SOFAR

# USER MANUAL

## ESI-5...12K-T1




Shenzhen SOFARSOLAR Co., Ltd.

**Shenzhen SOFARSOLAR Co., Ltd.**

11/F, Gaoxinqi Technology Building,

District 67, XingDong Community, XinAn Street,

Bao'An District, Shenzhen, China

Email: service@SOFAR.com

Web: www.sofarsolar.com

EU Representative Information: SofarSolar GmbH.

Krämerstraße 20 ,72764 Reutlingen,Germany

Tel: +49 (0)7121 31767-0

E-Mail: europe@sofarsolar.com

Document number

Issue 31 | 07 .2025

English

# CONTENT


| | | | |
|---|---|---|---|
| **1** | **About this manual** | | **1** |
| | 1.1 | Copyright declaration | 1 |
| | 1.2 | Presentation of warnings | 2 |
| | 1.3 | Presentation of action instructions | 3 |
| | 1.4 | Note | 3 |
| **2** | **Basic safety information** | | **4** |
| | 2.1 | Safety information | 4 |
| | 2.2 | Symbols and signs | 8 |
| **3** | **Product features** | | **11** |
| | 3.1 | Product information | 11 |
| | 3.2 | Product dimensions | 12 |
| | 3.3 | Labelling on the device | 13 |
| | 3.4 | Functional features | 13 |
| | 3.5 | Application modes | 15 |
| **4** | **Installation** | | **20** |
| | 4.1 | Installation information | 20 |
| | 4.2 | Installation procedure | 20 |
| | 4.3 | Examination before installation | 21 |
| | 4.4 | Connections | 24 |
| | 4.5 | Tools | 25 |
| | 4.6 | Installation Environment Requirements | 26 |
| | 4.7 | Installation location | 26 |
| | 4.8 | Unpacking the inverter | 27 |
| | 4.9 | Safety instructions | 28 |
| | 4.10 | Wiring overview | 31 |
| | 4.11 | System Electrical Topology | 32 |
| | 4.12 | Smart Meter / CT | 34 |
| | 4.13 | Electrical connection | 37 |
| | 4.14 | Connecting the PE cables | 38 |

4.15 Connecting the DC lines for the PV modules and battery 39
4.16 Connecting the AC power cables 42
4.17 AC connector installation 43
4.18 Communication interfaces 45
4.19 Feed-in limitation function 59
4.20 System monitoring 60
4.21 Installation of the WiFi 60
**5 Energy storage system construction 68**
5.1 Energy storage system with BTS 5K batteries 68
**6 Commissioning the inverter 77**
6.1 Safety test before commissioning 77
6.2 Double Check 77
6.3 Starting the inverter 77
6.4 Initial setup 78
**7 Operation of the device 80**
7.1 Control panel and display field 80
7.2 Standard display 81
7.3 Work modes 82
7.4 Menu structure 92
**8 Troubleshooting handling 102**
8.1 Troubleshooting 102
8.2 Error list 104
8.3 Maintenance 117
**9 Datasheet 118**

# 1 About this manual

This Installation and user manual (hereinafter referred to as the manual) describes the installation, electrical connection, commissioning, maintenance and fault elimination procedures of following products:
ESI-5K-T1, ESI-6.5K-T1, ESI-8K-T1, ESI-9.9K-T1-A, ESI-10K-T1,
ESI-12K-T1

- Carefully read this manual before use!
- Treat this manual as an integral component of the device.
- Keep this manual in close proximity to the device, including when it is handed over to another user or moved to a different location.

This manual contains important safety information on installation, operation and maintenance of the device.

- Read and observe all given safety information.

The products, services or features you purchased shall be subject to the company's commercial contracts and terms. All or part of the products and services described in this document may not within the scope of your purchase. Unless additional terms and conditions in your contract, the company does not make any statement or guarantee on the contents of this document.

## 1.1 Copyright declaration

The copyright of this manual is owned by SOFAR. It may not be copied – neither partially nor completely – by companies or individuals (including software, etc.) and must not be reproduced or distributed in any form, or with the appropriate means.
SOFAR reserves the right to final interpretation. This manual may be amended following feedback from users or customers.
Consult our website at: https://www.SOFAR.com for the latest version.

## 1.2 Presentation of warnings

This manual contains information on safe operation and uses symbols to ensure the safety of persons and property as well as the effcient operation of the inverter.

- Read through the following symbol explanations carefully in order to prevent injury or property damage.

### 1.2.1 Warnsymbol

| | |
|---|---|
|  | The general danger symbol warns of risk of serious injury when used with the signal words CAUTION, WARNING, and DANGER. |

### 1.2.2 Signalwords

| | |
|---|---|
| | Indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| **WARNING** | Indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| **CAUTION** | Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |
| | Indicates a danger that results in damage to or destruction of the inverter. |

### 1.2.3 Sectional warnings

Sectional warnings refer to a complete section and are structured as follows:

**⚠ WARNING**

**Type and source of danger**

**Consequences for non observance**

- Avoiding the danger

### 1.2.4 Embedded warnings

Embedded warnings are part of an action sequence and are placed right before the dangerous step.

**WARNING** Combination of type/source of danger, consequences for non observance and avoiding the danger.

## 1.3 Presentation of action instructions

This table shows the sequence of Action steps:

| Symbol | Function |
|---|---|
| ✓ | This describes an action requirement |
| 1.<br>2.<br>3. | This is the sequence of action steps that must be followed step by step |
| ▸ | This is a single action step |
| ↳ | This describes the result of the action |

## 1.4 Note

Notes are presented in a grey bar.

- Provides tips essential to the optimal operation of the product.

# 2 Basic safety information



- If you have any questions or problems after reading the following information, please contact SOFAR

This chapter details the safety information pertaining to the installation and operation of the device.

## 2.1 Safety information

Read and understand the instructions within this manual and familiarise yourself with the relevant safety symbols in this chapter before beginning with the installation of the device and eliminating any faults.

Before connecting to the power grid, you must obtain official authorisation from the local power grid operator in accordance with the corresponding national and state requirements. Furthermore, operation may only be carried out by qualified electricians.

Please contact the nearest authorised service centre if any maintenance or repairs are required. Please contact your dealer to obtain information about your nearest authorised service centre. Do NOT carry out repairs on the device yourself; this may lead to injury or property damage.

Before installing the device or carrying out maintenance on it, you must open the DC switch in order to interrupt the DC voltage of the PV generator. You can also switch off the DC voltage by opening the DC switch in the generation junction box. Not doing this may result in serious injury.

### 2.1.1 Qualified personnel

Personnel tasked with the operation and maintenance of the device must have the qualifications, competence and experience required to perform the described tasks, while also being capable of fully understanding all instructions contained within the manual. For safety reasons, this inverter may only be installed by a qualified electrician who:

- -has received training on occupational safety, as well as the installation and commissioning of electrical systems
- -is familiar with the local laws, standards and regulations of the grid operator.

SOFAR assumes no responsibility for the destruction of property or any injuries to personnel caused by improper usage.

### 2.1.2 Installation requirements

Please install the inverter according to the information contained in the following section. Mount the inverter to a suitable object with a sufficient load-bearing capacity (e.g. walls, PV frames etc.) and ensure that the inverter is upright. Choose a suitable place for the installation of electrical devices. Ensure that there is sufficient space for an emergency exit which is suitable for maintenance. Ensure sufficient ventilation in order to guarantee an air circulation for the cooling of the inverter.

### 2.1.3 Transport requirements

The factory packaging is specifically designed to prevent transport damage, i.e. violent shocks, moisture and vibrations. However, the device must not be installed if it is visibly damaged. In this case, notify the responsible transport company immediately.

### 2.1.4 Labelling on the device

The labels must NOT be concealed by items and foreign objects (rags, boxes, devices, etc.); they must be regularly cleaned and kept clearly visible at all times.

### 2.1.5 Electrical connection

Observe all applicable electrical regulations when working with the Solar inverter.

**DANGER**

**Dangerous DC voltage**

- Before establishing the electrical connection, cover the PV modules using opaque material or disconnect the PV generator from the inverter. Solar radiation will cause dangerous voltage to be generated by the PV generator!

**DANGER**

**Danger through electric shock!**

- All installations and electrical connections may only be carried out by trained electricians!

***NOTICE***

**Authorisation for grid feed-in**

- Obtain authorisation from the local power grid operator before connecting the inverter to the public power grid.

- Do not open the inverter or remove any of the labels. Otherwise, SOFAR shall assume no guarantee.

### 2.1.6 Operation

**DANGER**

**Electric shock**

- Contact with the electrical grid or the device's terminals may result in an electric shock or fire!
- Do not touch the terminal or the conductor which is connected to the electrical grid.
- Follow all instructions and observe all safety documents that refer to the grid connection.

**CAUTION**

**Burning due to hot housing**

- While the inverter is being operated, several internal components will become very hot.
- Please wear protective gloves!
- Keep children away from the device!

### 2.1.7 Repair and maintenance

**DANGER**

**Dangerous voltage!**

- Before carrying out any repair work, first switch off the AC circuit breaker between the inverter and power grid, and then the DC switch.
- After switching off the AC circuit breaker and the DC switch, wait a minimum of 5 minutes before starting any maintenance or repair work.

**NOTICE**

**Unauthorised repairs!**

- Following the elimination of any faults, the inverter should be fully functional once more. Should any repairs be required, please contact a local authorised service centre.
- The internal components of the inverter must NOT be opened without the relevant authorisation. Shenzhen SOFAR Co., Ltd. assumes no responsibility for any resulting losses or defects.

## 2.2 Symbols and signs

**⚠ CAUTION**

**Beware of burning hazards due to the hot housing!**

- While the inverter is in operation, only touch the display and the buttons, as the housing can become hot.

**NOTICE**

**Implement earthing!**

- The PV generator must be earthed in accordance with the requirements of the local power grid operator!
- For reasons of personal safety, we recommend that all PV module frames and inverters of the PV system are reliably earthed.

**⚠ WARNING**

**Damage due to overvoltage**

- Ensure that the input voltage does not exceed the maximum permissible voltage. Overvoltage may cause long-term damage to the inverter, as well as other damage that is not covered by the warranty!

### 2.2.1 Symbols on the inverter

Several symbols pertaining to safety can be found on the inverter. Please read and understand the content of these symbols before starting the installation.

| Symbol | Description |
|---|---|
|  | Residual voltage is present in the inverter! Before opening the inverter, you should wait fifteen minutes to ensure that the capacitor has been fully discharged. |
|  | Caution! Danger through electric shock |
|  | Caution! Hot surface |
|  | The product is compliant with EU guidelines |
|  | Earthing point |
|  | Please read the manual before installing the inverter |
|  | Device degree of protection according to EN 60529 |
|  | Positive and negative poles of the DC input voltage |
|  | Need to be moisture-proof and wet to store items in a clean and dry place |
|  | The inverter must always be transported and stored with the arrows pointing upward |
|  | The cartons are packed with fragile goods and should be handled with care |

| | |
|---|---|
|  | A maximum of 6 layers can be stacked during the stacking process |
|  | The material can be recycled and recycled. |
|  | Do not dispose of the equipment with household garbage at its end of life Dispose of it according to local laws and regulations or send it to the manufacturer. |

# 3 Product features

This chapter describes the product features, dimensions and efficiency levels.

