User Manual

SH3K6 / SH4K6

Grid-Connected Hybrid Inverter
About This Manual

Applicability

This manual is applicable to the inverter types:

- SH3K6
- SH4K6

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.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>! DANGER</td>
<td>Indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>! WARNING</td>
<td>Indicates a hazard with a medium level of risk that, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>Symbol</td>
<td>Explanation</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>! <strong>CAUTION</strong></td>
<td>Indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>NOTICE</td>
<td>Indicates a situation that, if not avoided, could result in equipment or property damage.</td>
</tr>
<tr>
<td>i</td>
<td>Indicates additional information, emphasized contents or tips that may be helpful, e.g. to help you solve problems or save time.</td>
</tr>
</tbody>
</table>
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1 Safety

General Safety

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

Incorrect operation or work may cause:

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

⚠️ DANGER

Lethal voltage!

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

NOTICE

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

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

Inverter

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

Tab. 1-1 Symbols on the Inverter

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Disconnect the inverter from all the external power sources before service!</td>
</tr>
<tr>
<td>⚪️ 10 min</td>
<td>Do not touch live parts until 10 minutes after disconnection from the power sources.</td>
</tr>
</tbody>
</table>
1 Safety  User Manual

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔥</td>
<td>There is a danger from a hot surface that may exceed 60°C.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Danger to life due to high voltages! Only qualified personnel can open and service the inverter.</td>
</tr>
<tr>
<td>📖</td>
<td>Check the user manual before service!</td>
</tr>
<tr>
<td>🚫</td>
<td>Do not dispose of the inverter together with household wastes.</td>
</tr>
<tr>
<td>☐</td>
<td>The inverter does not have a transformer.</td>
</tr>
<tr>
<td>🟢</td>
<td>TUV mark of conformity.</td>
</tr>
<tr>
<td>🟢</td>
<td>CE mark of conformity.</td>
</tr>
</tbody>
</table>

⚠️ DANGER

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

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

Risk of inverter damage or personal injury

Do not pull out PV connectors, AC connector or battery connectors while the inverter is running. De-energize from all 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.

---

**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.
Provide sufficient ventilation for lead-acid battery systems 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.

Improper settings or maintenance can permanently damage the battery.

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

Lethal voltages and danger to life due to electric shock!

- Only use the Energy Meter in a dry environment and keep it away from liquids.
- Install the Energy Meter in the switch cabinet only and ensure that the connection areas for the line and the neutral conductors are behind an insulting cover or have contact protection.
- Install an external disconnect switch between the Energy Meter and the grid-connected point. The external disconnector must be close to the Energy Meter and easily accessible.
- Disconnect the Energy Meter from voltage sources before cleaning. The Energy Meter must be cleaned with a dry cloth only.
**WARNING**

**Fire hazard**

If a fuse is missing or incorrect, a fire may be caused when a fault occurs. This can result in death or serious injury.

Protect the line conductors of the Energy Meter with a fuse or a main/selective circuit breaker, max. 100 A for single-phase meter and max. 65 A for three-phase meter.

**Skills of Qualified Personnel**

Qualified personnel must have the following skills:

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

WARNING

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 document is not permitted.

NOTICE

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

SH3K6/SH4K6 is a single-phase hybrid inverter applicable to on-grid PV systems. With the integrated Energy Management System (EMS), it can control and optimize the energy flow in order 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.

![Inverter Appearance](image-url)

Fig. 2-1 Inverter Appearance
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC-Grid</td>
<td>AC terminal to the utility grid.</td>
</tr>
<tr>
<td>2</td>
<td>Backup ctrl</td>
<td>Reserved.</td>
</tr>
<tr>
<td>3</td>
<td>PV connection</td>
<td>PV1+, PV1-, PV2+ and PV2-.</td>
</tr>
<tr>
<td>4</td>
<td>DC switch</td>
<td>To disconnect the DC current safely.</td>
</tr>
<tr>
<td>5</td>
<td>Wi-Fi terminal</td>
<td>To connect the Wi-Fi module (optional).</td>
</tr>
<tr>
<td>6</td>
<td>Battery connection</td>
<td>BAT+ and BAT-.</td>
</tr>
<tr>
<td>7</td>
<td>Communication connection</td>
<td>RS485, Ethernet, CAN, AI, DI and DO.</td>
</tr>
<tr>
<td>8</td>
<td>Second PE terminal</td>
<td>For reliable grounding.</td>
</tr>
<tr>
<td>9</td>
<td>LCD display panel</td>
<td>Human-computer interaction interface.</td>
</tr>
<tr>
<td>10</td>
<td>Nameplate</td>
<td>Clearly identify the product, including the SN, password, technical data, certifications, etc.</td>
</tr>
</tbody>
</table>

The following figure shows the dimensions of the inverter.

![Fig. 2-2 Outline Dimensions (unit: mm)](image)

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

![Fig. 2-3 LCD Display Panel](image)
### No. Name Description

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screen</td>
<td>To display the information.</td>
</tr>
<tr>
<td>2</td>
<td>Indicator</td>
<td>Green and red can be indicated via the indicator, from which user can know the current status. For detailed definition, see Tab. 7-3.</td>
</tr>
<tr>
<td>3</td>
<td>Buttons</td>
<td>User can operate the LCD menu via the four buttons. For detailed functions, see Tab. 7-1.</td>
</tr>
</tbody>
</table>

### Energy Meter

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

Single-phase energy meter and its terminals are shown in the following figure.

![Energy Meter Diagram](image)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1, 4</td>
<td>For the 1-phase sensor</td>
</tr>
</tbody>
</table>
| B 2, 5      | 2 is for RS485-A  
5 is for RS485-B |
| C PWR/COM   | Stead on: the meter is powered on.  
Flashing: the meter is communicating with the inverter.  
Off: no power supply to the meter. |
| 1000 imp/kWh | Glowing: 1000 impulse per kWh active power is detected.  
Off: no active power is detected. |
| D 3, 6      | 3 is for the line conductor  
6 is for the neutral conductor |
| E /         | CT clamp for the 1-phase sensor |

The dimensions of single-phase energy meter are shown as below.
Three-phase energy meter and its terminals are shown in the following figure.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A L1, L2, L3, N</td>
<td>Output terminals to the load side</td>
</tr>
<tr>
<td>Active PWR</td>
<td>Glowing: 1000 impulse per kWh active power is detected. Off: no active power is detected.</td>
</tr>
<tr>
<td>Reactive PWR</td>
<td>Glowing: reactive power is detected. Off: no reactive power is detected.</td>
</tr>
<tr>
<td>Com.</td>
<td>Flashing: the meter is communicating with the inverter. Off: no communication between the meter and the inverter.</td>
</tr>
<tr>
<td>C RS485-A, -B</td>
<td>RS485 communication terminals</td>
</tr>
<tr>
<td>D L1, L2, L3, N</td>
<td>Input terminals on the grid side.</td>
</tr>
</tbody>
</table>

The dimensions of three-phase energy meter are shown as below.
The single-phase Energy Meter and the three-phase Energy Meter are alternative in the delivery. The meter figures in this document have been created for the three-phase Energy Meter unless otherwise specified.

For details about the Energy Meter, please refer to the Quick Installation Guide for it.

### 2.1 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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Utility grid</td>
<td>Grid grounding system types: TT, TN</td>
</tr>
<tr>
<td>B</td>
<td>SUNGROW energy meter (three-phase for example)</td>
<td>Measures the export power and communicate with the inverter via the RS485 port.</td>
</tr>
</tbody>
</table>
### Item | Description | Remark
--- | --- | ---
D | PV strings | Monocrystalline silicon, polycrystalline silicon, and thin-film without grounding.  
E | Household load | Devices that consume energy.  
F | Battery (optional) | A Li-ion battery or a lead-acid battery.  

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

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

---

**Day**

---

**Energy Management during Night**
The battery discharges to provide energy to loads. If the battery is empty or there is not enough power from the battery system to supply active loads, the unmet power will be supplied by the grid.
If the meter is abnormal or not equipped:

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

### 2.2 Retrofitting the Existing PV System

The SH3K6/SH4K6 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 SH3K6 / SH4K6.

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 SH3K6/SH4K6, the self-consumption of the new system will be greatly improved.
**Fig. 2-7 Retrofitting the Existing PV System**

The existing PV inverter works as a load in the whole system but supply PV power to the energy storage system, as the power flow shown on the main screen. Refer to "11.4.2 Adding the Existing System" to set the rated power of the existing PV inverter.

The output power of the existing PV inverter should be taken into consideration for export power setting. For detailed settings, see the zero-export setting in commissioning.
3 Function Description

3.1 Safety Function

3.1.1 Protection

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

3.1.2 Earth Fault Alarm

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

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

If an earth fault occurs,

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

3.1.3 SPI and Auto Test (Italy only)

The auto test system will check the maximum/minimum frequency and voltage provided in the interface protection system (SPI). For each frequency and voltage protection function, the tripping threshold varies linearly upward or downward with a slope of $\leq 0.05$ Hz/s or $\leq 0.05$ V/s respectively for the frequency and voltage protection. For details, see “11.8 Auto Test (Italy)”.

The integrated SPI is capable to receive the signals aimed at changing the frequency protection thresholds or the command of remote shutdown. For details, see “13.2.6 Interface Protection System (SPI)”.
3.2 Energy Conversion and Management

The inverter 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.

\[ P = P_n \times \left( \frac{V_{\text{grid}}}{230 \text{ V}} \right) \]
The following figure shows the under-voltage derating curve.

![Under-voltage derating curve](Fig. 3-1)

**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.

![Power factor derating curve](Fig. 3-2)

**3.2.2 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 “13 Appendix IV: Power Response”.

- **PF**: Fixed power factor mode.
- **Qt**: Fixed reactive power mode.
• **Q(p):** The displacement power factor 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.

