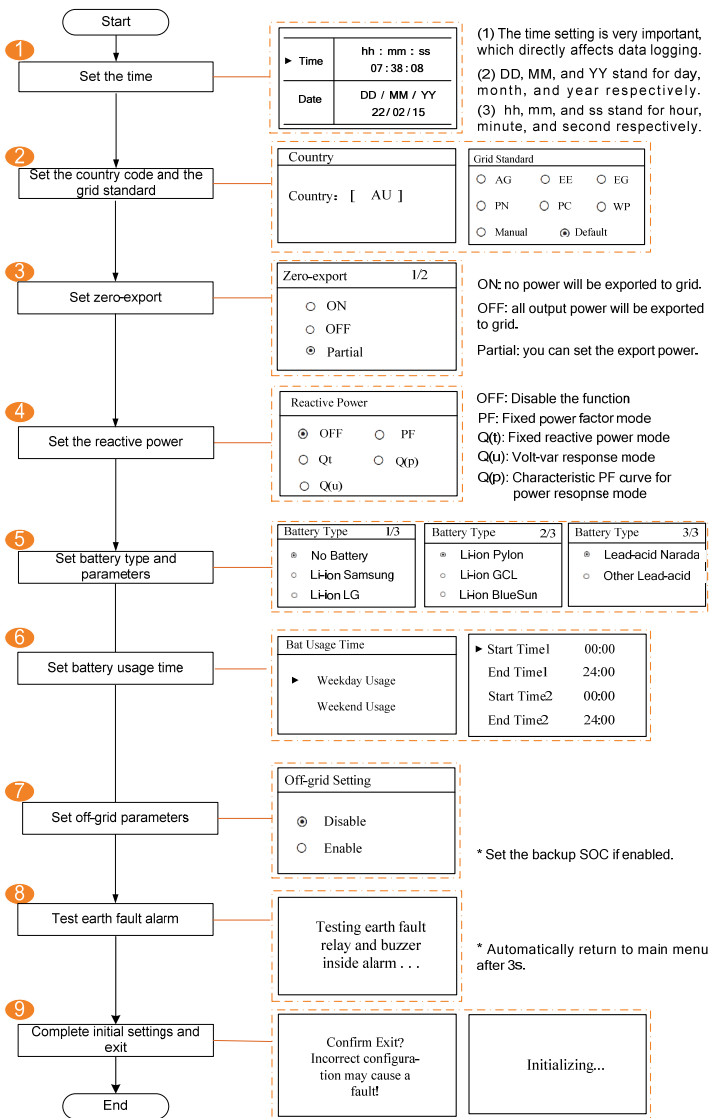
Fig. 7-2 Procedure for Initial Settings

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

Tab. 7-3 Parameters of Grid Standards

Parameter	Default	AG	EE	EG	PN	PC	WP
Over-voltage							
1-V_{max} (V)	260.0	260.0	260.0	260.0	257.0	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	210.0	210.0	200.0	195.0	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	210.0	210.0	200.0	195.0	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	51.50	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	51.50	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	48.00	48.50	47.00
1-Time (s)	2.0	1.80	1.80	1.80	1.80	1.80	1.80
2-F_{min}(Hz)	47.00	48.00	47.00	47.00	48.00	48.50	47.00
2-Time (s)	2.0	1.80	1.80	1.80	1.80	1.80	1.80
10-min voltage							
1-V_{10-min} (V)	255.0	255.0	255.0	257.0	255.0	255.0	258.0
1-V_{10-min} (V)	255.0	255.0	255.0	257.0	255.0	255.0	258.0

* Refer to **Tab. 10-2** for the parameter explanations.

- Set the Grid standard for the country code "AU". Set the protective parameters if you choose "Manual".

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- Zero-export (Partial):

Zero-export	1/2
○ ON	
○ OFF	
⊙ Partial	

Press ENT →
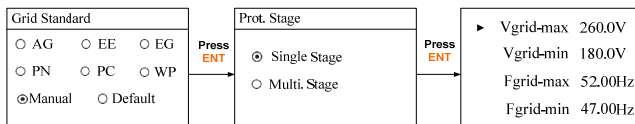
Partial	2/2
► Export Pwr[W] 5000	
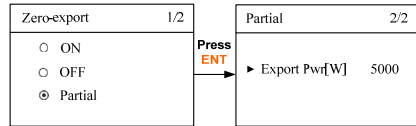
- Reactive power regulation:

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

Reactive Power	
⊙ OFF	○ PF
○ Qt	○ Q(p)
○ Q(u)	
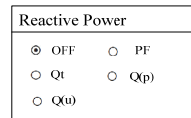
  "**PF**" mode:
  The inverter is capable of operating with fixed power factor.
  The PF ranges from 0.8 leading to 0.8 lagging.
  Leading: the inverter is sourcing reactive power to the grid.
  Lagging: the inverter is sinking reactive power from the grid.
  For the explanations of other modes, see "**12.2 Reactive Power Regulation**".

PF Setting	
► PF + 1.000	
+ : Laggingg & - : Leading	
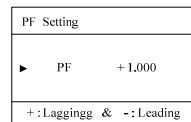
- Battery parameters:

  "No Battery" or "Lead-acid Narada" option:

Battery Type	1/3
⊙ No Battery	
○ Li-ion Samsung	
○ Li-ion LG	

Press ENT →

Setting completed !

  "Li-ion Samsung"option:
  Set the tray number of battery.

Battery Type	1/3
○ No Battery	
⊙ Li-ion Samsung	
○ Li-ion LG	

Press ENT →

Li-ion Samsung
► Tray Number   2

  "Li-ion LG" option:
  Set the battery capacity.

Battery Type	1/3
○ No Battery	
○ Li-ion Samsung	
⊙ Li-ion LG	

Press ENT →

Li-ion LG
⊙   LG Generation I
○   LG Generation II

Li-ion Generation II	
⊙ 3.3 kWh	○ 6.5 kWh
○ 9.8 kWh	○ 13.0 kWh
○ 16.3 kWh	○ 19.6 kWh

Li-ion Generation I
⊙   [6.4] kWh
○   [6.4+3.2] kWh
○   [6.4+3.2+3.2] kWh

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"Li-ion Pylon" option:

Battery Type	2/3
◉ Li-ion Pylon	
○ Li-ion GCL	
○ Li-ion BlueSun	

Press ENT →

Li-ion Pylon	
◉ US2000A	
○ US2000B/Phantom-S	

Press ENT →

US2000A	
► Tray Number	2

"Li-ion GCL" option:

Battery Type	2/3
○ Li-ion Pylon	
◉ Li-ion GCL	
○ Li-ion BlueSun	

Press ENT →

Li-ion GCL	
► Tray Cap [2.5kWh]	
Tray Number	1

"Li-ion BlueSun" option:

Battery Type	2/3
○ Li-ion Pylon	
○ Li-ion GCL	
◉ Li-ion BluseSun	

Press ENT →

Li-ion BlueSun	
► Tray Number	1

"Other Lead-acid" option:

Battery Type	3/3
○ Lead-acid Narada	
◉ Other Lead-acid	

Press ENT →

Only qualified personnel are allowed to adjust relevant parameters. Improper settings may cause damage to the inverter!

►Max. SOC	090.0 %
Min. SOC	040.0 %
Rated Vtg	048.0 V
Capacity	200 Ah

→

► Over Vtg	58.8 V
Low Vtg	42.0 V
Over Temp	60.0 ℃
Low Temp	-25.0 ℃

→

►Max. Chrg	0.300 C
Max. DChrg	0.300 C
CSTVtgChrg	56.40 V
DChrgEndVtg	43.20 V

- Battery usage enabled (Weekend):

Bat Usage Time	
Weekday Usage	
► Weekend Usage	

Press ENT →

Weekend Usage	
○ Disable	
◉ Enable	

Press ENT →

► Start Time 1	00:00
End Time 1	24:00
Start Time 2	00:00
End Time 2	24:00
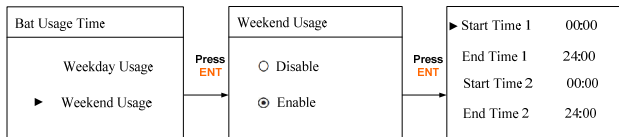
- Off-grid enabled:

In an on-grid system, battery will stop discharging when the backup SOC is reached.

The backup power will be supplied to the emergency loads in the off-grid system

Off-grid Setting	
○ Disable	
◉ Enable	

→

Off-grid Setting	2/2
► Backup SOC	000 %
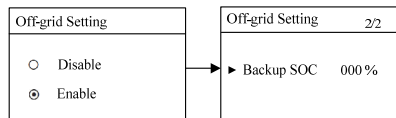
7. Check the icons on the main screen. Refer to "**10.1 Main Screen**" for the explanations.