## 3.1 Product information

The ESI-5...12K-T1 is a grid-coupled PV and energy storing inverter which can also supply energy in stand-alone operation.

The ESI-5...12K-T1 has integrated energy management functions which cover a wide range of application scenarios.

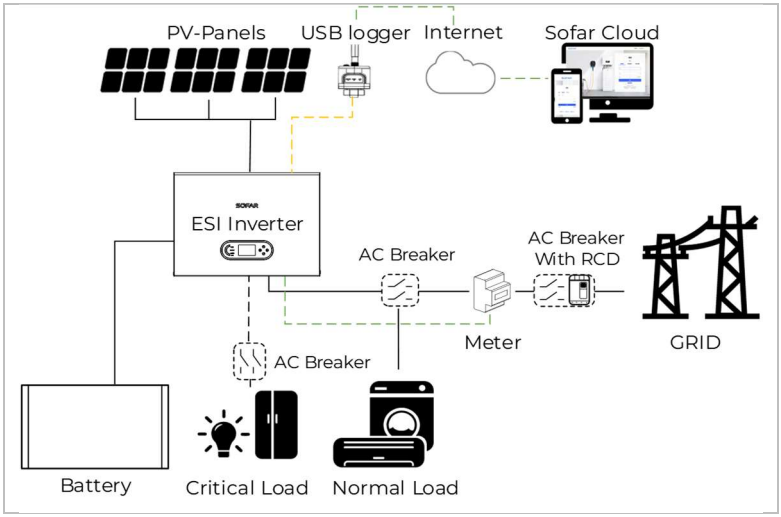



Figure 3-1 ESI-5...12K-T1 inverter system diagram

ESI-5...12K-T1 inverters may only be used with photovoltaic modules which do not require one of the poles to be earthed. In normal operation, the operating current must not exceed the limits specified within the technical data.

The selection of the optional inverter parts must be determined by a qualified technician who has good knowledge of the installation conditions.

## 3.2 Product dimensions

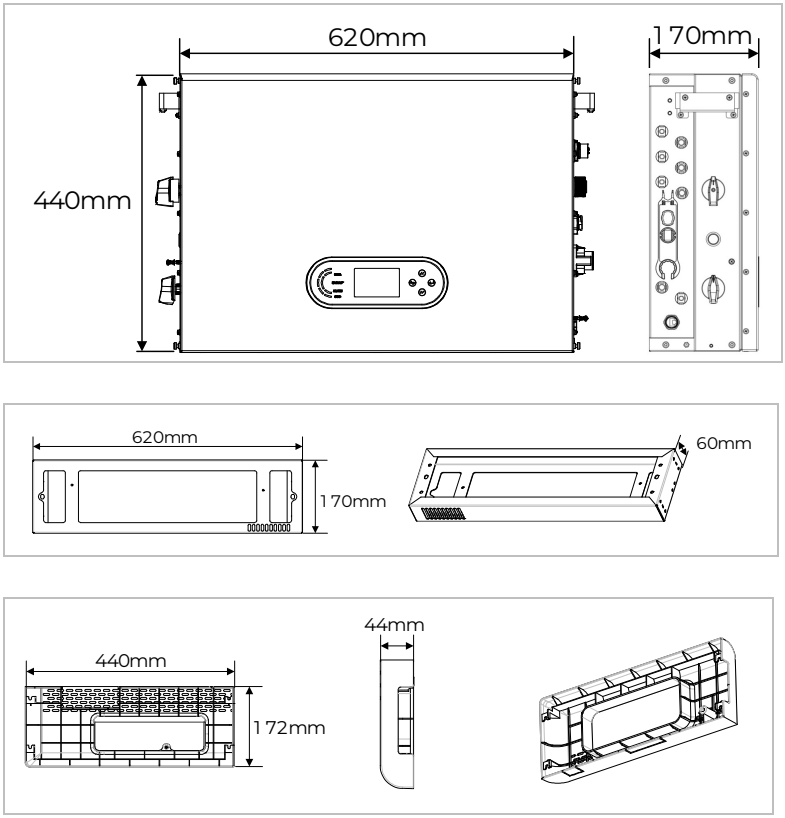



Figure 3-2 Dimensions

## 3.3 Labelling on the device

Labelling must not be covered or removed!

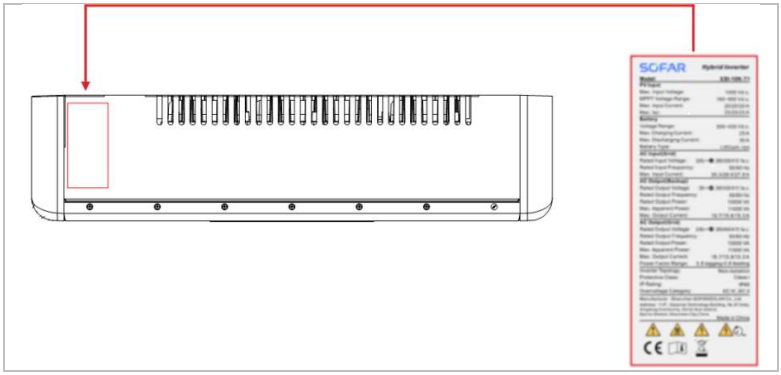


Figure 3-3 ESI-5...12K-T1 appearance and label

## 3.4 Functional features

The DC output generated by the PV generator can be used for both grid feed-in and battery charging.

The battery can supply the energy to the grid or the consumer. The BACKUP mode can provide inductive loads such as air conditioning systems or refrigerators with an automatic switchover time of less than 10 milliseconds (default).

### 3.4.1 Functions

- Three MPPT trackers.
- Flexible switching between on-grid operation and energy storage operation.
- ESI-5...8K-T1 has a maximum charge/discharge efficiency of 97.6% and ESI-9.9...12K-T1 has a maximum charge/discharge efficiency of 97.8%.
- If the BACKUP port of all devices in the system is connected, up to 36 kVA of power can be used BACKUP mode.
- A maximum cos phi of 0.8 is supported in emergency power mode.
- The ESI-5...12K-T1 all have a maximum charge current of 25 A. The ESI-5K-T1 has a maximum discharge current of 15 A, the ESI-6.5K-T1 has a maximum

discharge current of 19.5 A, the ESI-8K-T1 has a maximum discharge current of 24 A, the ESI-9.9K-T1 has a maximum discharge current of 29.7 A, and the ESI-10K-T1 has a maximum discharge current of 30 A, the ESI-12K-T1 maximum discharge current is 30A.

- Wide battery input voltage range (350-435 V).
- The BACKUP output can be connected to unbalanced loads.
- Up to 6 Inverters can be connected in parallel in master / slave mode via the link cable if used on-grid mode.
- Up to 3 inverters with Storage System can operate in parallel in master/slave when the BACKUP Mode (off- Grid) is used.
- BACKUP Mode always needs to be connected to a battery or PV system, otherwise it will not be operated.
- If there is more than one hybrid inverter in the system, they must be connected in parallel (Master-Slave mode). For maximum system performance and to prevent in future imbalances between the towers, the hybrid inverters must be identical to each other (i.e., same size, number and models of batteries). This mode makes it possible to synchronise the charging and discharging power of multiple interconnected hybrid inverters in order to maximise self-consumption.
- Additional PV string inverter can be integrated in the system using chint direct connected electric meter DTSU 666 energy meters. Up to 3 external PV meters can be connected, meter ID can be used 2,3,4.
- Monitoring via Wi-Fi/4G, optionally via Bluetooth.

### 3.4.2 Electrical block diagram

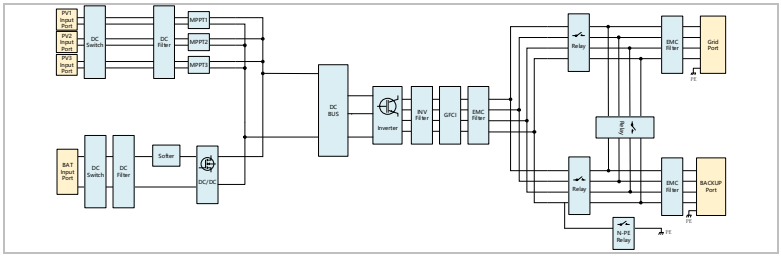



Figure 3-4 Electrical schematic diagram

## 3.5 Application modes

### 3.5.1 Typical energy storage system

A typical energy storage system with PV panels and battery unit(s), connected to the grid.

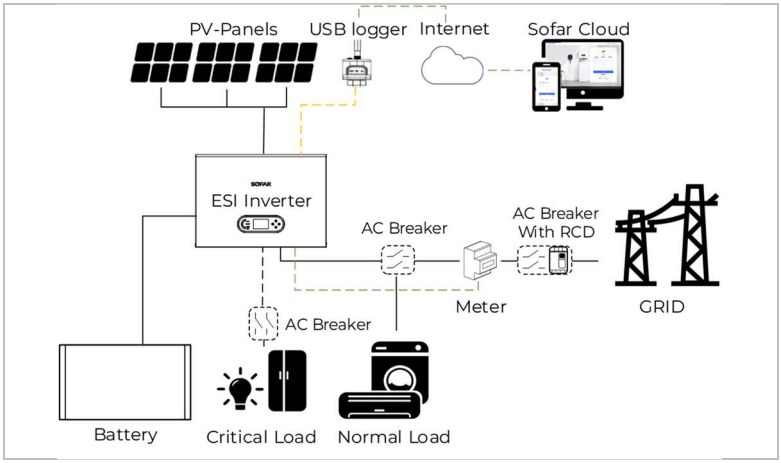



Figure 3-5 Typical energy storage system

### 3.5.2 System without PV connection

In this configuration, there are no PV panels connected and the battery is charged through the grid connection.

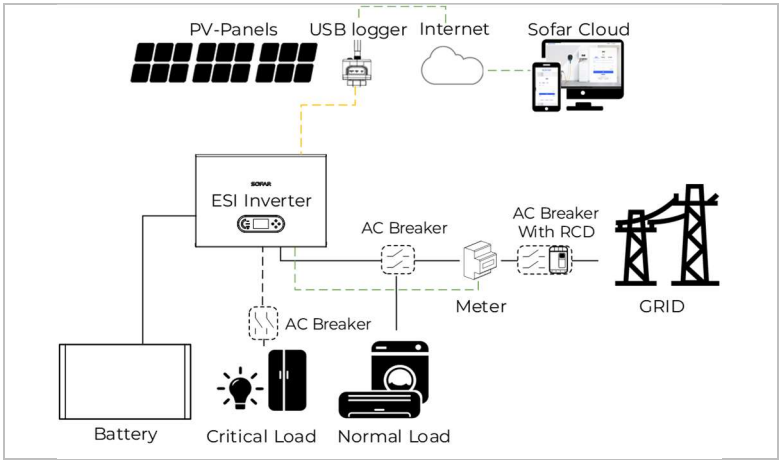


Figure 3-6 System without PV connection

### 3.5.3 System without battery

In this configuration, the battery unit(s) can be added later.