### 3.2.3 Active Power Response

For details about the LCD settings, see “13.1.4 Over-frequency Response”.

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.

### 3.2.4 Load Control

The inverter provides a load control dry-contact (DO1 relay), which can control the load via a contactor. Refer to “6.7 DO Connection” for the cable connection.

User may set the control mode according to individual demand. Refer to “11.4.9 Setting Load Control” for LCD settings.

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

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

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

### 3.3 Battery Management

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

- Li-ion battery from LG Chem, GCL, Pylon, BYD and Sungrow.

- Lead-acid battery from Narada (which has a pre-set setting) or others (which require manual configuration).

The inverter is capable of managing the battery charging, discharging, and maintenance based on the battery status, which will maximize the battery life.

**NOTICE**

The recommended parameters listed in this section may be updated or revised due to product development. Please refer to the manual supplied by the battery manufacturer for the latest information.
# State Definition

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

### Tab. 3-1 Battery Status Definition

<table>
<thead>
<tr>
<th>Type</th>
<th>Port Voltage / SOC</th>
<th>Damaged</th>
<th>Empty</th>
<th>Normal</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sungrow (new system)</td>
<td>&lt; 28 V</td>
<td>SOC &lt; 0 %</td>
<td>0 %–100 %</td>
<td>SOC = 100 %</td>
<td></td>
</tr>
<tr>
<td>Sungrow (retrofitting system or with the forced charge function enabled)</td>
<td>&lt; 28 V</td>
<td>SOC &lt; 5 %</td>
<td>5 %–100 %</td>
<td>SOC = 100 %</td>
<td></td>
</tr>
<tr>
<td>LG (RESU G1/G2)</td>
<td>&lt; 30 V</td>
<td>SOC &lt; 5 %</td>
<td>5 %–95 % (by default)</td>
<td>SOC &gt; 95 %</td>
<td></td>
</tr>
<tr>
<td>GCL</td>
<td>&lt; 30 V</td>
<td>SOC 15 %</td>
<td>&lt; 15 %–95 % (by default)</td>
<td>SOC &gt; 95 %</td>
<td></td>
</tr>
<tr>
<td>Pylon (US2000A)</td>
<td>&lt; 30 V</td>
<td>SOC 19 %</td>
<td>&lt; 19 %–97 % (by default)</td>
<td>SOC &gt; 97 %</td>
<td></td>
</tr>
<tr>
<td>Pylon (US2000B)</td>
<td>&lt; 30 V</td>
<td>SOC 20 %</td>
<td>&lt; 20 %–100 % (by default)</td>
<td>SOC = 100 %</td>
<td></td>
</tr>
<tr>
<td>BYD</td>
<td>&lt; 30 V</td>
<td>SOC 10 %</td>
<td>&lt; 10 %–100 % (by default)</td>
<td>SOC = 100 %</td>
<td></td>
</tr>
<tr>
<td>Narada lead-acid</td>
<td>&lt; 30 V</td>
<td>30 V–40 V</td>
<td>40 V–56.4 V</td>
<td>&gt; 56.4 V</td>
<td></td>
</tr>
<tr>
<td>Other lead-acid</td>
<td>&lt; 30 V</td>
<td>Configured by the customer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The SOC limits of Li-ion batteries except Sungrow batteries can be modified via the Webserver. For details about the Webserver, see "12 Appendix III: Visiting and Configuring the Webserver".

### 3.3.2 Charge Management

#### Emergency Charge Management

To avoid the damage caused by long time excessive discharge,

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

The inverter cannot respond to the discharge command during emergency charge. The following table describes the emergency charge of different types of batteries.
Tab. 3-2 Emergency Charge Description

<table>
<thead>
<tr>
<th>Type</th>
<th>Trigger Condition</th>
<th>Finishing Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sungrow (new system)</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Sungrow (retrofitting system)</td>
<td>SOC ≤ 2 %</td>
<td>SOC ≥ 4 %</td>
</tr>
<tr>
<td>LG (RESU G1/G2)</td>
<td>SOC ≤ 7 %</td>
<td>SOC ≥ 9 %</td>
</tr>
<tr>
<td>GCL</td>
<td>SOC ≤ 12 %</td>
<td>SOC ≥ 14 %</td>
</tr>
<tr>
<td>Pylon (US2000A/US2000B)</td>
<td>SOC ≤ 10 %</td>
<td>SOC ≥ 15 %</td>
</tr>
<tr>
<td>BYD</td>
<td>SOC ≤ 7 %</td>
<td>SOC ≥ 9 %</td>
</tr>
<tr>
<td>Lead-acid</td>
<td>The battery voltage is lower than the lower limit of under-voltage. (42 V by default)</td>
<td>The battery voltage rises to the setting value of under-voltage protection value.</td>
</tr>
</tbody>
</table>

Normal Charge Management

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

The maximum allowable charge current of battery is mainly limited to the maximum charge current of the inverter 65A and the maximum / recommended charge current from the battery manufacturer.

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

3.3.3 Discharge Management

Discharge management can effectively protect the battery from deep discharging.

The maximum allowable discharge current of battery is mainly limited to the maximum discharge current of the inverter 65A and the maximum / recommended discharge current from the battery manufacturer.

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

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

The maintenance process is as follows.

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

3.3.5 Battery Temperature Sensor (PT1000)

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

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

The temperature sampling function of the sensor PT1000 for lead-acid batteries is disabled by default. Refer to “11.4.12 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 records running information and error information. 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)
4.2 Delivery Contents

![Inverter](image)
![Wall-mounting bracket](image)
![Expansion plug set](image)

![Single-phase meter and CT cable](image)
![Three-phase meter](image)
![AC connector set](image)

![PV connectors (x2)](image)
![Power supply cable (meter)](image)
![RS485 cable (meter)](image)

![M5 screws and washers](image)
![OT25-6 terminals](image)
![Copper bar](image)

![CAN cable (battery)](image)
![Documents](image)

**Fig. 4-2 Delivery Contents**

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

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

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

d) The documents include a Quick User Manual for the inverter, a Quick Installation Guide for the meter, 1 CD, a packaging list, quality certificates and product test reports.
4.3 Storing the Inverter

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

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

The following figure shows the storage of the inverter.

![Fig. 4-3 Example of Inverter Storage](image)

**NOTICE**

The packaging should be upright.

If there is more than one inverter to be stored, at most 5 layers can be stacked.
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°C. The following figure shows the ambient temperature and relative humidity limits.
5. The location should be away from flammable materials or gas, and not enclosed.

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

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

8. Install vertically for good heat dissipation.

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

5.2 Installing the Inverter

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

1. Install the wall-mounting bracket.

Note:

(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 and bracket.
2. Mount the inverter to the bracket.

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

5.3 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.

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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cable socket</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>Washer</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>Spring washer</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>Screw</td>
<td>M5 x 12 mm (3.0 N·m)</td>
</tr>
<tr>
<td>E</td>
<td>Yellow-green cable</td>
<td>6–10 mm² copper wire or 10–16 mm² aluminum wire</td>
</tr>
</tbody>
</table>

**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.
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](image)

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-Grid</td>
<td>AC terminal to the utility grid.</td>
</tr>
</tbody>
</table>
### Connection terminals on the inner configuration circuit board are shown below:

![Connection Circuit Board](image)

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Label</th>
<th>Connection</th>
<th>Tool Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Copper</td>
<td>PV (Parallel mode)</td>
<td>Phillips screwdriver</td>
</tr>
<tr>
<td>2</td>
<td>Ethernet</td>
<td>Communication</td>
<td>Flat-head screwdriver with an open end of 2 mm</td>
</tr>
<tr>
<td>3</td>
<td>DRM</td>
<td>Local control for SPI (Italy)</td>
<td>Flat-head screwdriver with an open end of 2 mm</td>
</tr>
<tr>
<td>4</td>
<td>DI</td>
<td>Reserved</td>
<td>Flat-head screwdriver with an open end of 2 mm</td>
</tr>
<tr>
<td>5</td>
<td>RS485</td>
<td>A1, B1 for external device, A2, B2 for the meter</td>
<td>Flat-head screwdriver with an open end of 2 mm</td>
</tr>
<tr>
<td>6</td>
<td>120 Ohm</td>
<td>RS485</td>
<td>Flat-head screwdriver with an open end of 2 mm</td>
</tr>
<tr>
<td>7</td>
<td>BAT_Temp.</td>
<td>Temperature sensor</td>
<td>Phillips screwdriver</td>
</tr>
<tr>
<td>8</td>
<td>BAT_Com. (CANH, CANL)</td>
<td>Battery communication</td>
<td>Flat-head screwdriver with an open end of 3 mm</td>
</tr>
<tr>
<td>9</td>
<td>DO1</td>
<td>Power management</td>
<td>Phillips screwdriver</td>
</tr>
<tr>
<td>10</td>
<td>DO2</td>
<td>Earth fault alarm</td>
<td>Phillips screwdriver</td>
</tr>
<tr>
<td>11</td>
<td>BAT+, BAT-</td>
<td>Battery</td>
<td>Phillips screwdriver</td>
</tr>
</tbody>
</table>
6.2 Meter Connection

The Energy Meter must only be connected to the distribution board of household loads next to the main switch, as shown in the following figure.

For Three-phase Energy Meter

1. Take out the RS485 cable from the packaging and connect the ends to terminals A and B on the Energy Meter, as shown below.

2. Strip the insulation from the power wires by 10 mm. Then connect the wires to the terminals on the Energy Meter, as shown below. (Cross-section: 10 mm² to 25 mm²)
• The line conductor L1 supplies power to the Energy Meter. At least the line conductor L1 and the neutral conductor must be connected to switch on the Energy Meter.