SUNGROW
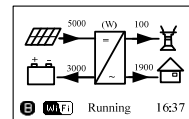
8.   Check the state of LED indicators.

Tab. 7-4 State Descriptions of LED Indicators

LED Label	LED State	Description
"RUN"	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.)
"FAULT"	On	Permanent fault or upgrade failure.
	Blinking	Other system faults or main alarms.
	Off	No fault occurs.

9.   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.

7.4   Result Verification

7.4.1 Meter Installation and Connection

The following figure shows the correct installation and connection of the meter. With the signal from the 1-phase sensor, the inverter determines the energy exchange with the utility grid on one phase.
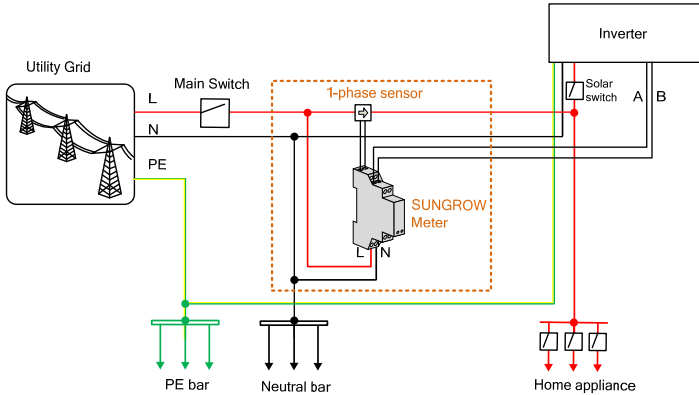
Fig. 7-3 Correct Installation and Connection of the Meter

Before the verification, proceed as follows:

- Disconnect the DC switch between the inverter and the battery module.
- Make sure that the L line and N line are connected to the right terminals.

For Incorrect Installation Position

Make sure that the 1-phase sensor of the SUNGROW meter should be placed to the phase line (L) from the main switch. If otherwise, the energy flow indicated on the LCD will be wrong.
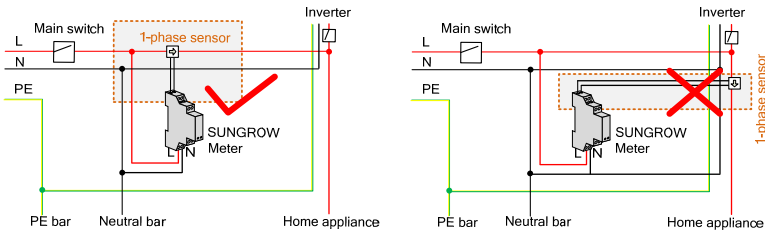
Action	LCD Display Explanation
Turn off all the household loads. All the PV power generation should be exported to the grid, as shown in the "Correct" figure.	

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For Reverse Sensor Connection

Make sure that the arrow on the 1-phase sensor must point away from the grid towards the load. If otherwise, the energy flow indicated on the LCD will be wrong.

Action	LCD Display Explanation
Method 1: Turn off all the household loads. All the PV power generation should be exported to the grid, as shown in the "Correct" figure.	
Method 2: Stop the inverter via the LCD menu. Refer to "**10.6 Starting and Stopping the Inverter**". Turn on the household loads. All the load power consumption should be imported from the grid, as shown in the "Correct" figure.	

7.4.2 Battery Information

After initial settings, check the detailed battery information on the LCD display.

If the battery type or capacity setting is inconsistent with the actual, the charge/discharge current may be less than the actual charge/discharge ability. However, the system can operate normally.
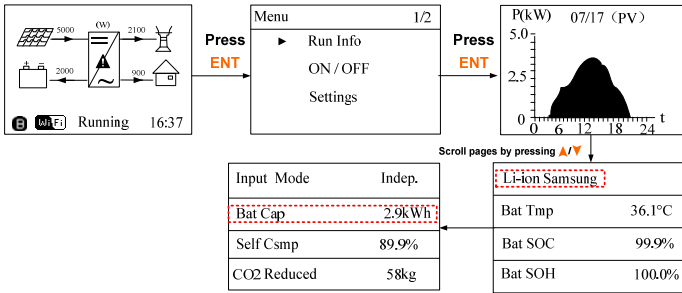
Proceed as follows to modify the settings.

1.   Stop the inverter via the LCD menu. Refer to "**10.6 Starting and Stopping the Inverter**".

2.   Reset the battery type and parameters. Refer to "**10.7.9 Setting the Battery Type**".

3.   Start the inverter via the LCD menu. Refer to "**10.6 Starting and Stopping the Inverter**".

7.4.3 System Time

The correct system time is very important. If there is deviation between the system time and the local time, the inverter will not operate normally. The clock is in 24-hour format. Proceed as follows to set the correct time.

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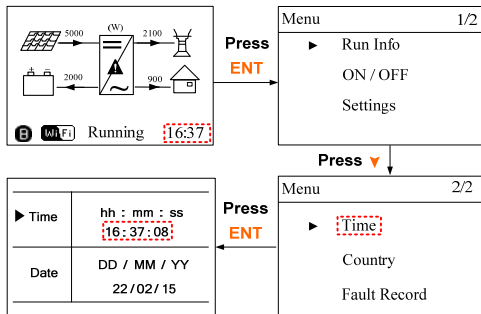
8 Troubleshooting and Maintenance

8.1 Troubleshooting

8.1.1 Troubleshooting of LED Indicators

See "**Tab. 7-4 State Descriptions of LED Indicators**" for the definition.

Fault Type	Troubleshooting
LED indicators 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.
"RUN" 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.
"Fault" indicator is lit	1. A fault is not resolved. 2. Perform troubleshooting according to the fault type on the LCD screen. See "**8.1.2 Troubleshooting of Faults**". 3. If it cannot be resolved, please contact SUNGROW.

8.1.2 Troubleshooting of Faults

When faults occur, the "Fault" state will be shown on the main screen. **Press ▼** to view all the fault information.

> • For the battery fault codes, if all the conditions are OK but the fault still occurs, contact the distributor or the battery manufacturer.
>
> • The default ranges only apply to the grid standards in Australia. Refer to **Tab. 7-3** for the specified value.
>
> • 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, fault code/name, and a brief description of the problem.

For Inverter Side

Code	Specification	Troubleshooting
002	Grid over-voltage. (default range: 257 V–270 V)	1. Check the grid voltage. 2. If the grid voltage exceeds the permissible range, consult the utility grid for a solution.
003	Temporary grid over-voltage in the on-grid system. (default value: 400 V)	This is a short-term fault. Wait a moment for inverter recovery or restart the system.
004	Grid under-voltage. (default range: 180 V–210 V)	1. Check the grid voltage. 2. If the grid voltage exceeds the permissible range, consult the utility grid for a solution.
005	Grid under-voltage. (default value: 180 V)	
007	Temporary AC over-current. The instantaneous AC current has exceeded the allowable upper limit.	Wait a moment for inverter recovery or restart the system.
008	Grid over-frequency. (default range: 51.5 Hz–52 Hz)	1. Check the grid frequency. 2. If the grid frequency exceeds the permissible range, consult the utility grid for a solution.
009	Grid under-frequency. (default range: 47.0 Hz–48.5 Hz)	
010	Islanding. Abnormal connection between the system and the grid.	1. Check whether the AC circuit breaker is triggered. 2. Check whether all the AC cables are firmly connected. 3. Check whether the grid is in service.
011	DC component over-current. The DC component of the AC current exceeds the upper limit.	Wait a moment for inverter recovery or restart the system.
012	Leakage current over-current. The leakage current exceeds the upper limit.	Check whether there is a grounding fault in the PV strings.
014	The average grid voltage is outside the permissible range for over 10 minutes. (default range: 255 V–258 V)	1. Check whether the grid is operating normally. 2. Wait a moment for inverter recovery or restart the system.
015	Grid over-voltage. (default value: 265 V)	1. Check the grid voltage. 2. If the grid voltage exceeds the permissible range, consult the utility grid for a solution.
019	The instantaneous bus voltage exceeds the upper limit.	Wait a moment for inverter recovery or restart the system.
021	PV1 over-current. The input current of PV1 exceeds	1. Check the PV input power and configuration.