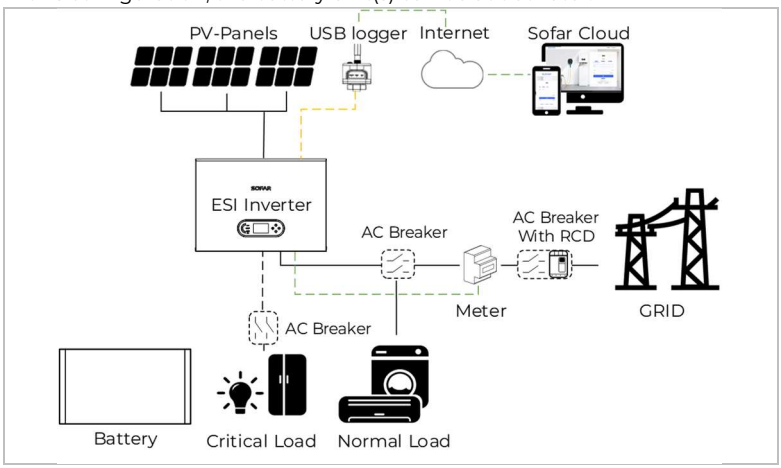



Figure 3-7 System without battery

### 3.5.4 Back-up mode (off-grid)

When there is no grid connection, the PV panels and the battery will provide electricity to the critical load.

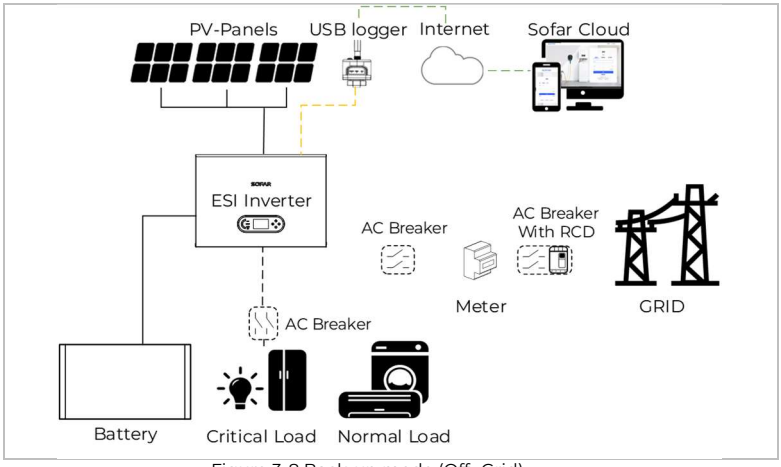



Figure 3-8 Back-up mode (Off- Grid)

### 3.5.5 System with multiple inverters (5–72kVA)

In the on-grid mode, a maximum of 6 inverters can be connected in parallel. In the off-grid mode, a maximum of 3 inverters can be connected in parallel, resulting in BACKUP output of up to 36 kVA.

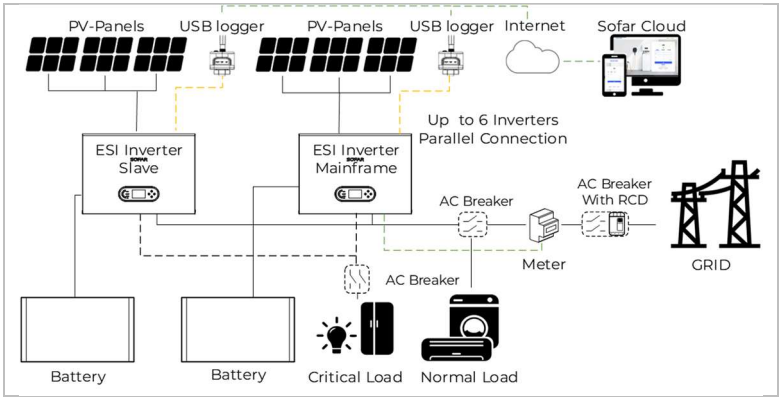



Figure 3-9 System with multiple inverter

- Multiple inverters connected in parallel shall be of the same power model with the same power and battery configuration.
- The energy meter are connected to the Master inverter. Control of all inverters takes place via the link cable.
- For the parallel switching of several devices, it is recommended to use a joint BACKUP break switch for the connected loads at the LOAD connection.
- For the parallel switching of several devices, it is recommended to use a joint BACKUP break switch for the connected loads at the GRID connection.
- In order to evenly distribute the loads among the inverters, the cable length between each output and the load must be the same.
- If the maximum apparent power of a load is greater than 110% of the inverter' s rated output, the device must not be connected via the BACKUP terminal, but rather directly to the grid.

### 3.5.6 AC retrofit system

In this system configuration, the hybrid system for an already existing PV system is supplemented with a solar inverter of any brand. By installing a second smart meter, the PV production can be taken into account and used for charging the battery.

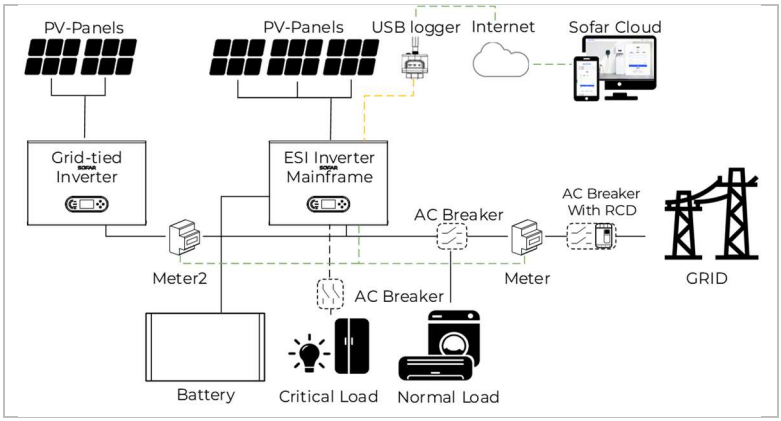



Figure 3-10 AC retrofit system

- The communication address of the PCC meter should be set to 1. Similarly, the communication address of the PV inverter meter 2...4 should be set to 2...4.

### 3.5.7 Unbalanced load

By enabling the "Unbalanced load" option, the inverter compensates unbalanced loads either in BACKUP mode.

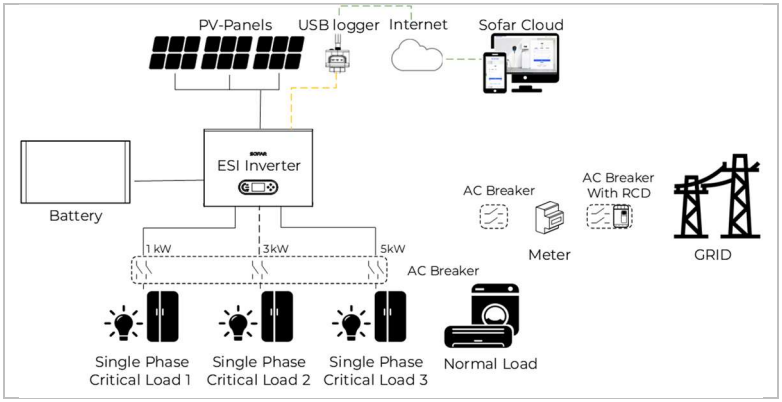



Figure 3-11 Unbalanced load (BACKUP Mode)

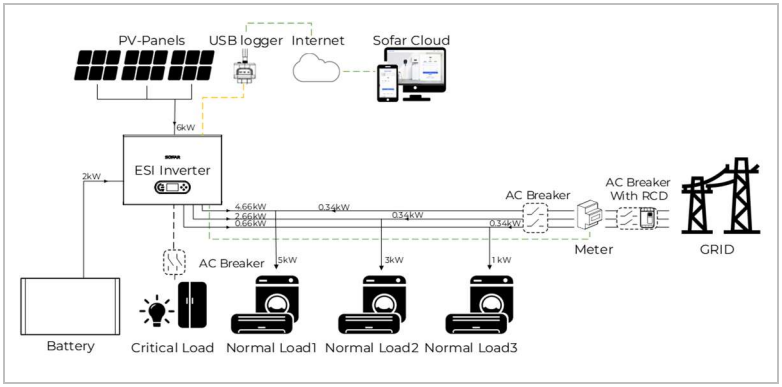



Figure 3-12 Unbalanced load (On Grid)

# 4 Installation

## 4.1 Installation information

**DANGER**

**Fire hazard**

- Do NOT install the inverter on flammable material.
- Do NOT install the inverter in an area in which flammable or explosive material is stored.

**CAUTION**

**Burning hazard**

- Do NOT install the inverter in places where it can be accidentally touched. The housing and heat sink may become very hot while the inverter is being operated.

***NOTICE***

**Weight of the device**

- Take into account the weight of the inverter when transporting and moving it.
- Choose a suitable installation location and surface.
- Commission a minimum of two persons for the installation of the inverter.

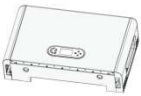
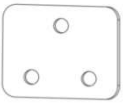
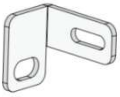
## 4.2 Installation procedure

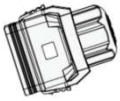
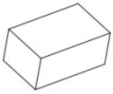
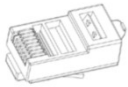
Mechanical installation is performed as follows:

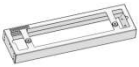
1. Examine the inverter before installation
2. Selection of mounting location and mounting method
3. Transport the inverter
4. Install the inverter

## 4.3 Examination before installation

After unpacking the inverter, check that the delivery items are both intact and complete. In the event of any damage or missing components, contact the wholesaler.

| NO. | Image | Description | Quantity PCS |
|---|---|---|---|
| 01 |  | Inverter ESI-5...12K-T1 | 1 |
| 02 |  | Connection plate | 2 |
| 03 |  | Retainer plate(left) | 1 |
| 04 |  | Retainer plate(right) | 1 |
| 05 |  | PV+ input terminal | 3 |
| 06 |  | PV- input terminal | 3 |
| 07 |  | MC4 connector contact PV+ | 3 |
| 08 |  | MC4 connector contact PV- | 3 |
| 09 |  | M6*60 expansion screws | 4 |

| NO. | Image | Description | Quantity PCS |
|---|---|---|---|
| 10 |  | M4*12 screws | 6 |
| 11 |  | M6*14 screws | 4 |
| 12 |  | BAT- connector contact | 1 |
| 13 |  | COM connector cable end | 1 |
| 14 |  | USB acquisition stick | 1 |
| 15 |  | Decorative cover withscrew (left side) | 1 |
| 16 |  | Decorative cover withscrew (right side) | 1 |
| 17 |  | Three-phase smart meter | 1 |
| 18 |  | Base decorative cover | 2 |
| 19 |  | Quick installation guide | 1 |
| 20 |  | Outgoing inspection report | 1 |
| 21 |  | Matching resistance | 1 |

| NO. | Image | Description | Quantity PCS |
|---|---|---|---|
| 22 |  | GRID wire end female connector | 1 |
| 23 |  | LOAD wire end male connector | 1 |
| 24 |  | Base | 1 |

### 4.3.1 Checking the external packaging materials

Packaging materials and components may become damaged during transportation. Therefore, the external packaging materials must be examined before the inverter is installed. Check the external packaging material for damage, e.g. holes and cracks. If you discover any damage, do not unpack the inverter and contact the transport company and/or dealer immediately. It is recommended that the packaging material should be removed within 24 hours before installing the inverter.