• Just connect the line conductor L1 and the neutral conductor, then the three-phase Energy Meter can be used as a single-phase meter.

For Single-phase Energy Meter

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

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.
      The CT clamp of 1-phase sensor can be placed before or after 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.

   Proceed as follows to connect the RS485 wires to the inverter.
3. Unscrew four screws and remove the enclosure lid. Retain the screws for later use.

4. Unscrew the swivel nut from any Com. Port.

5. Lead the cable through the cable gland. Plug the wires to terminals A2 and B2 on the inverter without tool tightening.

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

6. When the length of RS485 cable is longer than 100 m, push the 120 Ohm (2) switch to “ON” to ensure stable communication, as shown below.
6.3 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: 11 mm to 14 mm

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

6.3.1 Assembling the AC Connector

Take out the AC connector parts from the packaging.

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

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

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

Observe the terminal layout of terminal block.
Do not connect the phase lines to “PE” terminal, otherwise the inverter will not function properly.

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.

6.3.2 Installing the AC Connector

Procedure:

1. Install an AC circuit breaker next to the AC output of the inverter.

<table>
<thead>
<tr>
<th>Inverter Type</th>
<th>Specification for AC Circuit Breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH3K6</td>
<td>20 A</td>
</tr>
<tr>
<td>SH4K6</td>
<td>32 A</td>
</tr>
</tbody>
</table>

2. Disconnect the AC circuit breaker and secure it against reconnection.

3. Align the AC connector and the AC terminal and mate them together by hand until a “Click” is heard or felt.

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

5. Pull all the lines outward to check whether they are firmly installed.
6.4 PV Connection

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.

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

<table>
<thead>
<tr>
<th>Area</th>
<th>DC Limit Each Input</th>
<th>Power for Total Power</th>
<th>DC Limit</th>
<th>Open-circuit Voltage Limit for Each Input</th>
<th>Short Current Limit for Each Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC1</td>
<td>5600 W</td>
<td>6500 W</td>
<td>600 V</td>
<td>12 A</td>
<td></td>
</tr>
<tr>
<td>DC2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Parallel Mode

Both PV strings should have the same type, the same number of PV panels, identical tilt and identical orientation. Two trackers are configured in parallel to handle power and/or current levels higher than those a single tracker can handle.
Prior to connecting the inverter to PV inputs, the specifications in the following table should be met:

<table>
<thead>
<tr>
<th>Total DC Power Limit for Inverter</th>
<th>Open-circuit Voltage Limit for Each Input</th>
<th>Short circuit Current Limit for Total Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>6500 W</td>
<td>600 V</td>
<td>24 A</td>
</tr>
</tbody>
</table>

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

**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**

<table>
<thead>
<tr>
<th>Cross-Section</th>
<th>Cable Diameter</th>
<th>Max. Voltage</th>
<th>Max. Withstand Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mm²–6 mm²</td>
<td>6 mm–9 mm</td>
<td>600 V</td>
<td>Same as short circuit current.</td>
</tr>
<tr>
<td>AWG12–AWG10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Assembling the PV Connector**

1. Strip the insulation from the cables by 7 mm–8 mm.
2. Assemble the cable ends by crimping pliers.

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

Installing the PV Connector
1. 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.
The inverter will not function properly if the DC polarities are reversed. Check the positive and negative polarity of the PV cells.

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](image)

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

### 6.5.2 Ethernet Connection

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

![Fig. 6-4 Ethernet Connection without a Router](image)
The following figure shows how the Ethernet connection may work with a router.

![Ethernet Connection with a Router](image)

**Fig. 6-5 Ethernet Connection with a Router**

**Cable Requirements**

Use a TIA/EIA 568B standard network cable with a diameter of 3 mm–5.3 mm. Refer to the switch/router’s manual for the definition of the communication port.

**Procedure:**

1. Unscrew the swivel nut from any **Com.** port.
2. Lead the cable through the cable gland and remove the cable jacket by 8 mm–15 mm.

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

**Corresponding Relationship Between Cables and Pins:**

- Pin 1: White-orange;
- Pin 2: Orange;
- Pin 3: White-green;
- Pin 4: Blue;
- Pin 5: White-blue;
- Pin 6: Green;
- Pin 7: White-brown;
- Pin 8: Brown.
4. Install the RJ45 plug to the **Ethernet** port.
5. Fasten the swivel nut and connect the other end to the socket of the switch or the router.

### 6.5.3 Wi-Fi Connection

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

### 6.6 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.

**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

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

**NOTICE**

A two-pole DC circuit breaker with over-current protection (voltage rating not less than 100 V and current rating not less than 100 A) should be installed between the inverter and the battery module.
Cable Requirements
Cross-section: 16 mm²–25 mm², OT25-6, cable diameter: 13 mm–16 mm.
Procedure:

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

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

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

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

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

6. Fasten the cables to the corresponding terminals (torque 2.6 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, GCL, Pylon (US2000B), BYD or Sungrow.

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

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

For GCL and BYD batteries, if there are four wires, please cut through the green (pin 6) and white-green (pin 3) wires from the CANH and CANL terminals to set up successful communication.

6.6.3 Connecting the Temperature Sensor

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

Cable Requirements

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

Procedure:
1. Unscrew the swivel nut from any Com. port.

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

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

4. Plug the wires into BAT_Temp. terminal without tool tightening.
   **Note:**
   For reconnection, press the part as shown in the red circle so as to pull out the cable.

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

### 6.7 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

<table>
<thead>
<tr>
<th>Relay</th>
<th>Trigger condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer load control</td>
<td>The load control mode has been set via the LCD menu.</td>
<td>The relay is activated once the conditions of the control mode are satisfied. See “11.4.9 Setting Load Control”.</td>
</tr>
<tr>
<td>Earth fault alarm</td>
<td>The earth fault occurs.</td>
<td>Once the inverter receives the earth fault signal, the relay closes the contact. The relay remains triggered until the fault is removed.</td>
</tr>
</tbody>
</table>

### NOTICE

- An AC contactor must be installed between the inverter and appliances. It is forbidden to connect the load directly to the DO port.
- The current of the DO dry contact should not be larger than 3 A.
- The DO node is not controlled once the inverter is powered off. Connect the AC contactor by the manual switch, so as to control the loads.

### Cable Requirements

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

Procedure:

1. Unscrew the swivel nut from any Com. port.
2. Lead the cable through the cable gland.
3. Remove the cable jacket and strip the wire insulation.

4. Plug the wires into DO terminals without tool tightening.
   **Note:**
   For reconnection, press the part as shown in the red circle so as to pull out the cable.

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

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

7.1 Inspection before Commissioning

Check the following items before starting the system:
1. All the installation sites are convenient for operation, maintenance and service.
2. Check and confirm that 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.

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

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲</td>
<td>For navigating up or increasing the setting value.</td>
</tr>
<tr>
<td>▼</td>
<td>For navigating down or decreasing the setting value.</td>
</tr>
<tr>
<td>ESC</td>
<td>For navigating to the left, quitting the menu or canceling the settings.</td>
</tr>
<tr>
<td>ENT</td>
<td>For navigating to the right or confirming a selection or settings.</td>
</tr>
</tbody>
</table>
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) Power on the battery pack manually if a battery is equipped.
4. Rotate the DC switch to “ON”. The DC switch may be integrated in the inverter or installed by the customer.
5. The LCD screen will be activated 5s later and enter the initial settings.
6. Refer to Fig. 7-1 for button operations and complete all initial settings according to the procedure in Fig. 7-2.

- **Initial Settings 1/3**
  - Country
  - Time
  - Zero-export

- **Initial Settings 2/3**
  - Reactive Power
  - Battery Usage Time
  - Earth Fault

- **Initial Settings 3/3**
  - Exit

---

1. Start
   - Set the country code
      - Country: [ DE ]

2. Set the time
   - Time: 07:38:08
   - Date: 22/02/15

3. Set zero-export
   - Zero-export: ON
   - OFF
   - Partial

4. Set the reactive power
   - Reactive Power
     - OFF
     - PF
     - Q(t)
     - Q(p)
     - Q(u)

5. Set battery usage time
   - Weekday Usage
     - Start Time1: 00:00
     - End Time1: 24:00
     - Start Time2: 00:00
     - End Time2: 24:00
     - Weekend Usage

6. Test earth fault alarm
   - Testing earth fault relay and buzzer inside alarm...

7. Complete initial settings and exit
   - Confirm Exit?
     - Incorrect configuration may cause a fault!

---

* Automatically return to main menu after 3s.

---

Fig. 7-2 Procedure for Initial Settings
• Zero-export (Partial):

**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.

According to the local regulations in Germany, please set the export power to 70 % of the installation capacity.

For example, with a total maximum installation capacity of 4600 W (SH4K6), the export power should be set to 3220 W (i.e. 4600 * 70 %).

Export power range:
- When the existing system is disabled, the range is from 0 to the rated power of the hybrid inverter.
- When the existing system is enabled,
  - the lower limit is the rated power of the existing PV system.
  - the upper limit is ([rated power of the hybrid inverter] + [rated power of the existing PV system]).
  - the value will synchronize with the settings for retrofitting an existing system described in section 11.4.2.

• Reactive power regulation:

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

“PF” mode:
The inverter is capable of operating with fixed power factor.
The PF ranges from 0.8 leading to 0.8 lagging.
**Leading:** the inverter is sourcing reactive power to the grid.
**Lagging:** the inverter is sinking reactive power from the grid.

For the explanations of other modes, see “13 Appendix IV: Power Response”.

• Battery usage enabled (Weekend):

**Bat Usage Time**

- **Weekday Usage**
- **Weekend Usage**

**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

- **Press ENT**

**Optional** For lead-acid batteries, you should manually set the battery type.
- Turn off the inverter via the LCD menu.
Set the battery type to “Other Battery”.