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Code	Specification	Troubleshooting
	the upper limit.	2. Wait a moment for inverter recovery or restart the system.
022	PV2 over-current. The input current of PV2 exceeds the upper limit.	
024	The deviation of the neutral point voltage exceeds the allowable limit.	The inverter will recover once the deviation falls below the protective limit.
028	Reverse polarity of the PV1 connection.	1. Disconnect the DC switch. 2. Check the polarity of the PV inputs.
029	Reverse polarity of the PV2 connection.	3. Reconnect the PV strings if the polarity is incorrect.
037	The ambient temperature inside the inverter exceeds the upper limit.	1. Check and clean the heat sink. 2. Check whether the inverter is installed in sunlight or the ambient temperature of the enclosure exceeds 45℃. If not, please contact SUNGROW for a solution.
038	Relay fault on the grid side.	Wait 5 minutes for inverter recovery or restart the system.
041, 622	Leakage current sampling fault.	Wait 5 minutes for inverter recovery or restart the system.
043	The ambient temperature is too low.	The inverter will recover once the ambient temperature rises above -30℃.
044	Faults detected in the DC/AC inverter circuit.	Wait 5 minutes for inverter recovery or restart the system.
045	Faults detected in the PV1 boosted circuit.	
046	Faults detected in the PV2 boosted circuit.	
048	Faults detected in the phase current sampling channel.	
051	Load overpower fault in the off-grid system	Stop the inverter via the LCD menu or wait 5 minutes for inverter recovery.
052	Inverter under-voltage fault in the off-grid system	Wait 5 minutes for inverter recovery or restart the system.
062	DI fault of the backup box STB5K.	1. Check whether the DI connection between the inverter and the backup box is correct. 2. Wait 5 minutes for inverter recovery.
063	The version of CPLD (complex programmable logic device)	Power off the system and program the CPLD

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Code	Specification	Troubleshooting
	cannot be detected.	
064	Inverter over-voltage fault in the off-grid system	
065	Inverter under-frequency fault in the off-grid system (default value: 47 Hz)	Wait 5 minutes for inverter recovery or restart the system.
066	Inverter over-frequency fault in the off-grid system (default value: 52 Hz)	
067	Temporary grid over-voltage in the off-grid system (default value: 500 V)	
083	Fan 2 abnormal speed warning.	Restart the system.
100	Hardware over-current fault. The AC current exceeds the protective value.	Wait 5 minutes for inverter recovery or restart the system.
101	Grid over-frequency. (default value: 52 Hz)	Check the grid voltage and frequency.
102	Grid under-frequency. (default value: 47 Hz)	
106	The inverter is not grounded. Neither the PE terminal on the AC connection block nor the second PE terminal on the enclosure is reliably connected.	1. Check whether there is a reliable inverter grounding cable. 2. If there is access to the ground, and the fault still exists, please contact Sungrow Service Dept.
107	DC component over-voltage fault in the off-grid system. The DC component of inverter voltage exceeds the upper limit.	The inverter will recover once the DC component voltage falls below the recovery value.
200	Bus over-voltage hardware fault. The bus voltage exceeds the protection value.	Wait 5 minutes for inverter recovery or restart the system.
201	Bus under-voltage hardware fault.	
202	PV over-current hardware fault. The PV1 or PV2 current exceeds the protective value.	
203	The PV input voltage exceeds the bus voltage.	Check the functionality of the PV connection terminals.
204	Boost 1 short circuit fault	The inverter may be damaged. Contact SUNGROW for a solution.
205	Boost 2 short circuit fault	
300	The temperature of some components inside the inverter is too high.	1. Check and clean the heat sink. 2. Check whether the inverter is installed in sunlight or the ambient temperature of the enclosure exceeds 45℃.

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Code	Specification	Troubleshooting
		3. Restart the system.
302	PV insulation resistance fault.	1. Check whether the PV cable connection is intact. 3. Wait for a sunny day to check whether the system can run well.
308	Accessory processor fault	Restart the system.
309	Faults detected in the phase voltage sampling channel.	
312	Faults detected in the DC component sampling channel.	
315	Faults detected in the PV1 current sampling channel.	
316	Faults detected in the PV2 current sampling channel.	
317	Faults detected in the PV1 MPPT current sampling channel.	
318	Faults detected in the PV2 MPPT current sampling channel.	
319	System power supply failure fault.	
320	Leakage current CT self-check fault.	
321	Communication faults between the master DSP and the slave DSP.	
322	Communication faults between the master DSP and the LCD.	
401-408	Permanent faults.	
409	Faults with all temperature sensors	Forced restart the system.
501	FRAM reading warning.	1. Inverter can normally be connected to the grid. 2. Restart the system.
503-506, 511	Temperature sensor warnings.	
507	Error alarm of DO power settings.	Refer to the load power to reset the DO control power
509	Clock reset abnormal fault.	Manually reset the clock or synchronize the clock with the network time. This will clear the fault.
510	PV over-voltage fault.	1. Check whether the configuration of the PV array exceeds the permissible range of the inverter. 2. Wait a moment for inverter recovery or restart the system.

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Code	Specification	Troubleshooting
513	Fan 1 abnormal speed warning.	Restart the system.
514	Meter communication fault	1. Inverter can normally be connected to the grid. 2. Check whether the input and output connections of the meter are correct. 3. Check whether the RS485 connection between the meter and the inverter is correct.
600	The instantaneous battery charging current exceeds the upper limit.	Wait a moment for system recovery or restart the system.
601	The instantaneous battery discharging current exceeds the upper limit.	
602	Under-voltage of clamping capacitor.	1. Check the cable connection of the battery. 2. Wait a moment for system recovery or restart the system.
603	Temporary over-voltage of clamping capacitor.	Wait a moment for system recovery or restart the system.
608	Battery charge/discharge circuit self-check fault.	
612	The temperature of the battery charge/discharge circuit exceeds the protection value.	1. Check and clean the heat sink. 2. Check whether the inverter is installed in sunlight or the ambient temperature of the enclosure exceeds 45℃. 3. Restart the system.
616	Hardware over-current protection for the battery charge/discharge circuit.	The system will resume once the battery charge/discharge current falls below the upper limit or restart the system.
620	Faults detected in the current sampling channel of the battery charge/discharge circuit.	Wait a moment for system recovery or restart the system.
623	Communication faults between the slave DSP and the LCD.	
624	Soft start fault of the battery charge/discharge circuit.	
800,802 804,807	Battery charge/discharge internal permanent faults.	Restart the system
900,901	Battery charge/discharge inner temperature sensor warnings	1. Check and clean the heat sink. 2. Check whether the inverter is installed in sunlight or the ambient temperature of the enclosure

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Code	Specification	Troubleshooting
		exceeds 45℃.
		3. Restart the system.

For Battery Side

For the battery faults, please consult the battery manufacturer for a solution.

Code	Specification	Troubleshooting
703	Battery average under-voltage fault.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or restart the system.
707	Battery over-temperature fault.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the ambient temperature of the battery location. 3. Wait a moment for system recovery or restart the system.
708	Battery under-temperature fault.	
711	Instantaneous battery over-voltage.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or restart the system.
712	Battery average over-voltage fault.	
714	Abnormal communication between battery and the hybrid inverter.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the battery type and communication connection. 3. Wait a moment for system recovery or restart the system.
715	Battery hardware over-voltage fault.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or restart the system.
732,740, 748,756	Battery over-voltage protection.	1. The inverter can normally be connected to the grid. Charge has stopped but discharge is allowed. 2. Wait a moment for system recovery.
733,741, 749,757	Battery over-temperature protection.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the ambient temperature of the battery location.
734,742, 750,758	Battery under-temperature protection.	

Code	Specification	Troubleshooting
		3. Wait a moment for system recovery or restart the system.
735,743, 751,759	Battery charge/discharge over-current protection.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or restart the system.
736,744, 752,760	Battery FET over-temperature protection.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the ambient temperature of the battery location. 3. Wait a moment for system recovery or restart the system.
737,745, 753,761	CAN communication error between battery and the inverter.	1. The inverter can normally be connected to the grid but the charge has stopped. 2. Check whether the CAN cable connection is normal. 3. Power off and then restart the battery system.
738,746, 754,762	Battery FET under-temperature protection.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the ambient temperature of the battery location. 3. Wait a moment for system recovery or restart the system.
739,747, 755,763	Battery under-voltage protection.	1. The inverter can normally be connected to the grid. Discharge has stopped but charge is allowed. 2. Wait a moment for system recovery or restart the system.
832,840 848,856	Battery FET fault.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the battery port voltage and the battery communication cable connection. 3. Force a shutdown and restart the inverter and battery system. 4. Wait a moment for system recovery or restart the system.
833,841 849,857	Battery FET over-temperature fault.	
834,842 850,858	Battery over-current fault.	
835,843 851,859	Battery short circuit fault.	
864,872 880,888	Battery cell over-voltage fault.	
865,873 881,889	Battery total voltage & tray voltage fault.	
866,874	Battery precharge voltage	