### 4.3.2 Checking the delivery scope

After unpacking the inverter, check that the delivery items are both intact and complete. In the event of any damage or missing components, contact the wholesaler.

## 4.4 Connections

**CAUTION**

**Damage during transportation**

- Please check the product packaging and connections carefully prior to installation.

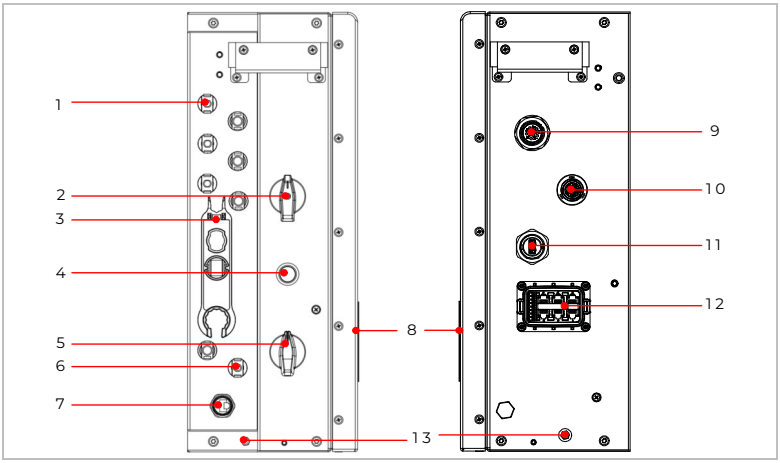
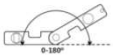
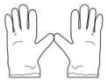



Figure 4-1 ESI-5...12K-T1 inverter overview

| | | | |
|---|---|---|---|
| 1 | PV input terminals | 8 | LCD display |
| 2 | PV switch | 9 | AC grid connection |
| 3 | Terminal remover | 10 | AC backup connection |
| 4 | Battery power button | 11 | Wi-Fi /4G |
| 5 | BAT switch | 12 | Communication connection |
| 6 | BAT input terminals | 13 | PE port |
| 7 | BAT communication port | | |

## 4.5 Tools

Prepare the tools required for the installation and the electrical connection.

| No. | Tool | Model | Function |
|---|---|---|---|
| 01 |  | Hammer drill<br>Recommended drill diameter: 8mm | Used to drill holes in the wall. |
| 02 |  | Screwdriver | Wiring |
| 03 |  | Phillips screwdriver | Used to remove and install the screws of the AC terminal |
| 04 |  | Removal tool | Used to remove the PV , battery terminal |
| 05 |  | Wire stripper | Used to strip the wire |
| 06 |  | 6mm Allen key | Used to turn the screw to connect the rear panel to the inverter |
| 07 |  | Crimping tool | Used to crimp power cables |
| 08 |  | Multimeter | Used to check the earthing |
| 09 |  | Marker | Used for marking |
| 10 |  | Measuring tape | Used to measure distances |
| 11 |  | Spirit level | Used to align the wall bracket |
| 12 |  | ESD gloves | for the installer |

| | | | |
|---|---|---|---|
| 13 |  | Safety goggles | for the installer |
| 14 |  | Anti-dust respiratory mask | for the installer |

## 4.6 Installation Environment Requirements

- Choose a dry, clean, and tidy place, convenient for installation.
- Operating temperature range: -30 to +60°C(derating above +45℃).
- Relative humidity: 5...95% (non-condensed).
- The inverter shall be installed in a well-ventilated place.
- Do not place the inverter close to flammable or explosive materials.
- The AC overvoltage category of the inverter is category III.
- Maximum altitude: 4000m(derating above 2000 m)

## 4.7 Installation location

Choose a suitable location to mount the inverter (stacking three batteries for example). Ensure that the following requirements are met:

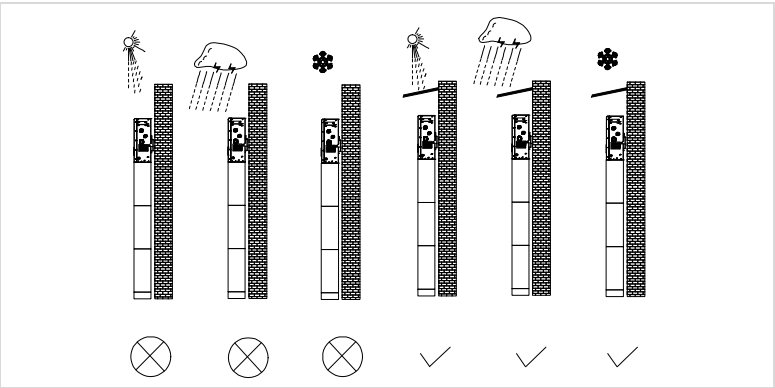


Figure 4-2 Installation Position of ESI-5...12K-T1

Minimum distances for individual ESI-5...12K-T1 inverters: 30 cm

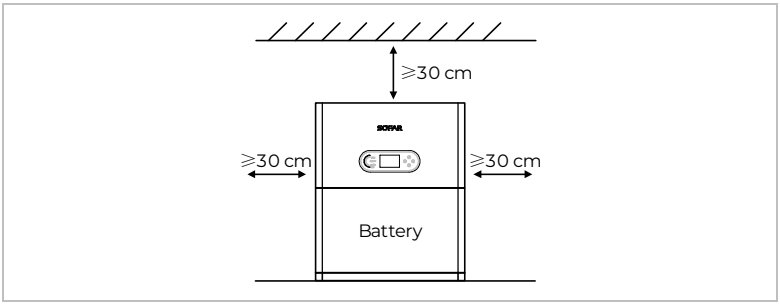



Figure 4-3 Minimum distances for individual inverter

Minimum distances for several ESI-5...12K-T1 inverters:

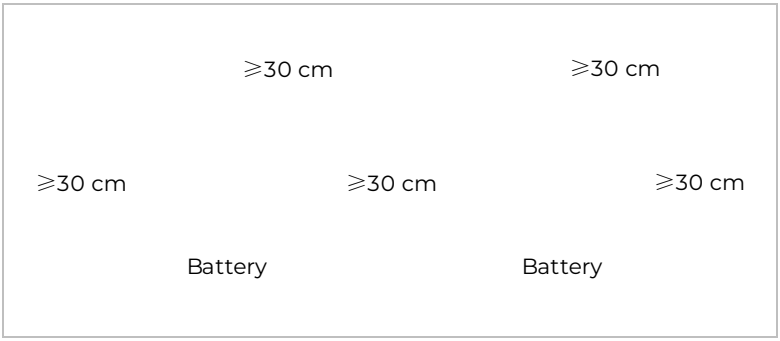



Figure 4-4 Minimum distances for several inverter

## 4.8 Unpacking the inverter

1. Open the package and hold the handles above the inverter on both sides with both hands.

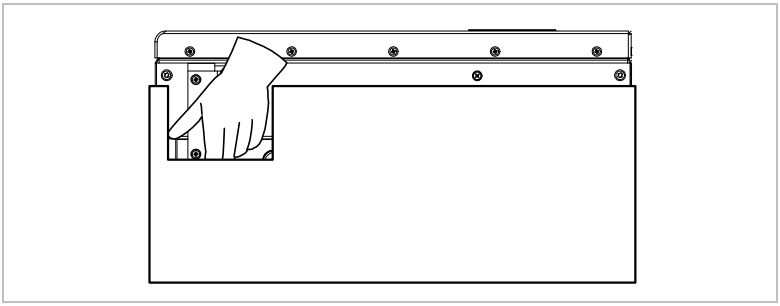


Figure 4-5 Moving the inverter

2. Lift the inverter out of the packaging and move it to its installation position.

**NOTICE**

**Mechanical damage**

- In order to prevent injuries and damage to the device, ensure that the inverter is kept balanced while it is being moved - it is very heavy.
- Do not place the inverter on its connections, as these are not designed to bear its weight. Place the inverter horizontally on the ground.
- When you place the inverter on the ground, place foamed material or paper underneath it in order to protect its housing.

## 4.9 Safety instructions

This topic describes the electrical connections of the inverter ESI-5...12K-T1. Read this section thoroughly and carefully before connecting the cables.

**⚠ DANGER**

**Electrical voltage at the DC connections**

- Ensure that the DC switch is OFF before establishing the electrical connection. The reason is that the electrical charge remains in the capacitor after the DC switch has been switched off. Therefore, at least 15 minutes must lapse before the capacitor has been electrically discharged.

**⚠ DANGER**

**Electrical voltage**

- PV modules generate electrical energy when exposed to sunlight, and this may present an electrical shock hazard. Therefore, cover the PV modules with an opaque sheet before connecting to the DC input power cable.

**DANGER**

**Electrical voltage at the DC connections**

- Wear rubber gloves and protective clothing (safety goggles and boots) when working on high voltage/high current systems such as inverter and battery systems.

***NOTICE***

**Qualification**

- The installation and maintenance of the inverter must be carried out by an electrician.
- Consumers must not remove the BACKUP plug from the inverter.

***NOTICE***

**On-grid operation**

- After connecting the external terminals of the inverter, the recommended power-up sequence is: first turn on the battery switch, then turn on PV switch,then press the battery power button,until you hear the battery turn on, then connect to the grid, and finally connect the load.
- After connecting the external terminals of the inverter, the recommended de-energizing sequence is: first disconnect the load, then disconnect the grid, then disconnect PV switch, then disconnect the battery switch, and finally press the battery power button,until you hear the battery shut down.

- The open-circuit voltage of the modules connected in series must be lower than or equal to 1000V.
- The connected PV modules must be compliant with IEC 61730 class.

The DVC (decisive voltage classification) is the circuit voltage which constantly occurs between two arbitrary live parts during proper use in a worst-case scenario:

Table 4-1 Description of limits for DVC

| DVC | Operating voltage limit(V) | | |
|---|---|---|---|
| | Ac voltage (RMS) | Ac voltage (PK) | Dc voltage (AVG) |
| A | 25 (16) | 35.4 (22.6) | 60 (35) |
| B | 50 (33) | 71 (46.7) | 120 (70) |
| C | 1000 | 4500 | 1500 |

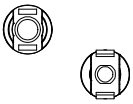
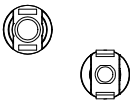
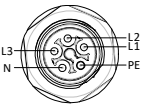
- The values in brackets apply when the inverter is installed in a humid environment.