Press ▲/▼ to select “Other Battery” and Press ENT to confirm.

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

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

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

Tab. 7-2 Parameter Description for Other Battery

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Chrg</td>
<td>The upper limit of the charging current</td>
<td>0.05C to 2C</td>
</tr>
<tr>
<td>Max. DChrg</td>
<td>The upper limit of the discharging current</td>
<td>0.1C to 2C</td>
</tr>
<tr>
<td>Rate Vtg</td>
<td>The rated voltage of the equipped battery</td>
<td>30 V to 60 V</td>
</tr>
<tr>
<td>Capacity</td>
<td>Capacity of the battery tray</td>
<td>10 Ah to 1000 Ah</td>
</tr>
<tr>
<td>Over Vtg</td>
<td>The upper limit of battery voltage when charging</td>
<td>48 V to 70 V</td>
</tr>
<tr>
<td>Low Vtg</td>
<td>The lower limit of battery voltage when discharging</td>
<td>32 V to 48 V</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Range</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Over Temp</td>
<td>The upper limit of battery temperature</td>
<td>20°C to 70°C</td>
</tr>
<tr>
<td>Low Temp</td>
<td>The lower limit of battery temperature</td>
<td>-30°C to 10°C</td>
</tr>
<tr>
<td>CSTVtgChar</td>
<td>The voltage of constant-voltage charging.</td>
<td>40 V to 63 V</td>
</tr>
<tr>
<td>DChrgEndVtg</td>
<td>The voltage at which the discharging is stopped</td>
<td>30 V to 53 V</td>
</tr>
</tbody>
</table>

* Consult battery manufacturer for an advice before any modification.

7. Check the icons on the main screen. Refer to “11.1 Main Screen” for the explanations.

![Icon Image]

8. Check the status of the indicator.

**Tab. 7-3 Status Descriptions of the Indicator**

<table>
<thead>
<tr>
<th>Color</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>On</td>
<td>The inverter is running normally.</td>
</tr>
<tr>
<td></td>
<td>Blinking</td>
<td>The inverter is in the process of starting.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Other statuses except Running and Startup. (Refer to Tab. 11-1 for status descriptions.)</td>
</tr>
<tr>
<td>Red</td>
<td>On</td>
<td>Permanent fault or upgrade failure.</td>
</tr>
<tr>
<td></td>
<td>Blinking</td>
<td>Other system faults or main alarms.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>No fault occurs.</td>
</tr>
</tbody>
</table>


If the inverter commissioning fails, Press ▼ to view the current errors. 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

Check the meter installation and connection, battery information and system time. For details, see the quick user manual.
8 Troubleshooting and Maintenance

8.1 Troubleshooting

8.1.1 Troubleshooting of the Indicator

See “Tab. 7-3 State Descriptions of the Indicator” for the definition.

<table>
<thead>
<tr>
<th>Fault Type</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>The indicator and LCD screen cannot be lit.</td>
<td>1. Disconnect the AC circuit breaker.</td>
</tr>
<tr>
<td></td>
<td>2. Rotate the DC Switch to “OFF”.</td>
</tr>
<tr>
<td></td>
<td>3. Check the polarities of the DC inputs.</td>
</tr>
<tr>
<td></td>
<td>4. If all of the above are OK, please contact SUNGROW.</td>
</tr>
<tr>
<td>The indicator goes out from green.</td>
<td>1. Disconnect the AC circuit breaker.</td>
</tr>
<tr>
<td></td>
<td>2. Rotate the DC Switch to “OFF”.</td>
</tr>
<tr>
<td></td>
<td>3. Check the electrical connection.</td>
</tr>
<tr>
<td></td>
<td>4. Check whether the DC input voltage exceeds the start voltage of the inverter.</td>
</tr>
<tr>
<td></td>
<td>5. If all of the above are OK, please contact SUNGROW.</td>
</tr>
<tr>
<td>The indicator is lit red.</td>
<td>1. A fault is not resolved.</td>
</tr>
<tr>
<td></td>
<td>2. Perform troubleshooting according to the fault type on the LCD screen.</td>
</tr>
<tr>
<td></td>
<td>3. If the fault persists, please contact SUNGROW.</td>
</tr>
</tbody>
</table>

8.1.2 Troubleshooting of the Errors

When an error occurs, the “Error” state will be shown on the main screen. Press ▼ to view all the error information. For the detailed troubleshooting, see the chapter “Troubleshooting of the Errors” in the quick user manual.
• For the battery error codes, if all the conditions are OK but the error still occurs, contact the distributor or the battery manufacturer.
• We need the following information to provide you with the best assistance: inverter type (e.g. string, central, grid-connected, hybrid, transformerless, single phase, triple phase, single MPPT, multiple MPPTs), or product name, serial number of the inverter, error code / name, and a brief description of the problem.

8.2 Maintenance

8.2.1 Routine Maintenance

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

8.2.2 Replacing the Button Cell

⚠️ 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 cell on the inner PCB board of the LCD. Contact 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 “11.3 Starting and Stopping the Inverter”.
2. Disconnect the AC circuit breaker and secure it against reconnection.
3. Rotate the DC switch to “OFF”. The DC switch may be integrated on the inverter bottom 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!
Do not touch any inner live parts until 10 minutes after disconnecting the inverter from the utility grid, the PV inputs and the battery module.

NOTICE
Do not power on the system again until 1 minute after the disconnection.

5. Wait for about 10 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” to disconnect the AC connector from the inverter in reverse procedure.
8. Release the locking part of DC connectors by pressing on the ribbing of the locking hooks with nipper pliers and pull it outwards.
9. Use the multimeter to measure the port voltage of the battery. Disconnect the power cables after the voltage is zero.
Dismantling the Inverter

Refer to Chapter 4 and Chapter 5 to 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 panel, batteries, capacitors, may cause environment pollution.

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

9.2 Decommissioning the Battery

Decommission the battery in the system after the inverter is decommissioned. Proceed as follows to decommission a Li-ion battery or lead-acid battery.

**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)** Turn off the switch on LG Li-ion battery or Pylon Li-ion battery, if applicable.
4. Wait for about 1 minute and then use the multimeter to measure the port voltage of the battery.
5. If the battery port voltage is zero, disconnect the power cables from the battery module.

**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 from the battery.
10 Appendix I: App Configuration

If the inverter has been connected to the home router with an Ethernet cable, the user can view inverter information via the SolarInfo Moni App.

10.1 App Operation Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Android System</th>
<th>iOS System</th>
</tr>
</thead>
<tbody>
<tr>
<td>System version</td>
<td>Android 4.0 or above</td>
<td>iOS 7.1 or above</td>
</tr>
<tr>
<td>System resolution</td>
<td>1280<em>720, 800</em>480, 960*540</td>
<td>1920<em>1080, 2560</em>1440, 960<em>640, 1136</em>640, 1334<em>750, 1920</em>1080</td>
</tr>
<tr>
<td>System memory</td>
<td>512 MB</td>
<td></td>
</tr>
<tr>
<td>Normal Net speed</td>
<td>Higher than 40 kB/s</td>
<td></td>
</tr>
<tr>
<td>Distance between phone and Wi-Fi module (for local access)</td>
<td>Less than 150 m and no obstacles</td>
<td></td>
</tr>
</tbody>
</table>

10.2 Installing the App

Download the SolarInfo Moni App and install it into your smart phone. You can select the App version for iOS or Android.

10.2.1 For iOS

**Scenario 1**


**Scenario 2**

Use your smart phone to scan the QR code to download and install the App.

**Scenario 3**

Search for SolarInfo Moni in your App Store to download and install it.
10.2.2 For Android

Scenario 1


Scenario 2

Use the scanning function of the Play Store or Explorer in your smart phone to scan the QR code to download and install the App.

10.3 Visiting in “Local Access” Mode

NOTICE

Do not name your router started with "SG-", Otherwise you cannot find it. The SN and password are displayed on the inverter nameplate.

Proceed as follows to use the SolarInfo Moni App in “[Local Access]” mode.

1. Enable the Wi-Fi function of your smart phone and connect it to the home router.

2. Visit the App in “Local Access” mode, select you inverter SN and input the password, then you can view the inverter information.
10.4 Visiting in "[Login]" Mode

Connect the inverter to your home router and complete the App registration. Then you can visit SolarInfo Moni App in "[Login]" mode and view the information wherever you happen to carry the smart phone. To perform the operations in this section, be sure that your smart phone can access the Internet.

- The e-mail address will be used to receive relevant mails, so it must be valid.
- The username will be needed when you find the forgotten password. If you forget the username, re-register.
11 Appendix II: LCD Operation

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

11.1 Main Screen

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current PV input power</td>
</tr>
<tr>
<td>2</td>
<td>Current export power</td>
</tr>
<tr>
<td>3</td>
<td>Warning information</td>
</tr>
<tr>
<td>4</td>
<td>Total load consumption</td>
</tr>
<tr>
<td>5</td>
<td>Battery charge/discharge power</td>
</tr>
<tr>
<td>6</td>
<td>System status bar</td>
</tr>
</tbody>
</table>

: 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 status.

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. The Wi-Fi icon may be not displayed when the inverter is used with some Wi-Fi modules.

If there is no button operation for:
• 1 minute, the LCD backlight is OFF;
• 2 minutes, system returns to the default menu (main screen).