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Code	Specification	Troubleshooting
882,890	fault.	
867,875 883,891	Battery under-voltage fault.	
868,876 884,892	Battery cell voltage imbalance fault.	
869,877 885,893	Battery over-temperature fault.	
870,878 886,894	Battery FET wrong connection fault.	
871,879 887,895	Battery power-off signal.	
836,837 838	Battery internal faults.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the cable connection of the battery. 3. Try to restart the inverter and battery.
906	Transformer direction recognition error.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or restart the system.
909	Low SOH (State of Health) warning.	1. The inverter can normally be connected to the grid and the charge/discharge function is normal. 2. Batteries are beyond the scope of the warranty. It is recommended to contact the distributor for replacements.
910	Abnormal warning of LCD FRAM	Restart the inverter.
932,940, 948,956	Battery over-voltage warning.	1. The inverter can normally be connected to the grid. Charge has stopped but discharge is allowed. 2. The system will resume after a certain time of discharging.
933,941 949,957	Battery over-temperature warning.	1. The inverter can normally connected be to the grid but charge/discharge has stopped.
934,942 950,958	Battery under-temperature warning.	2. Check the ambient temperature of the battery location. 3. Wait a moment for system recovery or restart the system.
935,943, 951,959	Battery charge/discharge over-current warning.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Wait a moment for system recovery or

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Code	Specification	Troubleshooting
		restart the system.
936,944, 952,960	Battery FET over-temperature warning.	1. The inverter can normally be connected to the grid but charge/discharge has stopped. 2. Check the ambient temperature of the battery location. 3. Wait a moment for system recovery or restart the system.
937,945, 953,961	Battery tray voltage imbalance warning.	1. The inverter can normally be connected to the grid and the charge/discharge functions are normal. 2. Check whether the cable connection of the battery is correct.
939,947, 955,963	Battery under-voltage warning.	1. The inverter can normally be connected to the grid. Discharge has stopped but charge is allowed. 2. The system will resume after a certain time of charging.
964	Battery internal warning.	Consult the battery manufacturer for a solution.

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.

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8.2.2 Replacing the Button Battery

⚠ DANGER

Disconnect the inverter from the grid first, then the PV array 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 "**10.6 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 SH5K 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 "**6.3 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.

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Dismantling the Inverter

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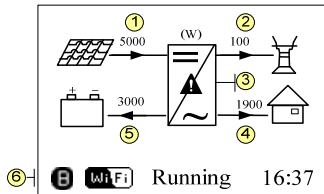
No.	Description
1	Current PV input power
2	Current export power
3	Warning information
4	Total load consumption
5	Battery charge/discharge power
6	System status bar

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

: Blinks if the Wi-Fi is not connected to the router's Wi-Fi network;

Steady if the Wi-Fi is successfully connected to the router's Wi-Fi network.

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).

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Tab. 10-1 State Descriptions

State	Description
Running	After being energized, the inverter tracks the PV array's 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)
Forced	The system is running normally, with the EMS in forced mode.
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.
Key-stop	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.
Starting	The inverter is initializing and synchronizing with the grid.
Upgrading	The DSP or LCD software is in its upgrading process.
Fault	If a fault occurs, the inverter will automatically stop operation, trigger the AC relay and show "Fault" on the LCD with the "FAULT" indicator lit. Once the fault 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 Structure

Main Menu

Run Info (1)   ON / OFF   Settings   Time   Country   Fault Record

Run Info:
- Power curve
- Daily energy
- Total energy
- Battery info (2)
- Grid info
- PV info
- System info
- DRM info
- Inverter info

* Refer to *12.1 Demand Response* Modes

ON / OFF:
- ON (3)
- OFF
- Restart (4)

Settings (Password: 111):
- Reactive Power   * Refer to *12.2 Reactive Power Regulation.*
- Active Power   * Refer to *12.3 Active Power Response.*
- Zero-export
- Off-grid Setting
- Bat Usage Time
- Forced Charge
- Load Control
- Comm. Param
- Battery Type
- Prot. Param
- Existing Sys
- Earth Fault
- DRM Switch   * To enable/disable the DRM function
- PT1000 Switch   * To enable/disable the temperature sampling
- Factory Reset

Country (Password: 111)

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 Pylon US2000A and GCL battery that do not have this parameter.

(3) The "ON" option will be disabled when the DRM state is DRM0.

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

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

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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
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

10.3   Setting the Time

The correct system time is very important. If there is deviation between the system time and the local time, the inverter will not operate normally. The clock is in 24-hour format.

Main Screen (Press ENT)→Menu (Press▼×3)→Time (Press ENT)

DD, MM, and **YY** stand for day, month, and year respectively. **hh**, **mm**, and **ss** stand for hour, minute, and second respectively.

▶ Time	hh : mm : ss
	07 : 38 : 08
Date	DD / MM / YY
	22 / 02 / 15

10.4   Setting the Country Code

The country setting is protected with a password.

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Main Screen (Press ENT)→Menu (Press ▼×4)→Country (Press ENT)

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

```
Country

 Password:
      1 1 1
```
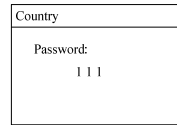
Only the codes of GB, NL, BE, CHN and AU are supported.

```
Country

 Country:    [    AU ]
```
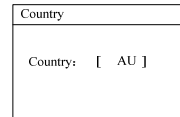
Select the correct grid standard for the country code "AU".
For parameter descriptions of other grid standards, see **Tab. 7-3**.

```
Country

 Country:    [    AU ]
```
Press ENT →
```
Grid Standard

○ AG        ○ EE        ○ EG
○ PN        ○ PC        ○ WP
○ Manual    ◉ Default
```

Set the single stage protective parameters manually for "AU".

```
Grid Standard

○ AG        ○ EE       ○ EG
○ PN        ○ PC       ○ WP
◉ Manual    ○ Default
```
Press ENT →
```
Prot. Stage

 ◉ Single Stage
 ○ Multi. Stage
```
Press ENT →
```
► Vgrid-max   260.0V
  Vgrid-min   180.0V
  Fgrid-max   52.00Hz
  Fgrid-min   47.00Hz
```
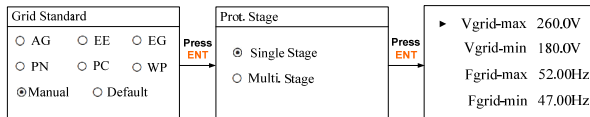
Set the multiple stage protective parameters manually for "AU".
Press ▲/▼ to turn pages.
After all the settings, **Press ENT** to confirm. **Press ESC** to discard the settings.

```
► 1-Vmax    260.0V
  1-Time    002.00s
  2-Vmax    265.0V
  2-Time    000.20s
```
```
► 1-Vmin    180.0V
  1-Time    002.00s
  2-Vmin    180.0V
  2-Time    002.00s
```
```
► 1-Fmax    52.00Hz
  1-Time    000.20s
  2-Fmax    52.00Hz
  2-Time    000.20s
```
```
► 1-Fmin    47.00Hz
  1-Time    001.80s
  2-Fmin    47.00Hz
  2-Time    001.80s
```
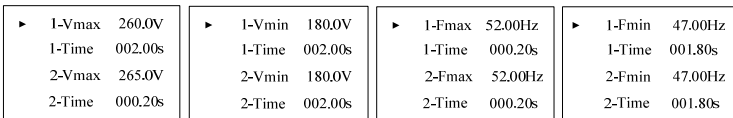
Descriptions of the country codes are as follows:

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

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Country Code	Full Name	Language
GR_IS	Greece Island	English
NL	Netherlands	English
PT	Portugal	English
CHN	China	Chinese
SE	Sweden	English
US	America	English
Other	Country not included above	English

Tab. 10-2 Description of Multi. Stage Protective Parameters

Parameter	Explanation
Max-V prot.	Over-voltage protection
1-V_{max}	Grid over-voltage 1 (V>)
1-Time	Grid over-voltage 1 (V>) tripping time
2-V_{max}	Grid over-voltage 2 (V>>)
2-Time	Grid over-voltage 2 (V>>) tripping time
Min-V prot.	Under-voltage protection
1-V_{min}	Grid under-voltage 1 (V<)
1-Time	Grid under-voltage 1 (V<) tripping time
2-V_{min}	Grid under–voltage 2 (V<<)
2-Time	Grid under–voltage 2 (V<<) tripping time
Max-F prot.	Over-frequency protection
1-F_{max}	Grid over-frequency 1 (F>)
1-Time	Grid over-frequency 1 (F>) tripping time
2-F_{max}	Grid over-frequency 2 (F>>)
2-Time	Grid over-frequency 2 (F>>) tripping time
Min-F prot.	Under-frequency protection
1-F_{min}	Grid under-frequency 1 (F<)
1-Time	Grid under-frequency 1 (F<) tripping time
2-F_{min}	Grid under-frequency 2 (F<<)
2-Time	Grid under-frequency 2 (F<<) tripping time

10.5   Viewing the Fault Codes

Viewing Current Fault

For the ⚠ icon or the "Fault" state on the main screen, **press** ▼ to view the current faults. Refer to "**8.1.2 Troubleshooting of Faults**" for the fault definition.
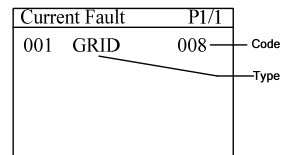
Refer to the following table for the fault type explanations.