Table 4-2 The decisive voltage class (DVC)

| Interface | DVC |
|---|---|
| PV input connection | DVCC |
| GRID connection | DVCC |
| BAT connection | DVCC |
| BACKUP connection | DVCC |
| WiFi/4G interface | DVCA |
| COM interface | DVCA |

## 4.10 Wiring overview

Table 4-3 Cable description

| Component | Description | | Recommended cable type |
|---|---|---|---|
|  | BAT+ : Connect the positive cable of the lithium battery | | Outdoor multicore copper cable (4...6mm²) |
| | BAT- : Connect the negative cable of the lithium battery | | |
|  | PV+ : Connect the positive cable of the PV array | | PV cable (4...6mm²) |
| | PV- : Connect the negative cable of the PV array | | |
|  Backup | Connection method: male and female terminals are inserted into each other. | L1 | Outdoor multicore copper cable 6...10mm² |
| | | L2 | |
| | | L3 | |
| | | N | |
| | | PE | |
|  Grid | Connection method: male and female terminals are inserted into each other. | L1 | Outdoor multicore copper cable 6...10mm² |
| | | L2 | |
| | | L3 | |
| | | N | |
| | | PE | |

- The selection of the cable cross-section must take into account the length of the cable used and the circuit breaker according to the national standard.

## 4.11 System Electrical Topology

The inverters GRID and BACKUP are wired with different N and PE wires depending on the regulatory requirements in different regions. For users in Australia, South Africa and New Zealand, please use the System Electrical Topology in System2.

**System 1: Internal relay controls N-PE grounding**

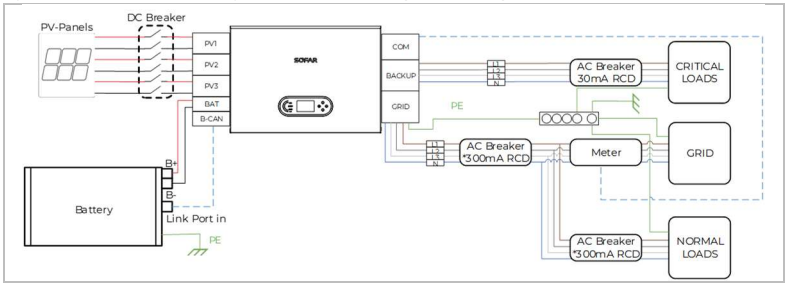



Figure 4-6 System Electrical Topology (a)

- Ensure that both the BACKUP and GRID PE wires are grounded at the same time, as shown in the diagram. Otherwise, the inverter may be abnormal in off-grid mode.
- In system 2, Neutral Point Grounding is disabled by default. Check whether Neutral Point Grounding is enabled, if not, enable it manually: Advanced Setting –> Input 0715 -> NeutralPointGrounding->Enable

**System 2: N and PE wires are connected together**

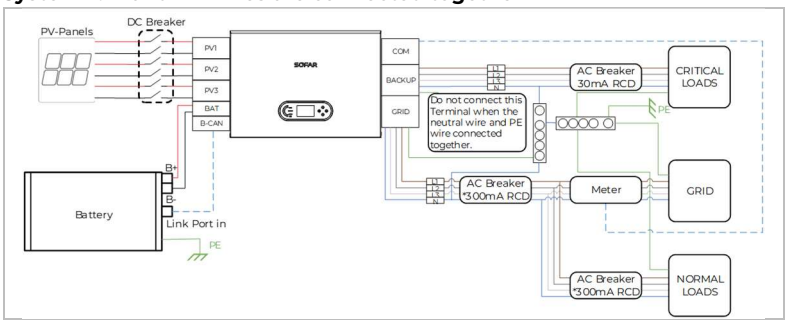



Figure 4-7 System Electrical Topology (b)

**DANGER**

**Install Residual current device (RCD) in front of the load**

- RCD is necessary for critical load, but optional for normal load.
- In off-grid mode, the BACKUP switch is unprotected and load leakage could lead to shock danger.
- The Entry master switch installed in the house must have earth leakage protection and its rated earth leakage action current > number of inverters * 100mA(suggestive value).

**DANGER**

**Be sure to ensure that the output is grounded**

- In system 1, the PE line of the inverter's GRID Port and BACKUP Port must be grounded through the PE-Bar, otherwise there may be a risk of leakage.

- According to the **Australian safety regulations**, the neutral cables on the grid-connected side and BACKUP side must be connected together. Otherwise, the BACKUP cannot be used.

## 4.12 Smart Meter / CT

There are different system configurations possible depending on the user's requirements, existing electrical infrastructure and local regulations. The distribution box must be configured to comply to the grid operator requirements.

The inverter has an integrated AC relay to disconnect all phases and Neutral from the grid in case of grid fault or grid outage.

The inverter's power generation and feed-in limiting functions require the use of an external direct-connected meter to obtain grid information.

There are 3 system configurations:

- System A: measurement of energy with directly connected smart meter – Default configuration(default)
- System B: direct measurement of energy with CT's (3000:1)

- The secondary side current of Scheme B is less than 100mA. The length of the lead of CT cannot exceed 1 km(too long will result in poor accuracy).

**⚠ CAUTION**

In the following three situations, the system must be connected to the fuse first and then to the machine's input terminal:

Lead-acid battery

Lithium battery without BMS

Multiple lithium batteries connected to one input

### 4.12.1 System A: measurement with directly connected energy meter (default)

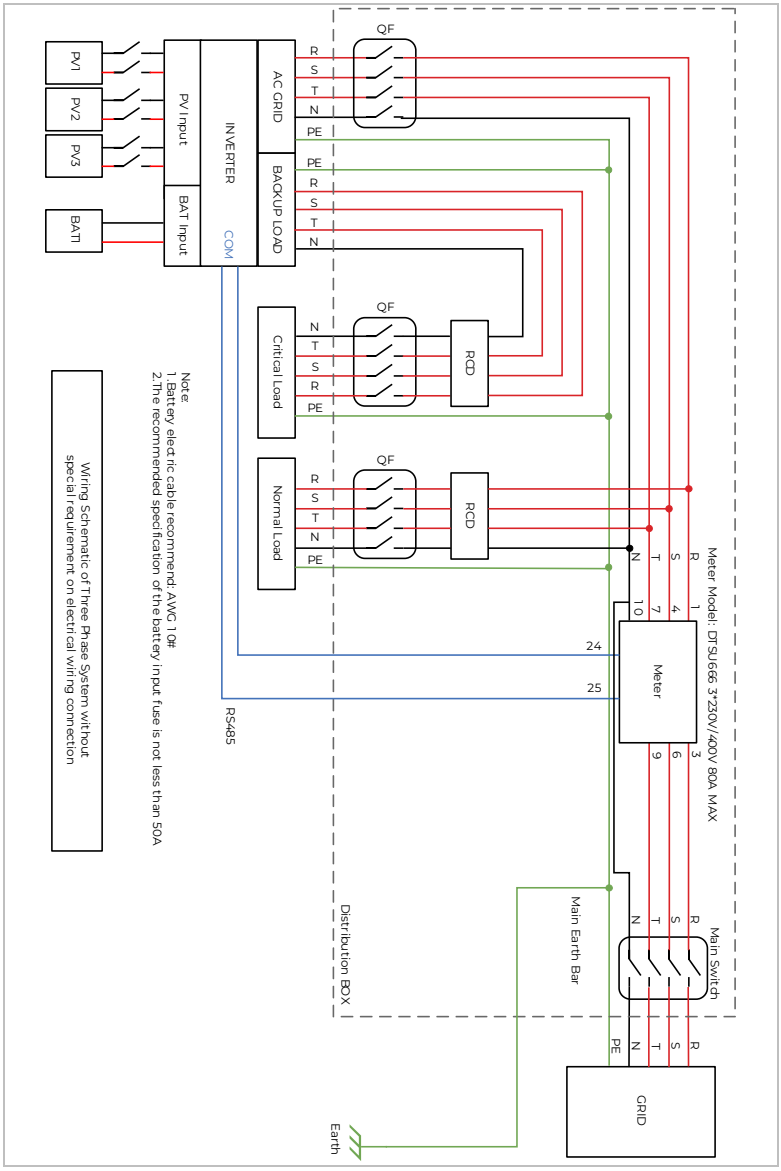



Figure 4-8 Electrical connections (Plan A: Meter)

### 4.12.2 System B: direct measurement of energy with CTs

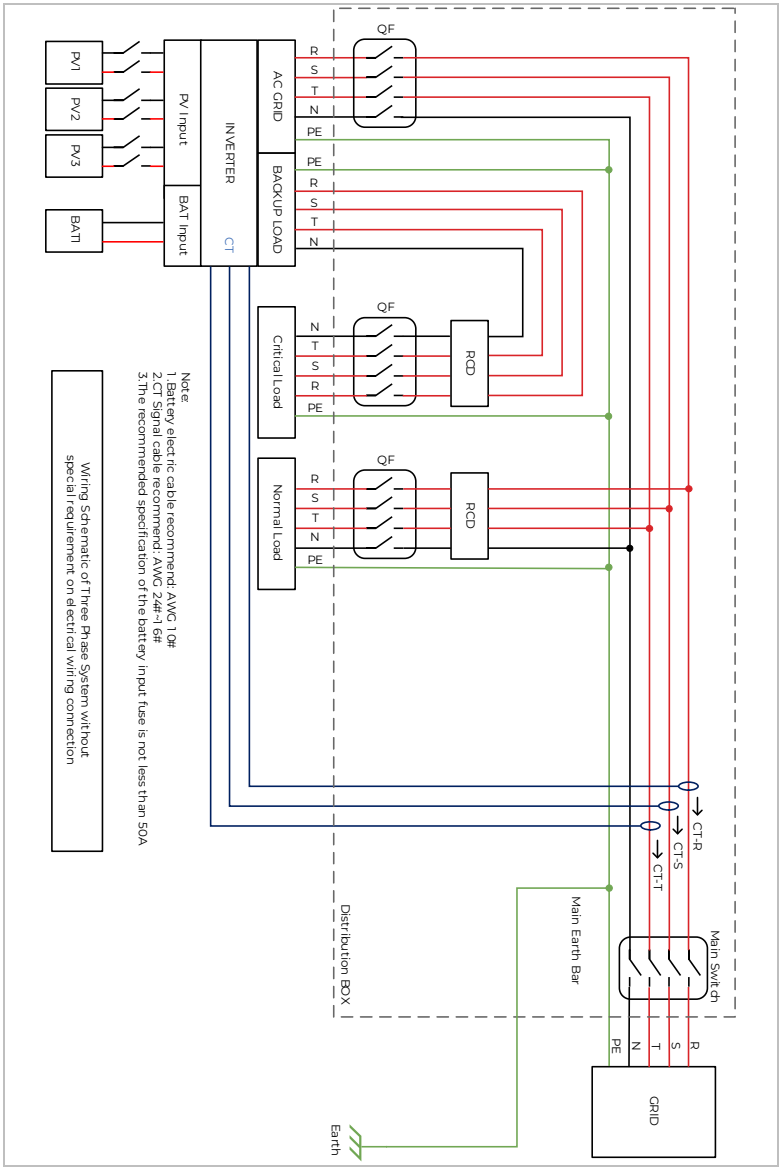



Figure 4-9 Electrical connections (Plan B: CTs)

**Directly connected Energy Meter:**

Table 4-4 Directly connected Smart Meter

| **Technical Data** | |
|---|---|
| Nominal voltage | 230 V AC/400 V AC, 50 Hz/60 Hz |
| Current measurement range | Direct connection: 0–80 A<br>Connection through current transformers: > 80 A |
| Voltage measurement range | 90–1000 V (line voltage; potential transformers are required if the voltage is greater than 500 V) |
| Electricity metering accuracy | Class 1 (error within ±1%) |
| Power grid system | Active Class 1, Reactive Class 2 |
| Baud rate | 1200/2400/4800/9600/19200/115200 bps (default value: 9600 bps) |
| Operating temperature | –25℃ to +60℃ |
| Installation mode | Guide rail-mounted |

## 4.13 Electrical connection

The electrical connection is established as follows:

1. Connect PE cable
2. Connect DC input cable
3. Connect battery cable
4. Connect AC output power cable
5. Connect communication cable (optional)

## 4.14 Connecting the PE cables

Connect the inverter to the equipotential bonding bar by using the protective earth cable (PE) for grounding.

| NOTICE |
| --- |
| **Pole earthing not permissible!**<br>▸ As the inverter is transformerless, the plus and minus poles of the PV generator must NOT be earthed. Otherwise, the inverter will malfunction. In the PV system, not all live metal parts (e.g. PV module frames, PV frame, generator connection box housing, inverter housing) require earthing.<br>▸ The protective grounding of the chassis shell cannot replace the PGND cable of the BACKUP Port. Ensure that the two PGND cables are reliably connected.<br>▸ When multiple inverters are deployed, ensure that the protection ground points of all inverters are equipotential connected. |

1. Remove the insulation of the cable. For outside use, the PE cable recommended for use in EU depends on the protection breakers used and the length of cable, it is recommended to use: 4mm² ⩽ PE cable ⩽ 10mm².