Tab. 11-1 Status Descriptions

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>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.</td>
</tr>
<tr>
<td>Maintain</td>
<td>The system is running normally, with the battery in maintenance process. (Only for lead-acid battery)</td>
</tr>
<tr>
<td>Status</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Forced</td>
<td>The system is running normally, with the EMS in forced mode.</td>
</tr>
<tr>
<td>Standby</td>
<td>The inverter waits for sufficient sunlight or battery level, then the DC</td>
</tr>
<tr>
<td></td>
<td>voltage recovers. The standby time can be set on the Webserver. Refer to</td>
</tr>
<tr>
<td></td>
<td>Chapter 11 for the introductions.</td>
</tr>
<tr>
<td>Turn off</td>
<td>The inverter will stop running by manual “OFF” through the LCD menu. Set</td>
</tr>
<tr>
<td></td>
<td>to “ON” if you want to restart the inverter.</td>
</tr>
<tr>
<td>Startup</td>
<td>The inverter is initializing and synchronizing with the grid.</td>
</tr>
<tr>
<td>Upgrade</td>
<td>The DSP or LCD software is in its upgrading process.</td>
</tr>
<tr>
<td>Error</td>
<td>If an error occurs, the inverter will automatically stop operation,</td>
</tr>
<tr>
<td></td>
<td>trigger the AC relay and show “Error” on the LCD with the indicator lit</td>
</tr>
<tr>
<td></td>
<td>red.</td>
</tr>
<tr>
<td>Upd-fail</td>
<td>The master DSP program online upgrade failure.</td>
</tr>
</tbody>
</table>

**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.

### 11.2 LCD Menu Structure

**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Complete</th>
<th>Abbreviation</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Csmp</td>
<td>Consumption</td>
<td>Exp</td>
<td>Export</td>
</tr>
<tr>
<td>Chrg</td>
<td>Charge</td>
<td>Tot</td>
<td>Total</td>
</tr>
<tr>
<td>Bat</td>
<td>Battery</td>
<td>Tmp</td>
<td>Temperature</td>
</tr>
<tr>
<td>SOC</td>
<td>State of Charge</td>
<td>SOH</td>
<td>State of Health</td>
</tr>
<tr>
<td>Vtg</td>
<td>Voltage</td>
<td>Curr</td>
<td>Current</td>
</tr>
<tr>
<td>Stt</td>
<td>State</td>
<td>Inv</td>
<td>Inverter</td>
</tr>
<tr>
<td>Pwr</td>
<td>Power</td>
<td>Freq</td>
<td>Frequency</td>
</tr>
<tr>
<td>Cap</td>
<td>Capacity</td>
<td>DRM</td>
<td>Demand respond mode</td>
</tr>
<tr>
<td>Ver.</td>
<td>Version</td>
<td>Ref.</td>
<td>Reference</td>
</tr>
<tr>
<td>CSTVtgChrg</td>
<td>Constant charging voltage</td>
<td>MDCV</td>
<td>Max. discharging current</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>value</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Complete</td>
<td>Abbreviation</td>
<td>Complete</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>DChrg</td>
<td>Discharge</td>
<td>MCCV</td>
<td>Max. charging current value</td>
</tr>
<tr>
<td>Prot.</td>
<td>Protection</td>
<td>Multi.</td>
<td>Multiple</td>
</tr>
<tr>
<td>Comm.</td>
<td>Communication</td>
<td>DChrgEndVtg</td>
<td>Final discharg voltage</td>
</tr>
<tr>
<td>Sys</td>
<td>System</td>
<td>En.</td>
<td>Enable</td>
</tr>
</tbody>
</table>

**Fig. 11-1 LCD Menu Tree**

- 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.
- The value of battery SOH will be displayed as “—” for Pylon US2000A and GCL batteries since they do not have this parameter.
- The “Restart” option will appear only if an unrecoverable fault occurs.
11.3 Starting and Stopping the Inverter

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

Confirm your choice by pressing ENT.

<table>
<thead>
<tr>
<th>ON / OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ ON</td>
</tr>
<tr>
<td>OFF</td>
</tr>
<tr>
<td>Restart</td>
</tr>
</tbody>
</table>

11.4 Advanced Settings

11.4.1 Inputting Password

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

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

Settings 1/5
- EPS Setting
- Existing Sys
- Zero-export

Settings 2/5
- Battery Type
- Bat Usage Time
- Forced Charge

Settings 3/5
- Prot. Param
- Reactive Power
- Active Power

Settings 4/5
- Load Control
- Comm. Param
- Earth Fault

Settings 5/5
- DRM Switch
- PT1000 Switch
- Factory Reset

11.4.2 Adding the Existing System

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

<table>
<thead>
<tr>
<th>Existing Sys</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Disable</td>
</tr>
<tr>
<td>☑ Enable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Existing Sys Rated-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000W</td>
</tr>
<tr>
<td>04600W</td>
</tr>
</tbody>
</table>

Settings 5/5
- Existing Sys Rated-P
Total Export Limit: the export power limit of the new system

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

For example, retrofit an existing PV system (rated power: 3000 W) with the hybrid inverter SH4K6 (rated power: 4600 W). The total export limit can be set from 3000 W to 7600 W.

The export power limit can also be set via the Zero-export menu that described in the commissioning. The settings in the two submenus are from the same source. If one is changed, the other will synchronize the value.

11.4.3 Setting the Battery Type

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

Refer to “11.3 Starting and Stopping the Inverter” to stop the inverter before modifying the battery type. Otherwise the warning screen will prompt.

Press ▲ / ▼ to select the battery type and Press ENT to confirm.

* Refer to Tab. 7-2 for the explanations, ranges and default values of the parameters.

**NOTICE**

The parameters can only be set by qualified personnel.
Consult battery manufacturer for an advice before any modification.
11.4.4 Setting the Battery Usage Time

When there is no battery equipped in the system, a prompt will appear. For details, see "7.3 Commissioning Procedure".

11.4.5 Setting Forced Charge

In the system without a battery, a prompt will appear. Enable the function for the system with a battery.

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.

11.4.6 Setting the Protective Parameters

For the function of interface protection system (SPI) for Italy, see "13.2.6 Interface Protection System (SPI)".

For more parameter settings, please visit the Webserver described in "12 Appendix III: Visiting and Configuring the Webserver".

When the grid voltage or frequency reaches the recovery value, the corresponding error code displayed on the LCD will be cleared and the inverter can start operating.
Power Ramp Rate (for countries except Great Britain):
The ramp up/down rate of power variation.
The power rate limit mode is enabled (ON) by default.
Set to OFF to turn off the function.

10-minute over-voltage protection (for countries except Great Britain):
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 OFF to turn off the function.

Tab. 11-2 Protective Parameter Explanations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmax-recover</td>
<td>Recovery value for over-voltage fault. Inverter can start operating only when the grid voltage is below this value.</td>
</tr>
<tr>
<td>Vmin-recover</td>
<td>Recovery value for under-voltage fault. Inverter can start operating only when the grid voltage is above this value.</td>
</tr>
<tr>
<td>Fmax-recover</td>
<td>Recovery value for over-frequency fault. Inverter can start operating only when the grid frequency is below this value.</td>
</tr>
<tr>
<td>Fmin-recover</td>
<td>Recovery value for under-frequency fault. Inverter can start operating only when the grid frequency is above this value.</td>
</tr>
<tr>
<td>Power Rate Ramp Rate</td>
<td>The ramp rate of power variation.</td>
</tr>
<tr>
<td>10-min Over Vtg</td>
<td>Over-voltage protection value of 10-min average voltage</td>
</tr>
</tbody>
</table>

11.4.7 Setting Reactive Power Regulation

For the modes Qt, Q(p) and Q(u), see “13 Appendix IV: Power Response”.

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.

11.4.8 Setting Active Power Response

For details, see “13.1.4 Over-frequency Response”, “13.2.4 Volt-watt Response” and “13.2.5 Frq-watt Response”.

Reactive Power

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>PF</td>
<td></td>
</tr>
<tr>
<td>Qt</td>
<td></td>
</tr>
<tr>
<td>Q(p)</td>
<td></td>
</tr>
<tr>
<td>Q(u)</td>
<td></td>
</tr>
</tbody>
</table>

PF Setting

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF</td>
<td>+1.000</td>
</tr>
</tbody>
</table>

+ : Lagging & - : Leading
11.4.9 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.

Press \( \uparrow/\downarrow \) to choose the control mode. Press ENT to confirm.

<table>
<thead>
<tr>
<th>Load Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer</td>
</tr>
<tr>
<td>ON/OFF</td>
</tr>
<tr>
<td>Optimized</td>
</tr>
</tbody>
</table>

**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.

**ON/OFF Control**

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

When the existing system is enabled, the upper limit of optimized power is the sum of the rated power of the hybrid inverter and the rated power of the existing PV system.

Once the optimized mode is enabled, the DO relay will not disconnect until 20 minutes after the DO connection.

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

<table>
<thead>
<tr>
<th>Load Control</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer</td>
<td></td>
</tr>
<tr>
<td>ON/OFF</td>
<td></td>
</tr>
<tr>
<td><strong>Optimized</strong></td>
<td><strong>P2/2</strong></td>
</tr>
<tr>
<td>Start time</td>
<td>09:00</td>
</tr>
<tr>
<td>End time</td>
<td>09:30</td>
</tr>
<tr>
<td>Power [W]</td>
<td>01000</td>
</tr>
</tbody>
</table>

**Fig. 11-4 DO Operation in Optimized Control**
11.4.10 Setting the Communication Parameters

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

Wi-Fi:
Press ENT to enable this function and then you can connect the inverter WiFi to your home router quickly with SolarInfo Moni APP. For details, see the manual delivered with the Wi-Fi module.

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

11.4.12 PT1000 Switch Setting
The temperature sampling function of the sensor PT1000 for lead-acid batteries is disabled by default.
Set to Enable to turn on the function.

11.4.13 Factory Reset
NOTICE
All history information will be irrecoverably cleared and all parameters will return to the default values except the protection parameters and time once the “Factory Reset” is performed.
Firstly, set the inverter to “OFF” via the LCD menu.