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Fault Type	Explanation
GRID	Grid faults (AC side)
PV	PV faults (DC side)
SYS	System faults (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 Fault Records

Main Screen (Press ENT)→Menu (Press ▼×5)→Fault Record (Press ENT)

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

```
Fault Record                P1/1
001    15022708:55:27    010
002    15022707:11:21    501
```

10.6   Starting and Stopping the Inverter

Main Screen (Press ENT)→Menu (Press▼×1)→ON / OFF (Press ENT)

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

```
ON / OFF
   ►    ON
        OFF
        Restart
```

Confirm your choice by pressing **ENT**.

```
Confirm 'ON'?
```
or
```
Confirm 'OFF'?
```
or
```
Confirm 'Restart'?
```

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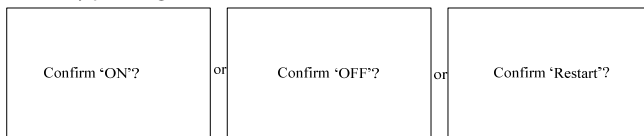
When the DRM state is DRM0, the "ON" option will be disabled.

The DRM0 state will
prohibit the 'ON'!

10.7   Advanced Settings

10.7.1 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.

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)

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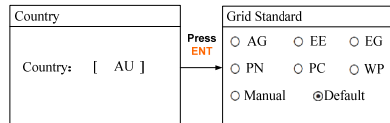**Press ENT** to confirm the password and enter the submenu.

Settings

Password:
    1 1 1

Settings	1/5
► Reactive Power	
Active Power	
Zero-export	

Settings	2/5
► Off-grid Setting	
Bat Usage Time	
Forced Charge	

Settings	3/5
► Load Control	
Comm. Param	
Battery Type	

Settings	4/5
► Prot. Param	
Existing Sys	
Earth Fault	

Settings	5/5
► DRM Switch	
PT1000 Switch	
Factory Reset	
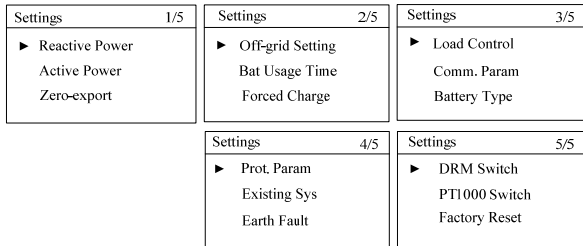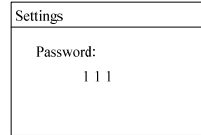
10.7.2 Setting Reactive Power Regulation

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Reactive Power (Press ENT)

For the modes Qt, Q(p) and Q(u), see **"12.2 Reactive Power Regulation"**.
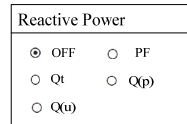
Reactive Power

⊙ OFF   ○ PF
○ Qt   ○ Q(p)
○ Q(u)

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.

```
┌─────────────────────────────────┐
│ PF  Setting                     │
│                                 │
│ ►      PF          + 1.000      │
│                                 │
│ + : Lagging  &  - : Leading     │
└─────────────────────────────────┘
```

10.7.3 Setting the Zero-export Function

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×2)→Zero-export (Press ENT)

ON: no power will be exported to the grid.
OFF: all inverter output power will be exported to the grid.
Partial: set partial of the output power to export 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]).

```
┌─────────────────────────────────┐
│ Zero-export            1/2      │
│   ○  ON                         │
│   ○  OFF                        │
│   ◉  Partial                    │
└─────────────────────────────────┘

┌─────────────────────────────────┐
│ Partial                2/2      │
│                                 │
│ ►  Export Pwr[W]     5000       │
│                                 │
└─────────────────────────────────┘
```

10.7.4 Setting Off-grid Backup SOC

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×3)→Off-grid Setting (Press ENT)

In an on-grid system, battery will stop discharging when the back-up SOC is reached. The back-up power will be supplied to the emergency loads in the off-grid system.

```
┌───────────────────────┐      ┌───────────────────────┐
│ Off-grid Setting      │      │ Off-grid Setting      │
│   ○  Disable          │ ───► │ ►  Backup SOC  000 %  │
│   ◉  Enable           │      │                       │
└───────────────────────┘      └───────────────────────┘
```

If the off-grid 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. 10-3 Threshold Values of Different Batteries

Battery Type	SOC Threshold Value
Samsung (BM3K), Pylon (US2000A)	≤21%
LG (RESU G1/G2)	≤16%
GCL (E-KwBe5.6)	≤11%

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Battery Type	SOC Threshold Value
BlueSun	≤16%
Narada lead-acid, Other lead-acid	≤45 V

10.7.5 Setting the Battery Usage Time

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×4)→Bat Usage Time (Press ENT)

When there is no battery equipped in the system, a prompt will appear.

```
No Battery !
```
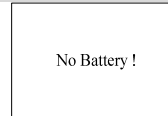
It is recommended to set the time period in peak tariff time.

```
Bat Usage Time              ► Start Time 1   00:00
                              End Time 1     24:00
  ►  Weekday Usage            Start Time 2   00:00
     Weekend Usage            End Time 2     24:00
```

When there is overlap time of the forced charge and the battery usage, the forced charge will be in priority.

```
Weekend Usage               ► Start Time 1   00:00
                              End Time 1     24:00
  ○  Disable                  Start Time 2   00:00
  ⊙  Enable                   End Time 2     24:00
```

10.7.6 Setting Forced Charge

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×5)→Forced Charge (Press ENT)

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

```
No Battery !
```
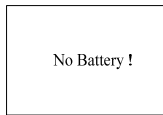
Enable the function for the system with a battery.

```
Forced Charge
  ○  Disable
  ⊙  Enable
```
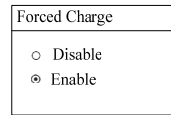
It is recommended to set the time period in off-peak tariff time. The time period 1 is in priority to the time period 2 if two periods overlap.

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.

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.

Forced Charge	1/3
► Start time1	00:00
End time1	00:00
Target SOC	100%

Forced Charge	2/3
►Start time2	00:00
End time2	00:00
Target SOC	100%

Forced Charge	3/3
Time	[Weekday]
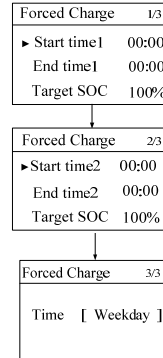
10.7.7 Setting Load Control

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

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×6)→Load Control (Press ENT)

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

Load Control	
◉ Timer	
○ ON/OFF	
○ Optimized	
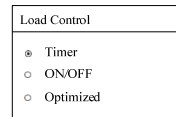
Timer Control

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.