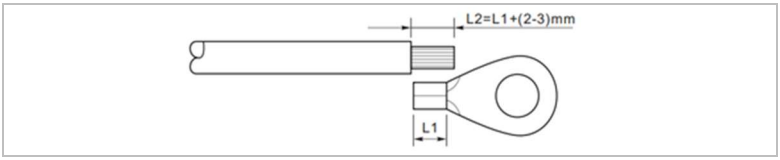



Figure 4-10 Connecting PGND cable(a)

▸ L2 is 2 to 3 mm longer than L1.

2. Crimp the cable to the ring terminal:

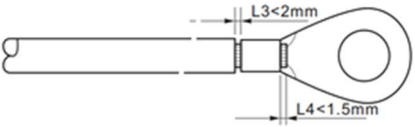



Figure 4-11 Connecting PGND cable(b)

## 4.15 Connecting the DC lines for the PV modules and battery

- The connection steps of the battery and PV are the same, only the terminal specifications are different. The colour of the battery terminal is blue, the colour of PV terminal is black.

Please observe the recommended cable dimensions:

| Cable cross-section ($mm^2$) | | Outer diameter of cable (mm) |
|---|---|---|
| Range | Recommended value | |
| 4.0 ... 6.0 | 4.0 | 4.5 ... 7.8 |

1. Remove the crimp contacts from the positive and negative connections.
2. Remove the insulation of the cables:

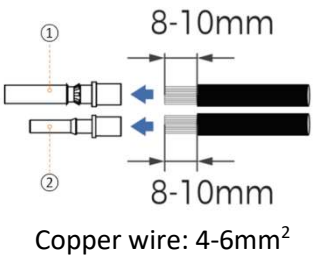



Figure 4-12 Connecting PV(a)

① Positive DC cable ② Negative DC cable

- L2 is 2 to 3 mm longer than L1

3. Insert the positive and negative DC cables into the corresponding cable glands.

4. Crimp the DC cables. The crimped cable must be able to withstand a tractive force of 400 Nm.

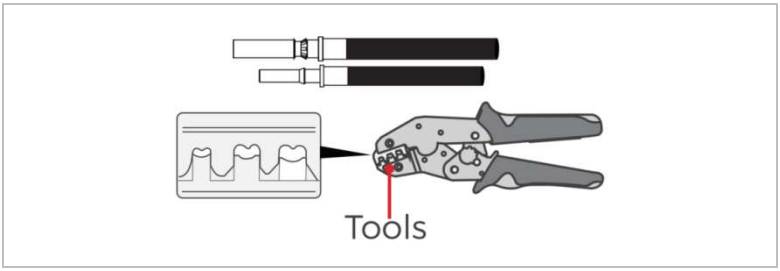



Figure 4-13 Connecting PV(b)

**CAUTION**

**Danger of reverse polarity!**

- Ensure that the polarity is correct before plugging into the DC connections!

5. Insert the crimped DC cables into the corresponding connector housing until you hear a “clicking” sound.

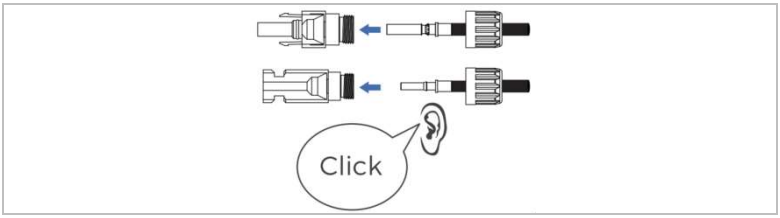



Figure 4-14 Connecting PV(c)

6. Re-screw the cable glands to the connector housing.

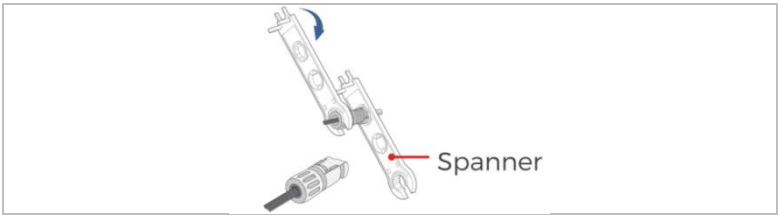



Figure 4-15 Connecting PV(d)

7. Use a multimeter to measure the voltage at both ends of the positive and negative terminals to ensure that the terminals are connected reliably.

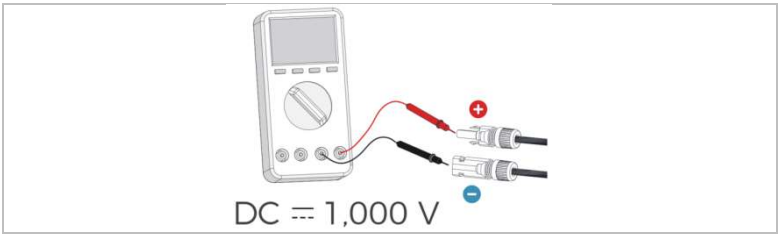



Figure 4-16 Testing PV(e)

8. Insert the positive and negative connectors into the corresponding DC input terminals of the inverter until you hear a “clicking” sound.

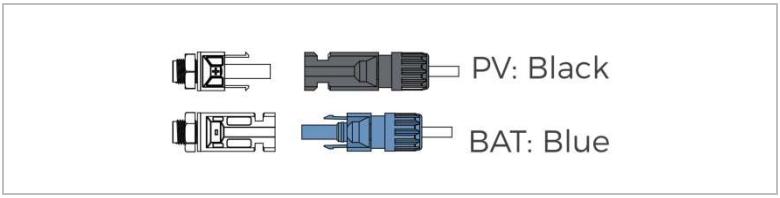



Figure 4-17 Connecting PV(f)

- Insert the protective caps into the unused DC connections.

**⚠ CAUTION**

**Danger of DC arcing**

- Before removing the plus and minus connector, ensure that the DC switch has been set to OFF.

In order to remove the plus and minus connection from the inverter, insert a removal key into the locking and press on the key with the adequate force as shown in the following illustration:

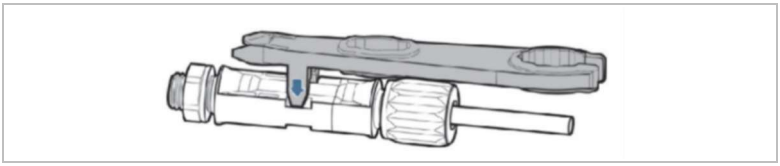


Figure 4-18 Connecting PV

## 4.16 Connecting the AC power cables

The AC power cables are used to connect the inverter to the critical loads (through the BACKUP port), and the AC power distributor or the power grid.

**⚠ CAUTION**

**AC connection**

- Each inverter must have its own circuit breaker.
- The AC disconnecting device must be easily accessible.

- The inverter ESI-5...12K-T1 has a built-in AFI (univ. sensitive residual current protection). If an external AFI is required, we recommend an AFI type A featuring a residual current of 100 mA(suggestive value) or higher.
- Please follow the national rules and regulations for the installation of external relais or circuit breakers!

The AC cable should be correctly dimensioned in order to ensure that the loss of power in the AC cable is less than 1% of the rated output. If the AC cable resistance is too high, then the AC voltage will increase; this may cause the inverter to become disconnected from the power grid. The relationship between the leakage power in the AC cable and the cable length, the cable cross-section, is displayed in the following illustration:

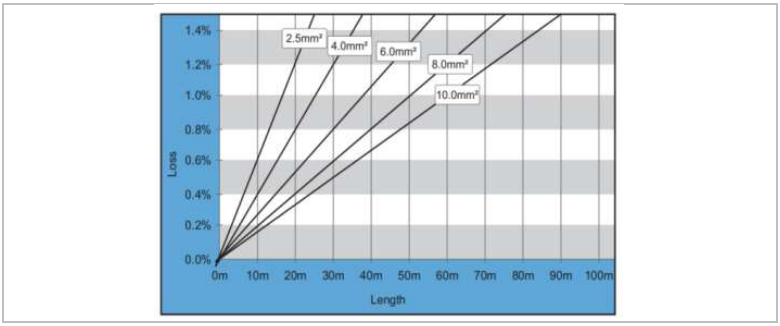



Figure 4-19 The relationship between the leakage power and cable length

## 4.17 AC connector installation

**⚠ CAUTION**

**Electrical voltage**

- Ensure that the grid has been switched off before removing the AC connector

Please follow below steps to install the AC connector.

1. Select the suitable cable in accordance with above diagram. Remove the insulating layer of the AC output cable using a wire stripper and in accordance with the following illustration:

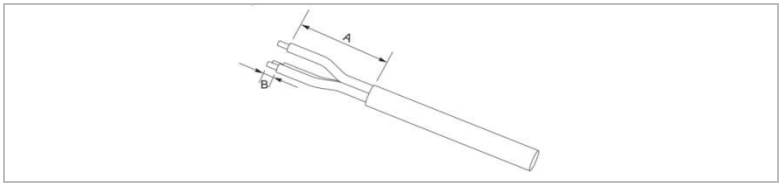



Figure 4-20 AC connection (a)

| | | | |
|---|---|---|---|
| A | 30~50 mm | B | 3~5 mm |

2. Disassemble the connector in accordance with the following illustration. Guide the AC output cable through the cable gland.