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

### 11.5 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.

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

### 11.6 Setting the Country Code

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

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

If the protection function is triggered, the inverter will automatically disconnect from the grid with the "Error" status displayed on the LCD main screen. After the grid voltage or frequency recovers to the specified range, the inverter will start running normally and connect to the grid. For the recovery conditions, see “11.4.6 Setting the Protective Parameters”.

---

**Time**

<table>
<thead>
<tr>
<th>hh : mm : ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 : 38 : 08</td>
</tr>
</tbody>
</table>

**Date**

<table>
<thead>
<tr>
<th>DD / MM / YY</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 / 02 / 15</td>
</tr>
</tbody>
</table>
Press ▲ and Press ENT to input the password 111. Press ENT to confirm the password.

Only the codes of GB, DE, IT, AT, AU, BE, NL, CN and SA are supported.

<table>
<thead>
<tr>
<th>Country Code</th>
<th>Full Name</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB</td>
<td>Great Britain</td>
<td>English</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>German</td>
</tr>
<tr>
<td>IT</td>
<td>Italy</td>
<td>Italian</td>
</tr>
<tr>
<td>AT</td>
<td>Austria</td>
<td>German</td>
</tr>
<tr>
<td>AU</td>
<td>Australia</td>
<td>English</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>French</td>
</tr>
<tr>
<td>NL</td>
<td>Netherlands</td>
<td>English</td>
</tr>
<tr>
<td>CN</td>
<td>China</td>
<td>Chinese</td>
</tr>
<tr>
<td>SA</td>
<td>South Africa</td>
<td>English</td>
</tr>
<tr>
<td>Other</td>
<td>Country not included above</td>
<td>English</td>
</tr>
</tbody>
</table>

### 11.7 Viewing the Error Codes

**Viewing the Active Error**

For the ⚠️ icon or the “Error” status on the main screen, press ▼ to view the active errors. Refer to “8.1.2 Troubleshooting of the Errors” for the error definition.

Refer to the following table for the error type explanations.

<table>
<thead>
<tr>
<th>Fault Type</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRID</td>
<td>Grid faults (AC side)</td>
</tr>
<tr>
<td>PV</td>
<td>PV faults (DC side)</td>
</tr>
<tr>
<td>SYS</td>
<td>System faults (inverter)</td>
</tr>
<tr>
<td>PER</td>
<td>Permanent faults</td>
</tr>
<tr>
<td>WARN</td>
<td>Warnings</td>
</tr>
<tr>
<td>BDCF</td>
<td>Faults of battery charge/discharge circuit</td>
</tr>
<tr>
<td>BDCPF</td>
<td>Permanent faults of battery charge/discharge circuit</td>
</tr>
<tr>
<td>Fault Type</td>
<td>Explanation</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>BATW</td>
<td>Battery warnings</td>
</tr>
<tr>
<td>BATP</td>
<td>Battery protection</td>
</tr>
<tr>
<td>BATF1</td>
<td>Battery faults</td>
</tr>
<tr>
<td>BATF2</td>
<td></td>
</tr>
</tbody>
</table>

### Viewing the Error Record

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

<table>
<thead>
<tr>
<th>Error Record</th>
<th>P1/1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>15022708:55:27</td>
<td>010</td>
</tr>
<tr>
<td>002</td>
<td>15022707:11:21</td>
<td>501</td>
</tr>
</tbody>
</table>

### 11.8 Auto Test (Italy)

The inverter is integrated with interface protection functions and provides an auto test system to verify the maximum / minimum frequency and maximum / minimum voltage functions. The “Auto Test” item can only display when the country code is set to “IT” (Italy), so the screenshots introduced in this section will be in Italian.

Press ENT to confirm “Iniziare Autotest” and start the auto test.

If the inverter is in the status of “Error” or “Turn off”, it cannot start the test and a prompt interface will appear.

During normal auto testing, the LCD will automatically display the grid protection testing items in the following turn cyclically:
(1) \textbf{81>.S1: over-frequency test (stage I)}

(2) \textbf{81<.S1: under-frequency test (stage I)}

(3) \textbf{59.S1: over-voltage test (stage I)}

(4) \textbf{27.S1: under-voltage test (stage I)}

(5) \textbf{81>.S2: over-frequency test (stage II)}

(6) \textbf{81<.S2: under-frequency test (stage II)}

(7) \textbf{59.S2: over-voltage test (stage II)}

(8) \textbf{27.S2: under-voltage test (stage II)}

\textit{Imp.}: the default protection threshold

\textit{Ril.}: the actual sample value

- For over- frequency / voltage protection testing, the default protection threshold (\textit{Imp.}) is linearly decreased with a ramp <= 0.05 Hz/s or <= 0.05 Vn/s. The protection function will be triggered if the threshold is lower than the actual sample value (\textit{Ril.}).

- For under- frequency / voltage protection testing, the default protection threshold (\textit{Imp.}) is linearly increased with a ramp <= 0.05 Hz/s or <= 0.05 Vn/s. The protection function will be triggered if the threshold is higher than the actual sample value (\textit{Ril.}).

If the protection function is triggered, the LED indicator will be lit red and the corresponding error code will be displayed on the main screen. When the test is completed, the interface as shown will appear. \textbf{Press} \textbf{▼} to view the test result and the trip time.

<table>
<thead>
<tr>
<th>\textbf{Imp.}</th>
<th>\textbf{Ril.}</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.50 Hz</td>
<td>49.99 Hz</td>
</tr>
<tr>
<td>195.5 V</td>
<td>230.0 V</td>
</tr>
<tr>
<td>51.50 Hz</td>
<td>49.99 Hz</td>
</tr>
<tr>
<td>92.0 V</td>
<td>230.0 V</td>
</tr>
<tr>
<td>264.5 V</td>
<td>230.0 V</td>
</tr>
</tbody>
</table>
Do not press ESC to exit this interface, otherwise the test results will be cleared and you need to do the test again.

For each test, the values of frequency/voltage and the trip times will be visualized as well as the current values of the frequency and voltage measured by the inverter.

Press ▲▼ to scroll pages and press ESC to exit.

The thresholds (Imp.) are compliant with standard CEI 0-21 and the actual values (Ril.) are for your reference only.

Pass: The inverter will restore the normally used settings and automatically reconnect to the grid.

Fail: The inverter will report the error 105. The inverter cannot reconnect to the network until the test faults are cleared.

If the auto test fails, Press ENT to confirm “Canc. Guasto Test” and clear the test faults.

If an external command aimed at changing the frequency protection thresholds is sent to the inverter during the testing process, the test results will be invalid. You should restart the system and re-do the auto test.
12 Appendix III: Visiting and Configuring the Webserver

12.1 User and Authority

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.

The Webserver provides permissions as follows.

<table>
<thead>
<tr>
<th>Permission</th>
<th>Username</th>
<th>Password</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>user</td>
<td>1111</td>
<td>By default</td>
</tr>
<tr>
<td>Installer</td>
<td>installer</td>
<td>2222</td>
<td>Qualified personnel only. To modify the operating parameters and the protection parameters.</td>
</tr>
</tbody>
</table>

**NOTICE**

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

Follow the steps to login.

1. Connect the network cable to the Ethernet port. See “6.5.2 Ethernet Connection”.
2. Query the inverter IP address according to the instructions in “11.4.10 Setting the Communication Parameters”.
3. Open the browser. Input the inverter’s IP address and press “Enter”.
4. Select the username and input the corresponding password according to the visitor's role. Press “Sign in” or “Enter” to log in, as shown below.
If there is no operation for 10 minutes, the system will automatically return to the login interface.

The figures in this chapter are all with an installer’s permission.

### 12.2 Main Interface

**Fig. 12-1 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. 12-1 Icon Explanations**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current status</td>
<td>OK or fault indication, e.g. with the inverter, and with DSP and LCD communication.</td>
</tr>
<tr>
<td>CO₂ reduced</td>
<td>CO₂ reduction (kg) due to the use of the solar system.</td>
</tr>
<tr>
<td>Total runtime</td>
<td>Total operating time of the inverter (hour).</td>
</tr>
<tr>
<td>Battery status</td>
<td>Charging, discharging or stop.</td>
</tr>
<tr>
<td>Self-consumption</td>
<td>The proportion of PV power generation used for load consumption (in %).</td>
</tr>
</tbody>
</table>
12.3 Navigation and Abbreviations

Fig. 12-2 Webserver Navigation

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

The following table explains some abbreviations at the webserver.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Complete</th>
<th>Abbreviation</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vtg</td>
<td>Voltage</td>
<td>Ter-Vtg</td>
<td>Terminated voltage</td>
</tr>
<tr>
<td>Tmp</td>
<td>Temperature</td>
<td>Curr</td>
<td>Current</td>
</tr>
<tr>
<td>Chrg</td>
<td>Charge</td>
<td>Ter-Curr</td>
<td>Terminated current</td>
</tr>
<tr>
<td>Dischrg</td>
<td>Discharge</td>
<td>SOC</td>
<td>State of Charge</td>
</tr>
<tr>
<td>Bat</td>
<td>Battery</td>
<td>Max</td>
<td>Maximum</td>
</tr>
<tr>
<td>Emergcy</td>
<td>Emergency</td>
<td>Min</td>
<td>Minimum</td>
</tr>
</tbody>
</table>
13 Appendix IV: Power Response

**NOTICE**

Only qualified personnel can perform the power regulation settings. The parameter values indicated are only for your reference. All the parameter settings must comply with local standards.

13.1 For Countries except Italy

Proceed as follows to navigate to the submenu.

Press \( \uparrow/\downarrow \) to select the desired option and Press ENT to confirm.

For the PF mode, see “11.4.7 Setting Reactive Power Regulation”.

### 13.1.1 “Qt” Mode

Qt limit: the maximum ratio of reactive power to rated apparent power in %.