Load Control	
◉ Timer	
○ ON/OFF	
○ Optimized	

Start Time1	09:00
End Time1	09:30
Start Time2	09:00
End Time2	09:30
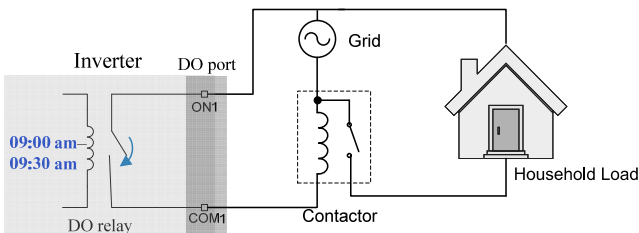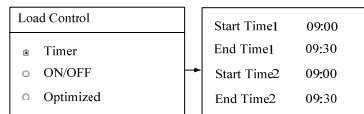
Fig. 10-2 DO Operation in Timer Control

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ON/OFF Control

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

Load Control		ON/OFF	2/2
○ Timer		◉ OFF	
◉ ON/OFF	→	○ ON	
○ Optimized			

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:

Load Control	
○ Timer	
○ ON/OFF	
◉ Optimized	

Optimized	P2/2
Start time	09:00
End time	09:30
Power[W]	1000

- The optimized mode is disabled in an off-grid system.
- The optimized power is the rated power of the load ranging from 0 to 5000 W.
- 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.
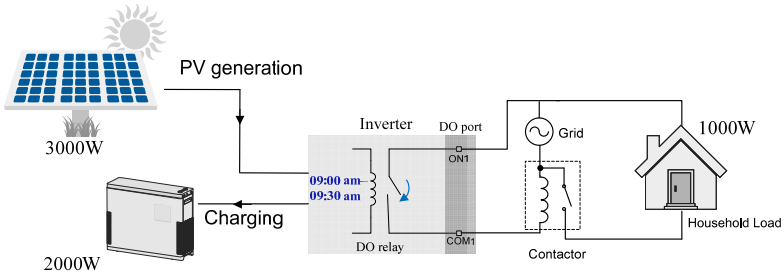
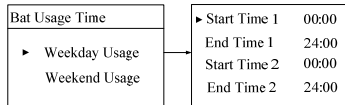**Fig. 10-4** DO Operation in Optimized Control

10.7.8 Setting the Communication Parameters

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×7)→Comm. Param (Press ENT)
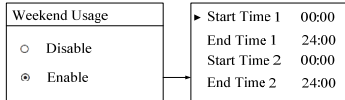
– The communication address ranges from 1 to 247.

– 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.
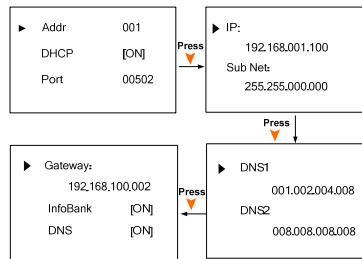
10.7.9 Setting the Battery Type

If the battery type or capacity setting is inconsistent with the actual, the charge/discharge current may be less than the actual charge/discharge ability. However, the system can operate normally. Proceed as follows to modify the settings.

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×8)→Battery Type (Press ENT)

Refer to "**10.6 Starting and Stopping the Inverter**" to stop the inverter before modifying the battery type. Otherwise the warning screen will prompt.

Pls stop inverter first!
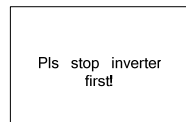
Press ▲/▼ to select the battery type and **Press ENT** to confirm.

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"No Battery" or "Lead-acid Narada" option:

Battery Type   1/3
◉   No Battery
○   Li-ion Samsung
○   Li-ion LG

Press ENT →

Setting completed !

"Li-ion Samsung"option:
Set the tray number of battery.

Battery Type   1/3
○   No Battery
◉   Li-ion Samsung
○   Li-ion LG

Press ENT →

Li-ion Samsung
► Tray Number   2

"Li-ion LG" option:
Set the battery capacity.

Battery Type   1/3
○   No Battery
○   Li-ion Samsung
◉   Li-ion LG

Press ENT →

Li-ion LG
◉   LG Generation I
○   LG Generation II

Li-ion Generation II
◉ 3.3 kWh   ○ 6.5 kWh
○ 9.8 kWh   ○ 13.0 kWh
○ 16.3 kWh   ○ 19.6 kWh

Li-ion Generation I
◉   [6.4] kWh
○   [6.4+3.2] kWh
○   [6.4+3.2+3.2] kWh

"Li-ion Pylon" option:

Battery Type   2/3
◉   Li-ion Pylon
○   Li-ion GCL
○   Li-ion BlueSun

Press ENT →

Li-ion Pylon
◉   US2000A
○   US2000B/Phantom-S

Press ENT →

US2000A
► Tray Number   2

"Li-ion GCL" option:

Battery Type   2/3
○   Li-ion Pylon
◉   Li-ion GCL
○   Li-ion BlueSun

Press ENT →

Li-ion GCL
► Tray Cap   [2.5kWh]
Tray Number   1

"Li-ion BlueSun" option:

Battery Type   2/3
○   Li-ion Pylon
○   Li-ion GCL
◉   Li-ion BlueSun

Press ENT →

Li-ion BlueSun
► Tray Number   1

"Other Lead-acid" option:

Battery Type   3/3
○   Lead-acid Narada
◉   Other Lead-acid

Press ENT →

Only qualified personnel are allowed to adjust relevant parameters. Improper settings may cause damage to the inverter!

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```
┌─────────────────────────┐    ┌─────────────────────────┐    ┌─────────────────────────────┐
│ ▶ Max. SOC    090.0 %   │    │ ▶ Over Vtg     58.8 V   │    │ ▶ Max. Chrg     0.300 C     │
│   Min. SOC    040.0 %   │ →  │   Low Vtg      42.0 V   │ →  │   Max. DChrg    0.300 C     │
│   Rated Vtg   048.0 V   │    │   Over Temp    60.0 ℃   │    │   CSTVtgChrg    56.40 V     │
│   Capacity    200 Ah    │    │   Low Temp    -25.0 ℃   │    │   DChrgEndVtg   43.20 V     │
└─────────────────────────┘    └─────────────────────────┘    └─────────────────────────────┘
```

10.7.10 Setting the Protective Parameters

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×9)→Prot. Param (Press ENT)

When the grid voltage or frequency reaches the recovery value, the corresponding fault code displayed on the LCD will be cleared and the inverter can start operating.

```
┌──────────────────┐    ┌──────────────────┐
│ ▶ Vmax-recover   │    │ ▶ Fmax-recover   │
│     253.0        │    │     50.15Hz      │
│   Vmin-recover   │    │   Fmin-recover   │
│     205.0V       │    │     47.50Hz      │
└──────────────────┘    └──────────────────┘
```

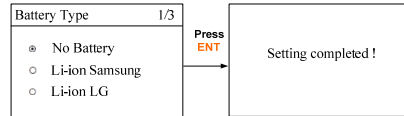**Power Ramp Rate**: the ramp up/down rate of power variation.
The power rate limit mode is enabled by default.
The default set-point is 16.67% of rated power per minute.
Set to *Disable* to turn off the function.

```
┌──────────────────────┐
│ ▶ Power Ramp Rate En. │
│       [ Enable ]      │
│   Power Ramp Rate     │
│       16.67%          │
└──────────────────────┘
```

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.

```
┌──────────────────────┐
│ ▶ 10 Min Over Vtg En. │
│       [ Enable ]      │
│   10 Min Over Vtg     │
│       255.0V          │
└──────────────────────┘
```

Tab. 10-4 Protective Parameter Explanations

Parameter	Explanation	Default	Range
Vmax-recover	Recovery value for over-voltage fault. Inverter can start operating only when the grid voltage is below this value.	253.0 V	230 V–264 V
Vmin-recover	Recovery value for under-voltage fault. Inverter can start operating only when the grid voltage is above this value.	205.0 V	184 V–230 V
Fmax-recover	Recovery value for over-frequency fault. Inverter can start operating only when the grid frequency is below this value.	50.15 Hz	50 Hz–53 Hz
Fmin-recover	Recovery value for under-frequency fault. Inverter can start operating only when the grid frequency is above this value.	47.50 Hz	47 Hz–50 Hz

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Parameter	Explanation	Default	Range
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	244 V–258 V

10.7.11 Adding the Existing System

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×10)→Existing Sys (Press ENT)

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

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

```
Existing Sys

  ○  Disable
  ⦿  Enable
```

```
▶ Existing Sys Rated-P
              00000W
   Total Export Limit
              05000W
```
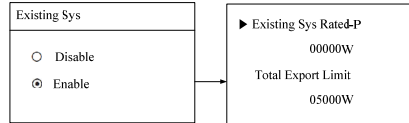
10.7.12 Testing Earth Fault

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×11)→Earth Fault (Press ENT)

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.

```
Testing earth fault
 relay and buzzer
 inside alarm. . .
```
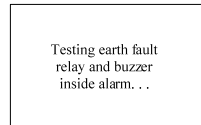
10.7.13 DRM Switch Setting

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×12)→DRM Switch (Press ENT)

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

Set to *Disable* to turn off the function.