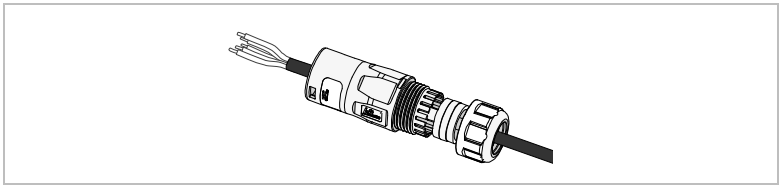


Figure 4-21 AC connection (b)

3. Connect the AC cable in accordance with the following requirements and tighten the terminal using the Allen key.

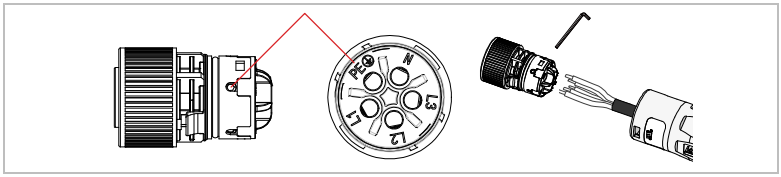



Figure 4-22 AC connection (c)

| Connection | Cable |
|---|---|
| L1 | Phase 1 (brown) |
| L2 | Phase 2 (black) |
| L3 | Phase 3 (grey) |
| N | Neutral conductor (blue) |
| PE | Earthing cable (yellow-green) |

4. Plug the connector into the port and end when you hear a click.

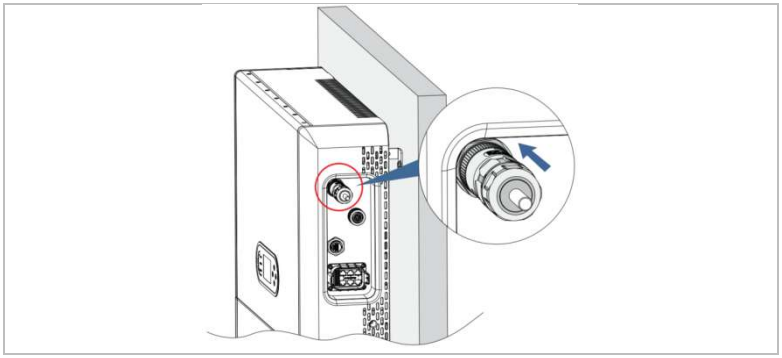


Figure 4-23 AC connection (d)

- Use the removal tool to unlock and then rotate counterclockwise to remove the connector.
- When you use the meter connection function, make sure that the AC terminal cable corresponds to the meter cable one by one (L1, L2, L3, N, and PE cables)
- Corresponding to the grid identification of different regions, L1, L2, L3 correspond to A, B, C or R, S, T or U, V, W respectively.

## 4.18 Communication interfaces

The positions of the communications interfaces of the ESI-5...12K-T1 are displayed below:

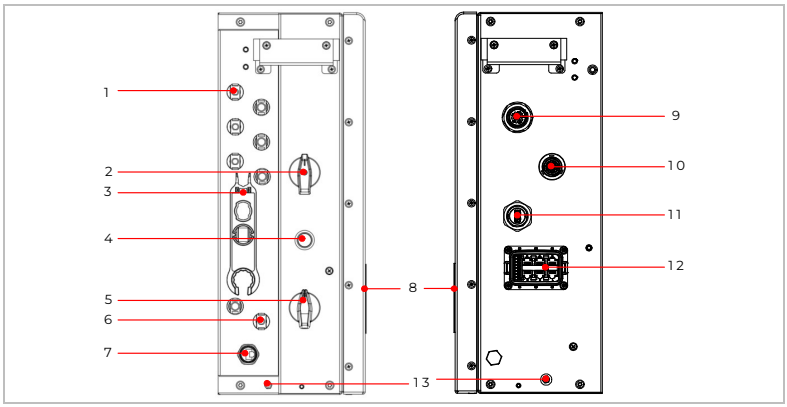



Figure 4-24 ESI-5...12K-T1 interfaces

| No. | Connection | Function |
|---|---|---|
| 7 | BAT communication port | Connect the battery to read battery information or assist with battery software upgrades. |
| 11 | Wi-Fi /4G | USB port for firmware upgrade and safety parameter import; Port to connect Stick Logger (Wi-Fi). |
| 12 | Communication connection | Multi-functional communication ports including parallel, Ethernet, Meter/CT, DRMS, charging pile, dry contact, etc. |

### 4.18.1 Multifunctional Communication Port Definition

Please refer to the following table for the specific PIN assignments.

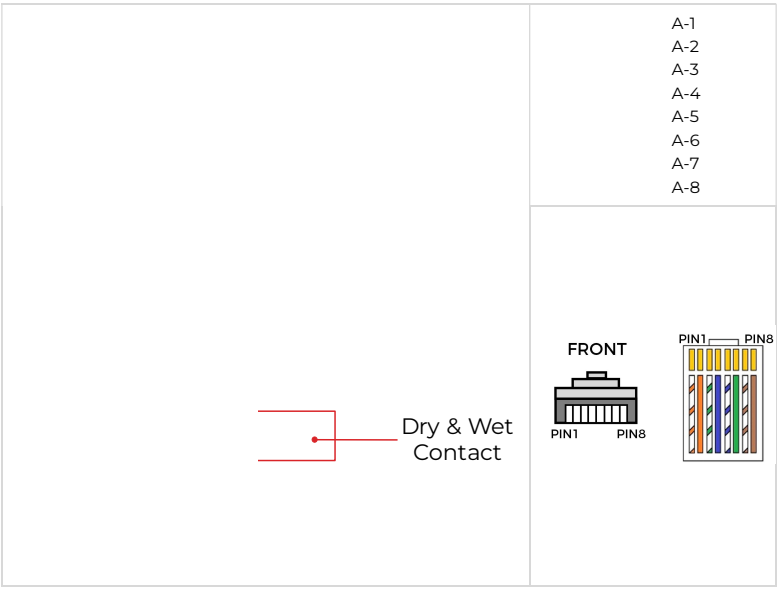



Figure 4-25 COM interfaces

| Wall Box | | | |
|---|---|---|---|
| **PIN** | **Colour** | **Connection** | **Function** |
| 1 | Orange White | Wallbox-RS485 A | Wallbox-RS485 differential signal+ |
| 2 | Orange | Wallbox-RS485 B | Wallbox-RS485 differential signal- |

| Meter/CT | | | |
|---|---|---|---|
| **PIN** | **Colour** | **Connection** | **Function** |
| 1 | Orange White | Meter-RS485 A | Meter-RS485 differential signal+ |
| 2 | Orange | Meter-RS485 B | Meter-RS485 differential signal- |
| 3 | Green White | CT A+ | CT A differential signal+ |
| 4 | Blue | CT B+ | CT B differential signal+ |
| 5 | Blue White | CT B- | CT B differential signal- |
| 6 | Green | CT A- | CT A differential signal- |
| 7 | Brown White | CT C+ | CT C differential signal+ |
| 8 | Brown | CT C- | CT C differential signal- |

| DRMs | | | |
|---|---|---|---|
| **PIN** | **Colour** | **Connection** | **Function** |
| 1 | Orange White | DRM1/5 | DRM1/5 |
| 2 | Orange | DRM2/6 | DRM2/6 |
| 3 | Green White | DRM3/7 | DRM3/7 |
| 4 | Blue | DRM4/8 | DRM4/8 |
| 5 | Blue White | GND | GND |
| 6 | Green | DRM0 | DRM0 |
| 7 | Brown White | / | Internally shorted |
| 8 | Brown | / | |

| Dry & Wet Contact | | | |
|---|---|---|---|
| **PIN** | **Ports** | **Connection** | **Function** |
| 1 | A-1 | DI IN | Dry contact input signal |
| 2 | A-2 | DI GND | Dry contact ground signal |
| 3 | A-3 | DO NO | Dry contact normal high signal |
| 4 | A-4 | DO COM | Dry contact communication signals |
| 5 | A-5 | WO1 NO | Wet contact normal high signal 1 |
| 6 | A-6 | WO1 GND | Wet contact ground signal 1 |
| 7 | A-7 | WO2 NO | Wet contact normal high signal 2 |
| 8 | A-8 | WO2 GND | Wet contact ground signal 2 |

- Link port for Ethernet: Ethernet.
- Link port for Parallel: link0 and link1.

### 4.18.2 Multifunctional Communication Cable Production

1. Prepare a RJ45 cable, according to the length of the connector appropriate to open one end of the cable :

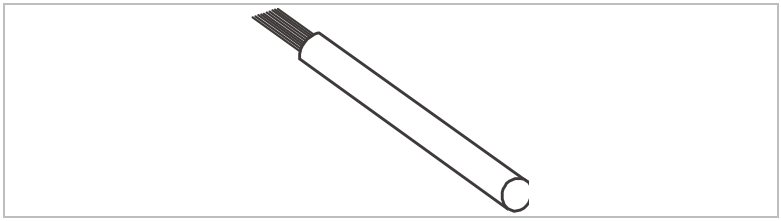


Figure 4-26 COM connector production (a)

2. Remove the rubber plugs from the COM connector and pull out the appropriate number of plugs according to the desired function:

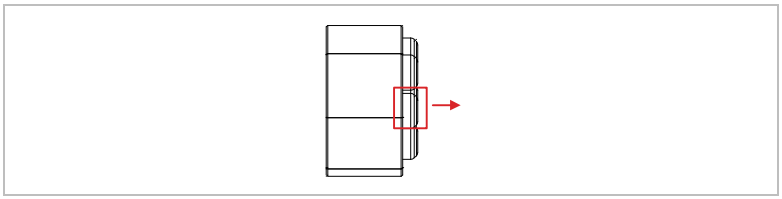


Figure 4-27 COM connector production (b)

3. After removing the stopper, pass the cable through the connector gland, connector clip and connector through-hole. Crimp the cable to the terminal connector in the colour shown below:

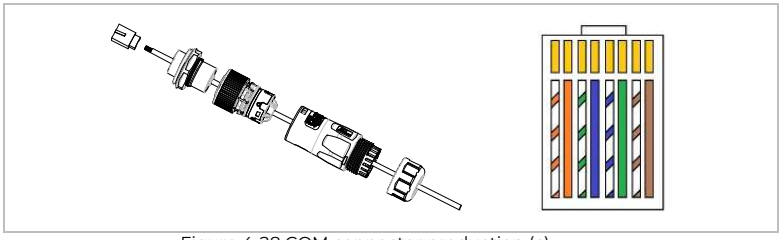


Figure 4-28 COM connector production (c)

4. After assembling the connectors in order, insert the RJ45 connector into the corresponding terminal of the COM port:

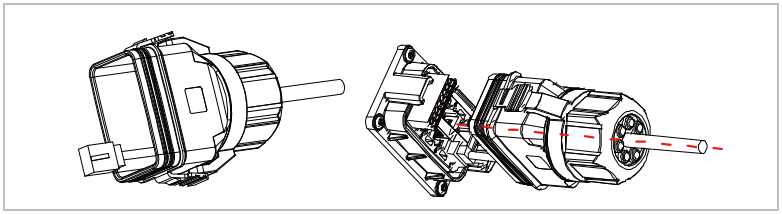


Figure 4-29 COM connector production (d)

5. Locking the connector housing to the inverter COM port:

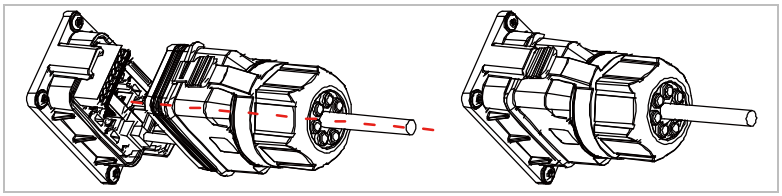


Figure 4-30 COM connector production (e)

### 4.18.3 Smart meter

The integrated energy management functions integrated of the ESI 5...12K-T1 require to measure the power flow at the point of grid interconnection. There are different system configurations possible. It can be measured using directly connected smart meter or using smart meter with CTs.