The Qt limit ranges from -60.0 % to +60.0 %.

<table>
<thead>
<tr>
<th>Qt Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲ Qt Limit + 000.0%</td>
</tr>
</tbody>
</table>

### 13.1.2 “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 | 050.0%|

**Tab. 13-1 “Q(P)” Mode Parameter Explanations**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
<th>Default</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading PF</td>
<td>Power factor of the lower power point</td>
<td>1.000</td>
<td>0.900–1.000</td>
</tr>
<tr>
<td>Lagging PF</td>
<td>Power factor of the upper power point</td>
<td>0.900</td>
<td>0.900–1.000</td>
</tr>
<tr>
<td>Lower Power*</td>
<td>Lower limit of the output power (in %)</td>
<td>50 %</td>
<td>0–50 %</td>
</tr>
</tbody>
</table>

*Sungrow*
13.1.3 “Q(u)” Mode

Define the response curve with four grid voltages, leading Q/Sn of the lower limit point and lagging Q/Sn of the upper limit point. The reactive power output of the inverter will vary in response to the grid voltage.

The Q(u) parameters can only be set via the Webserver.

Tab. 13-2 “Q(u)” Mode Parameters Explanation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Q/Sn</td>
<td>Q/Sn value of point P4 in the Q(u) mode curve</td>
</tr>
<tr>
<td>Upper Q/Sn</td>
<td>Q/Sn value of point P1 in the Q(u) mode curve</td>
</tr>
<tr>
<td>Lower U Limit</td>
<td>Grid voltage limit (in %) of point P1 in the Q(u) mode curve</td>
</tr>
<tr>
<td>Upper U Limit</td>
<td>Grid voltage limit (in %) of point P4 in the Q(u) mode curve</td>
</tr>
<tr>
<td>U1 Limit*</td>
<td>Grid voltage limit (in %) of point P2 in the Q(u) mode curve</td>
</tr>
<tr>
<td>U2 Limit*</td>
<td>Grid voltage limit (in %) of point P3 in the Q(u) mode curve</td>
</tr>
<tr>
<td>Hysteresis*</td>
<td>Hysteresis voltage width (in %)</td>
</tr>
</tbody>
</table>

*U1 Limit + Hysteresis < U2 Limit – Hysteresis
13.1.4 Over-frequency Response

The *Volt-watt* mode and *Volt-watt (Chrg)* mode are not supported! Press \( \downarrow \) to select *Frq-watt* and Press ENT to confirm.

**Tab. 13-3 Description of Frq-watt Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OverFrq Start</td>
<td>The Start frequency value for over-frequency response</td>
</tr>
<tr>
<td>OverFrq End</td>
<td>The Stop frequency value for over-frequency response</td>
</tr>
</tbody>
</table>

When there is an increase in grid frequency which exceeds the Start value (50.20 Hz), the inverter will reduce the power output linearly with an increase of frequency until the End value (51.50 Hz) is reached. When the frequency exceeds the End value, the inverter output shall be ceased (i.e. 0 W).
13 Appendix IV: Power Response

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13.2 For Italy ("IT")

13.2.1 "Qt" Mode

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

13.2.2 "Q(p)" Mode

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
<th>Default</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>Active power at point A (in %)</td>
<td>20 %</td>
<td>20 %–100 %</td>
</tr>
<tr>
<td>PB</td>
<td>Active power at point B (in %)</td>
<td>50 %</td>
<td>20 %–100 %</td>
</tr>
<tr>
<td>PC</td>
<td>Active power at point C (in %)</td>
<td>100 %</td>
<td>20 %–100 %</td>
</tr>
<tr>
<td>Max. PF</td>
<td>Power factor at point C</td>
<td>0.95</td>
<td>0.95–1</td>
</tr>
<tr>
<td>Uin</td>
<td>Enter into the Q(P) regulation mode when the grid voltage is above Uin</td>
<td>105 %</td>
<td>100 %–110 %</td>
</tr>
</tbody>
</table>

Tab. 13-4 Italy “Q(P)” Mode Parameters Explanation
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
<th>Default</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uout</td>
<td>Exit from the Q(P) regulation mode when the grid voltage is below Uout</td>
<td>100 %</td>
<td>90 %–100 %</td>
</tr>
</tbody>
</table>

* PA < PB ≤ PC, Uin > Uout

![Diagram](image)

**Fig. 13-4 Reactive Power Regulation Curve in “IT” Q(P) Mode**

* The maximum PF depends on the total rated power of the system. The Max. PF is 0.95 by default for a system not greater than 11.08 kW. Set it to 0.9 if the system capacity is beyond 11.08 kW.

### 13.2.3 “Q(u)” Mode

Define the response curve with four grid voltages. The reactive power output of the inverter will vary in response to the grid voltage.

The Q(u) parameters can only be set via the Webserver.

**Tab. 13-5 Italy “Q(u)” Mode Parameters Explanation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Explanation</th>
<th>Default</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2i*</td>
<td>Grid voltage at point A (in %)</td>
<td>90 %</td>
<td>90 %–110 %</td>
</tr>
<tr>
<td>V1i*</td>
<td>Grid voltage at point B (in %)</td>
<td>92 %</td>
<td>90 %–110 %</td>
</tr>
<tr>
<td>V1s*</td>
<td>Grid voltage at point C (in %)</td>
<td>108 %</td>
<td>90 %–110 %</td>
</tr>
<tr>
<td>V2s*</td>
<td>Grid voltage at point D (in %)</td>
<td>110 %</td>
<td>90 %–110 %</td>
</tr>
<tr>
<td>k</td>
<td>The ratio of the base reactive power (in %)</td>
<td>10 %</td>
<td>0–100 %</td>
</tr>
<tr>
<td>Pin**</td>
<td>Enter into the Q(u) regulation mode when the power is above Pin</td>
<td>20 %</td>
<td>20%–100%</td>
</tr>
<tr>
<td>Pout**</td>
<td>Exit from the Q(u) regulation mode when the power is below Pout</td>
<td>5 %</td>
<td>1 %–20 %</td>
</tr>
<tr>
<td>Qmax</td>
<td>The max. ratio of reactive power (in %)</td>
<td>32.8 %</td>
<td>0–60 %</td>
</tr>
</tbody>
</table>

* V2i < V1i < V1s < V2s    **Pin > Pout
13.2.4 Volt-watt Response

Press ENT to confirm the choice. The active power reduction function for voltage values is disabled by default.

If the function is enabled, the active power output will be reduced when the grid voltage stated on the LCD screen has a value higher than 112 % $V_n$ (nominal voltage). The charge power drawn from the grid will be at least equal to $0.80 \times P_{cmax}$, within 5 minutes, where the $P_{cmax}$ is the maximum charge power of the system.

When the grid voltage falls lower than 108 % $V_n$, the inverter will response and the active power output will return them to the values consistent with the power available by the DC side.

13.2.5 Frq-watt Response

Press ▼ to select Frq-watt and Press ENT to confirm.

The variation of the active power generated by the system will take place for exceeding of the threshold values in the over-frequency adjustable between 50 and 52 Hz (default of 50.3 Hz).
The variation of the active power absorbed by the system will take place for exceeding of the threshold values in the under-frequency adjustable between 47 and 50 Hz (default equal to 49.7 Hz).

The power control of function active for transient over- and under-frequency has an activation delay can be set from 0 to 1s with 50 ms steps (default setting: 0.20 s).

The quadrilateral in the following figure shows the active power control in the conditions of over- and under-frequency. The area included in the central rectangular zone defines the possible points of normal operation in which the storage system may be at work and from these points the system will have to change its active power and move to the vertices of the quadrilateral according to the thresholds of over- or under-frequency (see dashed lines).

![Graph showing active power control in conditions of over- and under-frequency](image)

**Fig. 13-6** Control of Active Power in Conditions of Over- and under-frequency

- *$P_{smax}$*: the maximum discharge power; *$P_{cmax}$*: the maximum charge power

When the grid frequency returns back to $50 \pm 0.1$ Hz (default setting) for a minimum continuous time of 300 s, the system will end the frequency response and return to its ordinary operation linearly with a transitional time not less than 300 s, as shown in the figure below.
13.2.6 Interface Protection System (SPI)

The inverter has integrated the interface protection system (SPI) to provide the following functions:

- **Maximum/minimum frequency protection**;
- **Ability to receive signals aimed at changing the frequency protection thresholds and to receive the command of remote shutdown**.

![Fig. 13-7 Power Restoration in Condition of Transient Over-frequency](image)

- $P_{\text{max}}$ : active power delivered instantly exceeded 50.3 Hz (setting value)
- $P_{\text{nom}}$ : nominal power of the hybrid inverter
- $P_{\text{imin}}$ : minimum power obtained during the transient over-frequency
### Appendix IV: Power Response

<table>
<thead>
<tr>
<th>NO.</th>
<th>Interface</th>
<th>SPI Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ethernet</td>
<td>Receive external signal/command to change the frequency protection parameters or shutdown the inverter. See &quot;6.5.2 Ethernet Connection&quot; for the cable connection.</td>
</tr>
<tr>
<td>2</td>
<td>RefGen, Com/DRM0</td>
<td>Shortly connecting the two terminals will change the frequency protection parameters. See Fig. 13-8.</td>
</tr>
<tr>
<td>3</td>
<td>A1, B1</td>
<td>Receive external command to shutdown the inverter remotely. See Fig. 13-9.</td>
</tr>
</tbody>
</table>

The following figure shows the cable connection to external interface device.