```
DRM Switch

  ○  Disable
  ⦿  Enable
```
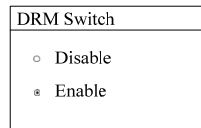
10.7.14 PT1000 Switch Setting

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×13)→PT1000 Switch (Press ENT)

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

Set to *Enable* to turn off the function.

PT1000 Switch
◉ Disable
○ Enable

10.7.15 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.

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×14)→Factory Reset (Press ENT)

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

Menu	1/2
Run Info	
► ON / OFF	
Settings	

ON / OFF
ON
► OFF
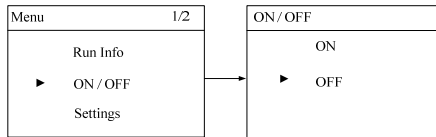
Enter the "Settings" menu and navigate to "Factory Reset". Press **ENT** to confirm.

Factory Reset
Confirm factory reset?

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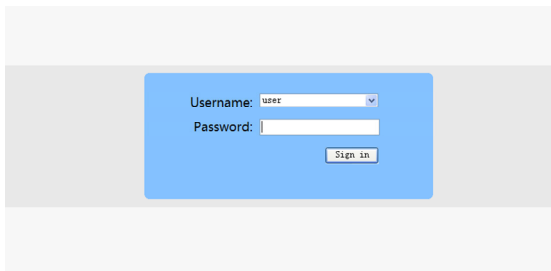
NOTICE
Abnormality may be caused if users make parameter modification with installer permission. This action will void any warranty rights.

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 "**10.7.8 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 user can change the password after signing in. For details, see the tab in the Webserver "**System Information**".
> - The figures in this chapter are all with an installer's permission.

11.2　Main Interface
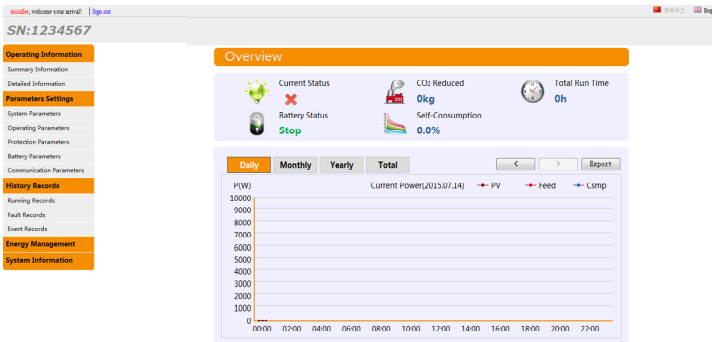
Fig. 11-1 Webserver Main Interface

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.

Tab. 11-1 Icons Explanation

Icon	Name	Description
	Current status	✓: no indication of faults ✗: indication of faults, e.g. with the inverter, and with DSP and LCD communication.
	CO_2 reduced	CO_2 reduction (kg) due to the use of the solar system.
	Total runtime	Total operating time of the inverter (h).
	Battery status	Battery state of charge.
	Self-consumption	The proportion of PV power generation used for load consumption, as a percentage.

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11.3   Navigation Introduction
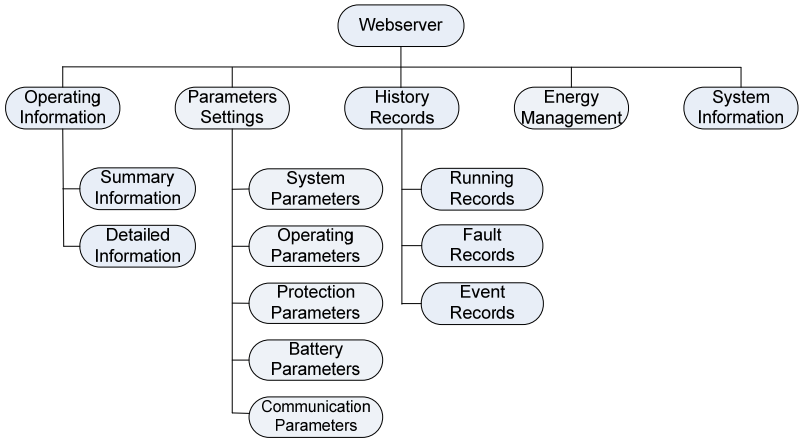
Fig. 11-2 Webserver Navigation

> 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 4777.2 Compliant

The inverter supports the demand response modes, the reactive power regulation, and the power quality response, as specified in the standard AS/NZS 4777:2015.

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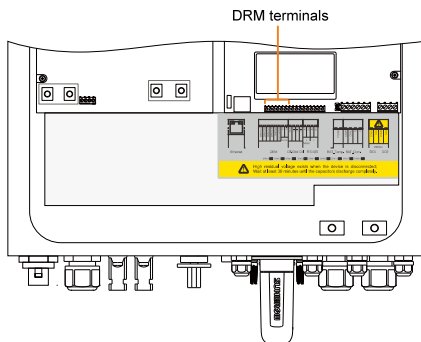
The modes from DRM0 to DRM8 are supported by the inverter and the information is marked on the label located near the DRM terminals.

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

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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:

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

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

4. Remove the cable jacket by 40 mm to 50 mm and strip the wire insulation by 5 mm–7 mm.

5. Tighten the wires to the corresponding terminals, as shown below.

DRM

DRM Termianls

1 2 3 4 5 6 7 8

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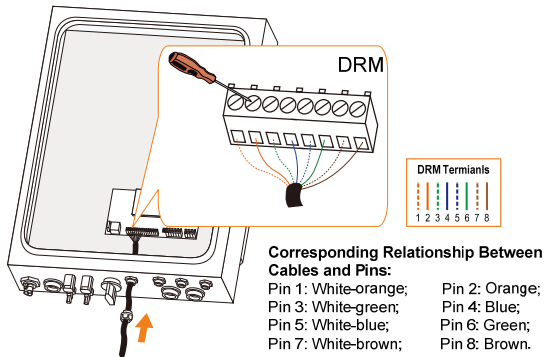
6. Fasten the swivel nut and connect the other end to the DRED.

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.

Main Screen (Press ENT)→Menu→Run Info (Press ENT)		

Press ▲ / ▼ to turn to the page showing DRM information.	Menu 1/2
	▶ Run Info
	    ON / OFF
	    Settings
		DRM State No
		Import Limit 100.0%
		Export Limit 100.0%

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 4777:2015.

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Reactive Power (Press ENT)

Press ▲/▼ to select the desired option and
Press **ENT** to confirm.
For the PF mode, see "**10.7.2 Setting Reactive Power Regulation**".

```
Reactive Power

  ⊙ OFF      ○  PF
  ○ Qt       ○  Q(p)
  ○ Q(u)
```

12.2.1 "*Qt*" Mode

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

```
Qt  Setting


► Qt Limit      + 060.0%
```

12.2.2 "*Q(p)*" Mode

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

```
Leading PF      1.000
Lagging PF      0.900
Upper Power    100.0%
Lower Power     50.0%
```

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 (as %)	50%	0%–50%
*Upper Power**	Upper limit of the output power (as %)	100%	50%–100%

*Lower Power <Upper Power

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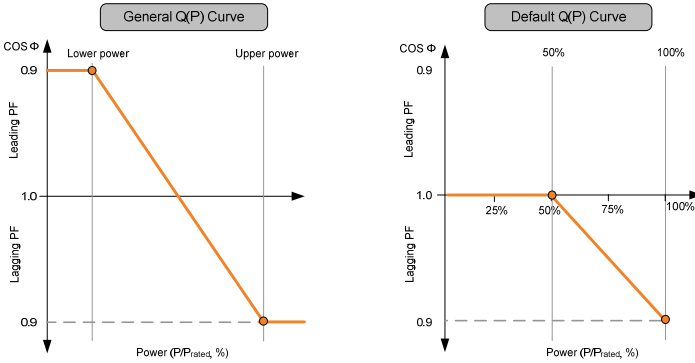
Fig. 12-1 Reactive Power Regulation Curve in Q(p) Mode

12.2.3 "*Q(u)*" Mode

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

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

Leading Q/Sn	30.0%
Lagging Q/Sn	30.0%

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

Parameter	Explanation	Default	Range
V1 Ref.	Grid voltage reference value 1	207.0 V	Not applicable
V2 Ref.	Grid voltage reference value 2	220.0 V	216 V–230 V
V3 Ref.	Grid voltage reference value 3	250.0 V	235 V–255 V
V4 Ref.	Grid voltage reference value 4	265.0 V	244 V–265 V
Leading Q/Sn	Q/Sn value of voltage *V1 Ref.*	30%	0%–60%
Lagging Q/Sn	Q/Sn value of voltage *V4 Ref.*	30%	0%–60%
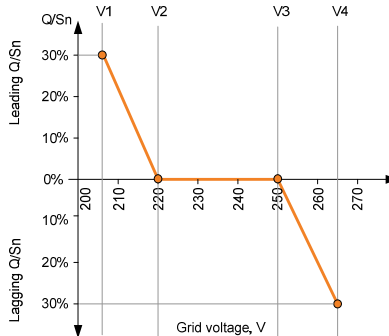
Fig. 12-2 Reactive Power Regulation Curve in Q(u) Mode

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12.3   Active Power Response

Main Screen (Press ENT)→Menu (Press ▼×2)→Settings (Press ENT)→Input password 111 (Press ENT)→Settings (Press ▼×1)→Active Power (Press ENT)

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

```
┌─────────────────────────┐
│ Active Power            │
│  ►    Volt-watt         │
│       Frq-watt          │
│       Volt-watt (Chrg)  │
└─────────────────────────┘
```

12.3.1 Volt-watt Response

The Volt-watt response mode is enabled by default.