Cross-section: 2*0.5 mm², cable diameter: 3 mm–5.3 mm

![RefGen and Com/DRM0 Connection](image)

**Fig. 13-8** RefGen and Com/DRM0 Connection

![RS485 Connection to External Device](image)

**Fig. 13-9** RS485 Connection to External Device

**Note:**

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

**Local Control**

In this mode, the inverter is in the absence of a communication “always on” prepared by the distributor. Through the local control via RefGen and Com/DRM0 terminals:

- Low (state value 0): two terminals are not connected and you can get permanent operation at permissive thresholds;
• High (state value 1): two terminals are connected and you can get permanent operation at restrictive thresholds;

**External Control**

In this mode, the inverter is connected with the external device via an Ethernet cable. Through the external signal:

• Low (state value 0) in case of really operating communication
• High (state value 1) in case of external commands sent by the external device

**Note:** The local control must be set permanently in the high state (value 1).

**Tab. 13-6 Frequency Protection Parameters in Conditions of SPI**

<table>
<thead>
<tr>
<th>Explanation</th>
<th>Local Control</th>
<th></th>
<th>External Control</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum frequency 1 (F&lt;) (Hz)</td>
<td>47.50</td>
<td>49.50</td>
<td>47.50</td>
<td>49.50</td>
</tr>
<tr>
<td>Minimum frequency 1 (F&lt;) tripping time (s)</td>
<td>0.1</td>
<td>0.1</td>
<td>4</td>
<td>0.1</td>
</tr>
<tr>
<td>Minimum frequency 2 (F&lt;&lt;) (Hz)</td>
<td>47.50</td>
<td>47.50</td>
<td>47.50</td>
<td>47.50</td>
</tr>
<tr>
<td>Minimum frequency 2 (F&lt;&lt;) tripping time (s)</td>
<td>0.1</td>
<td>0.1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Maximum frequency 1 (F&gt;) (Hz)</td>
<td>51.50</td>
<td>50.50</td>
<td>51.50</td>
<td>50.50</td>
</tr>
<tr>
<td>Maximum frequency 1 (F&gt;) tripping time (s)</td>
<td>0.10</td>
<td>0.1</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Maximum frequency 2 (F&gt;&gt;) (Hz)</td>
<td>51.50</td>
<td>51.50</td>
<td>51.50</td>
<td>51.50</td>
</tr>
<tr>
<td>Maximum frequency 2 (F&gt;&gt;) tripping time (s)</td>
<td>0.10</td>
<td>0.1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

• The default mode of SPI is local control with low state value 0 (no connection between *RefGen* and *Com/DRM0* terminals).
• When the local control and external control modes exist at the same time, the external control mode takes priority over the local control mode.
## 14 Appendix V: Technical Data

### 14.1 Inverter

<table>
<thead>
<tr>
<th>Input Data</th>
<th>SH3K6</th>
<th>SH4K6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. PV input power</td>
<td>6500 W</td>
<td>6500 W</td>
</tr>
<tr>
<td>Max. PV input voltage</td>
<td>600 V</td>
<td>600 V</td>
</tr>
<tr>
<td>Startup voltage</td>
<td>125 V</td>
<td>125 V</td>
</tr>
<tr>
<td>Nominal input voltage</td>
<td>360 V</td>
<td>360 V</td>
</tr>
<tr>
<td>MPP voltage range</td>
<td>125 V–560 V</td>
<td>125 V–560 V</td>
</tr>
<tr>
<td>MPP voltage range for nominal power</td>
<td>180 V–520 V</td>
<td>220 V–520 V</td>
</tr>
<tr>
<td>No. of MPPTs</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Max. number of PV strings per MPPT (DC1/DC2)</td>
<td>1 / 1</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Max. PV input current (DC1/DC2)</td>
<td>22 A (11 A / 11 A)</td>
<td>22 A (11 A / 11 A)</td>
</tr>
<tr>
<td>Max. current for input terminals</td>
<td>24 A (12 A / 12 A)</td>
<td>24 A (12 A / 12 A)</td>
</tr>
<tr>
<td>Short circuit current of PV input</td>
<td>24 A (12 A / 12 A)</td>
<td>24 A (12 A / 12 A)</td>
</tr>
<tr>
<td>Max. inverter backfeed current to array</td>
<td>0 A</td>
<td>0 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Battery Data</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery type</td>
<td>Li-ion battery / Lead-acid battery</td>
<td></td>
</tr>
<tr>
<td>Battery voltage (rated voltage / range)</td>
<td>48 V (32 V–70 V)</td>
<td></td>
</tr>
<tr>
<td>Max. charging / discharging current</td>
<td>65 A / 65 A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AC Input and Output Data</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal AC output power to grid</td>
<td>3680 W</td>
<td>4600 W</td>
</tr>
<tr>
<td>Max. AC output apparent power to grid</td>
<td>3680 VA (1)</td>
<td>4600 VA (2)</td>
</tr>
<tr>
<td>Max. AC input power from grid</td>
<td>3000 W</td>
<td>3000 W</td>
</tr>
<tr>
<td>Nominal AC output current</td>
<td>16 A</td>
<td>20 A</td>
</tr>
<tr>
<td>Max. AC output current</td>
<td>16 A</td>
<td>20 A</td>
</tr>
<tr>
<td>Max. inrush current (peak / duration)</td>
<td>10 A / 12 ms</td>
<td>10 A / 12 ms</td>
</tr>
<tr>
<td>Max. output fault current (peak / duration)</td>
<td>100 A / 3.2 ms</td>
<td>100 A / 3.2 ms</td>
</tr>
<tr>
<td>Max. output over-current protection</td>
<td>32 A</td>
<td>32 A</td>
</tr>
<tr>
<td>Nominal grid voltage</td>
<td>230 Vac</td>
<td></td>
</tr>
<tr>
<td>Grid voltage range</td>
<td>180 Vac–276 Vac</td>
<td>(this may vary with grid standards)</td>
</tr>
<tr>
<td>Nominal grid frequency</td>
<td>50 Hz</td>
<td></td>
</tr>
<tr>
<td>Grid frequency range</td>
<td>45 Hz–65 Hz</td>
<td>(this may vary with grid standards)</td>
</tr>
</tbody>
</table>

<p>| Total Harmonic Distortion (THD)                | &lt; 3 % (of nominal power) |                |</p>
<table>
<thead>
<tr>
<th>DC current injection</th>
<th>&lt; 0.5 % (of nominal current)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power factor</td>
<td>&gt; 0.99 at default value at nominal power (adj. 0.8 overexcited / leading–0.8 underexcited / lagging)</td>
</tr>
</tbody>
</table>

**Protection**

- Anti-islanding protection: Yes
- AC short circuit protection: Yes
- Leakage current protection: Yes
- DC switch (solar): Yes
- DC fuse (solar): No
- DC fuse (battery): Yes
- Over-voltage category: III [Main], II [PV] [Battery]

**System Data**

| Max. efficiency | 97.7 % | 97.7 % |
| Max. European efficiency | 97.0 % | 97.2 % |
| Max. charge / discharge efficiency | 94.0 % | 94.0 % |
| Isolation method (solar) | Transformerless |
| Isolation method (battery) | HF |
| Ingress protection (IP) rating | IP65 |
| Power loss in night mode | < 1 W |
| Operating ambient temperature | -25°C to 60°C (> 45°C derating) |
| Relative humidity | 0–100 % |
| Cooling method | Natural convection |
| Max. operating altitude | 2000 m |
| Display | Graphic LCD |
| Communication | 2 x RS485, Ethernet, Wi-Fi (optional), CAN |
| Analogue input | PT1000 |
| Power management | 1 x Digital output |
| Earth fault alarm | 1 x Digital output, email, buzzer inside |
| PV connection type | MC4 |
| AC connection type | Clamping yoke connector |
| Certificates and approvals | VDE-AR-N-4105, DIN VDE0126-1-1, G83/2, G59/3, CEI 0-21, IEC 62109-1, IEC62109-2, EN 62477-1, EN 61000-6-1/-3 |
### Mechanical Data

<table>
<thead>
<tr>
<th>Item</th>
<th>Single-phase</th>
<th>Three-phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x H x D)</td>
<td>457 mm x 515 mm x 170 mm</td>
<td></td>
</tr>
<tr>
<td>Mounting method</td>
<td>Wall-mounting bracket</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>22 kg</td>
<td></td>
</tr>
</tbody>
</table>

For the Q(p) mode in Italy, when the PF is 0.90 and the active power is 100 %,

1. SH3K6: the maximum AC output apparent power to grid is 4000 VA.
2. SH4K6: the maximum AC output apparent power to grid is 5110 VA.

### 14.2 Energy Meter

<table>
<thead>
<tr>
<th>Item</th>
<th>Single-phase</th>
<th>Three-phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage</td>
<td>240 Vac</td>
<td>230 Vac / 400 Vac</td>
</tr>
<tr>
<td>Input voltage range</td>
<td>180 Vac–286 Vac</td>
<td>180 Vac–276 Vac</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 2 W (10 VA)</td>
<td>&lt; 2 W (10 VA)</td>
</tr>
<tr>
<td>Max. operating current</td>
<td>100 A</td>
<td>65 A</td>
</tr>
<tr>
<td>Grid frequency</td>
<td>50 Hz</td>
<td></td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>Class I</td>
<td></td>
</tr>
<tr>
<td>Interface and communication</td>
<td>RS485</td>
<td></td>
</tr>
<tr>
<td>Ingress protection rating</td>
<td>IP20</td>
<td></td>
</tr>
<tr>
<td>Operating temperature ambient</td>
<td>-25°C to 75°C</td>
<td>-25°C to 70°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0–95 %</td>
<td></td>
</tr>
<tr>
<td>Mounting method</td>
<td>35 mm DIN-rail</td>
<td></td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>18 x 117 x 65 (mm)</td>
<td>85 x 72 x 72 (mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.2 kg</td>
<td>0.4 kg</td>
</tr>
</tbody>
</table>

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