```
┌─────────────────────────┐
│ Volt-watt         1/2   │
│                         │
│   ○  Disable            │
│   ⊙  Enable             │
└─────────────────────────┘
```

Set four grid voltage reference values. The output power of the inverter will vary in response to the grid voltages.

```
┌─────────────────────────┐
│ ►  V1 Ref.     207.0V   │
│    V2 Ref.     220.0V   │
│    V3 Ref.     250.0V   │
│    V4 Ref.     265.0V   │
└─────────────────────────┘
```

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

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

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12.3.2 Volt-watt Response for Battery Charging

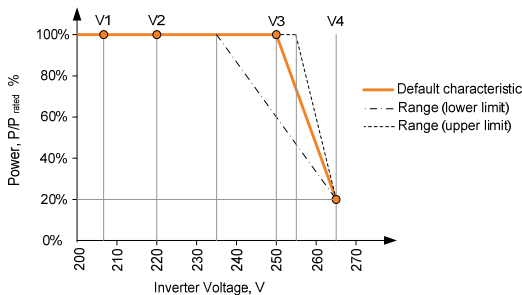When the power from the grid is required to charge the energy storage system, the import power from the grid varies in response to the grid voltages. The response curve is defined by the voltage reference values and the corresponding power consumption from the grid for charging energy storage.

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.

```
▶  V1 Ref.        207.0V
    V2 Ref.        220.0V
    V3 Ref.        250.0V
    V4 Ref.        265.0V
```
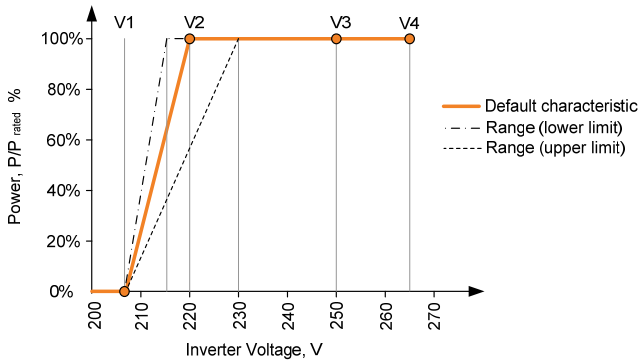

Fig. 12-4 Vtg-Watt Response Mode for Battery Charging

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	50.25 Hz–52.00 Hz
OverFrq End	The Stop frequency value for over-frequency response	52.00 Hz	51.00 Hz–52.00 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).

▶ OverFrq Start
          50.25 Hz
  OverFrq End
          52.00 Hz

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 "**10.7.10 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).

▶ UnderFrq Start
          49.75 Hz
  UnderFrq End
          49.00 Hz

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 "**10.7.10 Setting the Protective Parameters**".
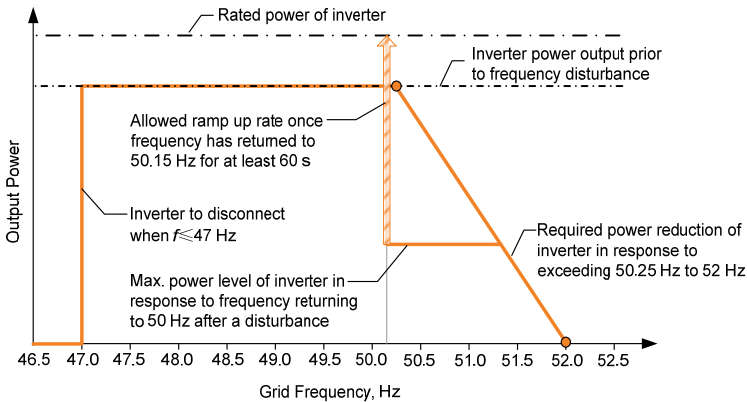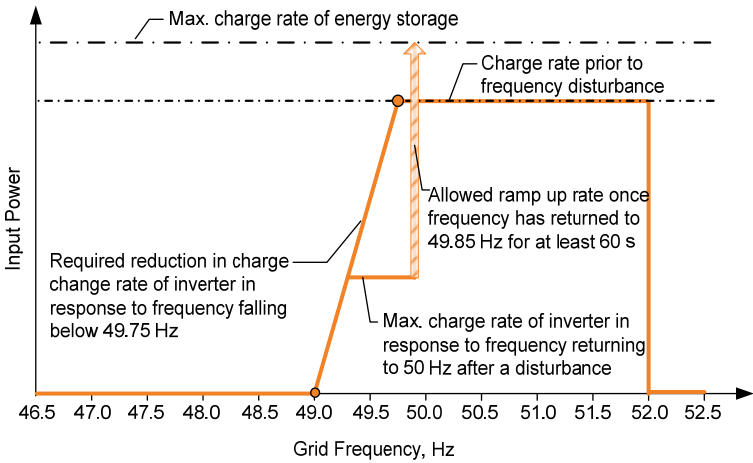

Fig. 12-6 Frq-Watt Mode for Under-frequency Conditions

13 Appendix IV: Technical Data

13.1   Inverter Technical Data

PV Input Data	
Max. PV input power	6500 W
Max. PV input voltage	600 V
Startup voltage	125 V
Nominal input voltage	360 V
MPP voltage range	125 V–560 V
MPP voltage range for nominal power	260 V–520 V
No. of MPPTs	2
Max. number of PV strings per MPPT (DC1/DC2)	1/1
Max. PV input current (DC1/DC2)	20 A (10 A / 10 A)
Max. current for input terminals	12 A
Short circuit current of PV input	24 A (12 A / 12 A)
Max. inverter backfeed current to array	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	
Max. AC input power	3000 W
Nominal AC output power	4990 W
Nominal AC output current	21.6 A
Max. AC output apparent power	5000 VA
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)

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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 switch (solar)	Optional
DC fuse	No
Over-voltage protection	III
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
Night power consumption	<1 W
Operating ambient temperature range	-25℃ to 60℃(> 45℃ derating)
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 (optional), 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
Certificates and approvals (planned)	AS4777, AS/NZS3100, IEC 62109-1, IEC62109-2, IEC 62619, IEC 62040, EN 61000-6-2/-3
Mechanical Data	
Dimensions (W x H x D)	447 mm x 510 mm x 150 mm
Mounting method	Wall-mounting bracket
Weight	20 kg
Backup Data	
Nominal voltage	230 Vac (±2%)

Total harmonic factor output	4% (full load)
Frequency range	50 Hz (±0.2%)
Switch time to emergency mode	10 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 / 5000 VA

13.2 STB5K (backup box) Technical Data

Max. input / output current	25 A
Nominal AC voltage	230 Vac–240 Vac
AC voltage range	180 Vac–275 Vac
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

* The AC voltage ranges from 180 Vac to 250 Vac when the operating ambient temperature is 50℃...60℃.

13.3 Meter Technical Data

Nominal voltage	240 Vac
Input voltage range	180 Vac–286 Vac
Power consumption	<2 W (10 VA)
Max. operating current	100 A
Grid frequency	50 Hz
Measurement accuracy	Class I
Interface and communication	RS485
Ingress protection rating	IP20
Operating temperature range	-25℃ to 75℃
Allowable relative humidity range	0%–95%
EMC (Electro Magnetic Compatibility)	Class B
Dimensions (W x H x D)	18 mm x 117 mm x 65 mm
Mounting method	35 mm DIN-rail
Weight	0.2 kg

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- installing or operating the products in an unintended environment;
- ignoring relevant safety regulations in the deployment location when installing or operating the products;
- ignoring safety warnings and instructions contained in all documents relevant to the products;
- installing or operating the products under incorrect safety or protection conditions;
- altering the products or supplied software without authority;
- the product faults due to operating attached or neighboring devices beyond allowed limit values; and
- damage caused by the natural environment beyond the rated operating range of the inverter.

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About Us

SUNGROW is a China-leading manufacturer of various power electronic products for renewable energy generation systems, supplying to a global customer base. Our products include converters, inverters, battery chargers and other power supplies for distributable generation systems in both grid-connected and stand-alone applications. The power rating of SUNGROW products covers from hundred watt to mega-watt systems.

The vision of SUNGROW is to help our customers acquire stable and clean power with minimum cost, maximum reliability and enhanced safety.

Contact Information

Should you have any problems, please contact us through the following information. We will be more than happy to assist you!

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