The PIN assignment for the RS485 connection between inverter and smart meter can be found in the table below.

| Inverter COM Port Pin | Function | Meter Pin |
|---|---|---|
| Meter/CT PIN1 | Meter-RS485 A | Pin 24 |
| Meter/CT PIN2 | Meter-RS485 B | Pin 25 |

- The Smart meter shows a positive power value for feed-in to the grid, and a negative value for energy purchase from the grid.
- Use the shielded twisted pair cable.
- The copper outer diameter should be more than 0.5 $mm^2$.
- Keep away from power cables or other electric fields.
- Use termination resistors at the ends of the RS485 line to improve signal quality

Connect the grid phases to the Smart Meter Pins according to below drawing for correct functionality of the inverter.

**Smart meter with directly connection (System A, default configuration)**

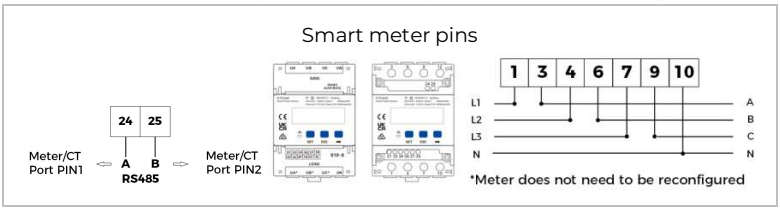



Figure 4-31 Directly Meter

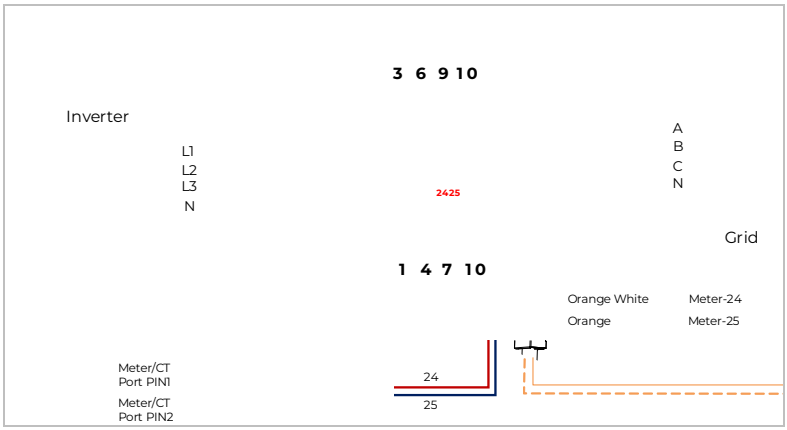



Figure 4-32 Directly Meter Electrical Connection

- No additional configuration required for direct-connected meters
- Up to 80 A measurement
- Accuracy class and load rating (VA/Ω):1 class
- Rated operating voltage: 90 – 1000 V (line voltage; potential transformers are required if the voltage is greater than 500 V)
- Rated frequency: 50~60Hz
- Ambient temperature: -25℃~60℃
- Altitude: ⩽3000m

- The inverter connected to the meter is a power generation device, and the function of the meter connected to the traditional load (electrical device) is opposite. Therefore, for our product, when the power is output to the grid, the electricity meter will show a positive value, and when the power is purchased from the grid, it will show a negative value.

**Smart Meter Configuration**

The smart meter is preconfigured to be used with the inverter with these settings:

- Modbus Address: 1
- Baud Rate: 9600
- Current Ratio: 60:1

In case you want to change or check the settings, please refer to below procedure:

**Modbus Address and Baud Rate setting**

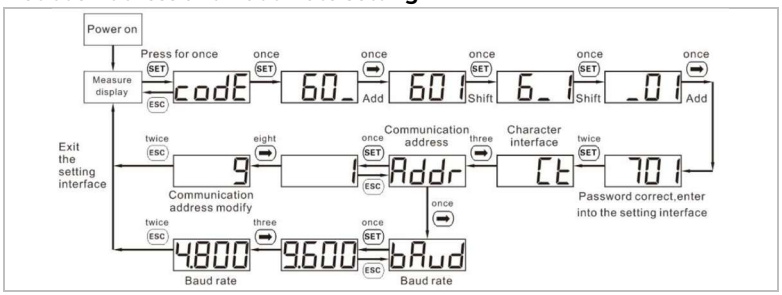



Figure 4-33 Meter address and baud rate setting

**Current Ratio setting**

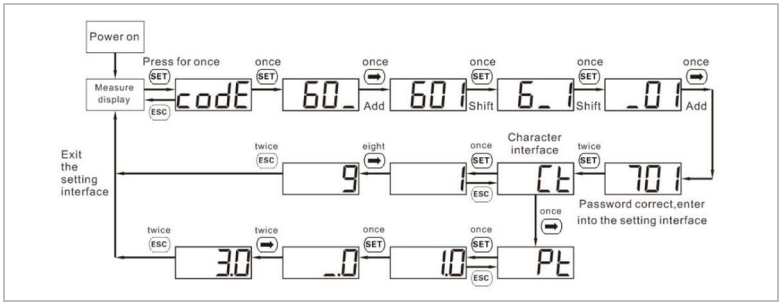



Figure 4-34 Meter current ratio setting

- The inverter connected to the meter is a power generation device, and the function of the meter connected to the traditional load (electrical device) is opposite. Therefore, for our product, when the power is output to the grid, the electricity meter will show a positive value, and when the power is purchased from the grid, it will show a negative value.

### 4.18.4 Parallel Port

In systems with multiple inverters, you can connect the devices in a Master/Slave configuration. In this configuration, only one energy meter is connected to the Master inverter for the system control.

- In the **off-grid mode**, a maximum of 3 inverters can be connected in parallel.
- In the **on-grid mode**, a maximum of 6 inverters can be connected in parallel.

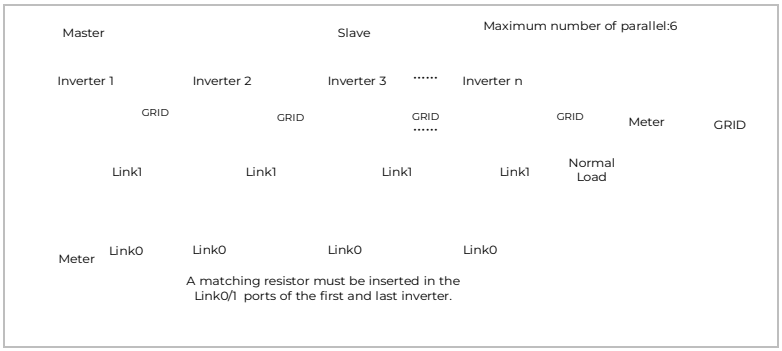



Figure 4-35 parallel system(on-grid mode)

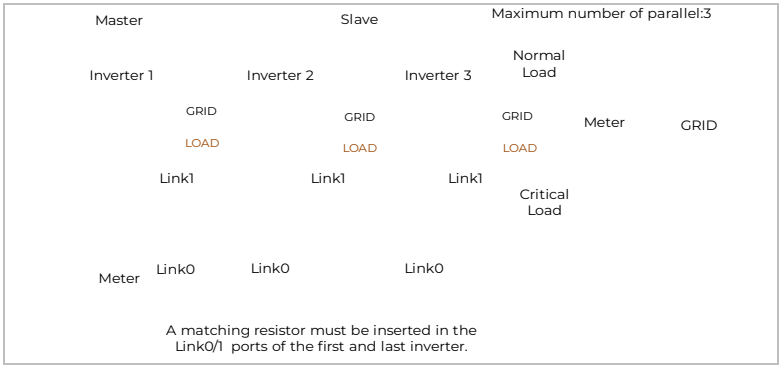
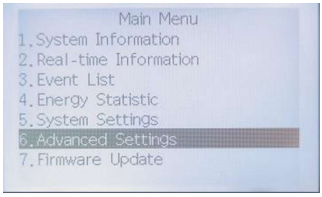
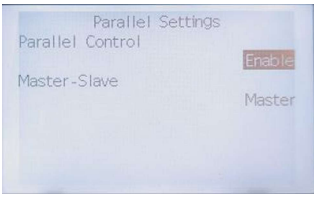
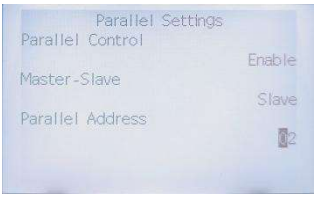



Figure 4-36 parallel system(off-grid mode)

**Parallel setting**

| | |
|---|---|
|  | Select Advanced Settings |
|  | Select Parallel Settings |
|  | Enter the password 0715. |
|  | **Master inverter**<br>Select Inverter 1. Switch the parallel control from disabled to enabled. The default state of inverter 1 is that it is in the Master mode. |
|  | **Slave inverters**<br>Configure inverters 2 to n in sequence based on the number of parallel units. The maximum number of parallel units for three phase ESI inverter is six.<br>Setting parallel address from 2 to 6 for slave inverter. |

- In the parallel operation mode, emergency power supply, generator mode and unbalanced support need to be turned off remotely first. The settings for the slave units must be made on the master machine after the remote shutdown.

- Be careful when the parallel inverters are connected, then the communication cable should not be bundled with the power cable (GRID - BACKUP) in one cable channel or to be very close, it may cause abnormal faults in the parallel system. it is preferable to pass the communications cables in a separate cable channel.

### 4.18.5 DRMs/Logic interface

The DRMs/Logic interface is used to control the inverters feed-in or purchases power by external signals, usually provided from grid operators with ripple control receivers or other means. The DRM0 can be used for a switch off signal from external grid protection devices.

The logical interface pins are defined according to the requirements of different standards. Please connect according to the safety requirements of your country (see below for a brief description of the safety requirements).

First, connect the DRMs port cable in the COM port cable set to the control unit in accordance with the wire sequence required by the safety regulations:

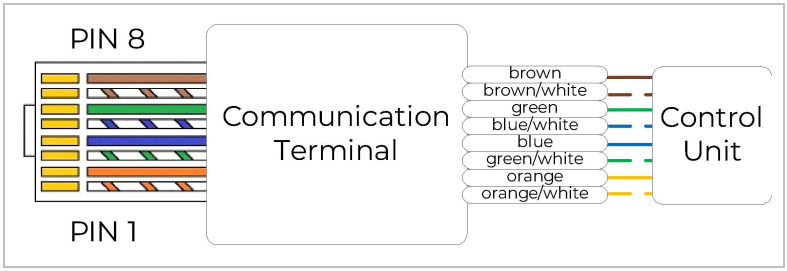



Figure 4-37 DRM connection(a)

Connect the RJ45 terminal on the other end of the COM connector to the DRMs port:

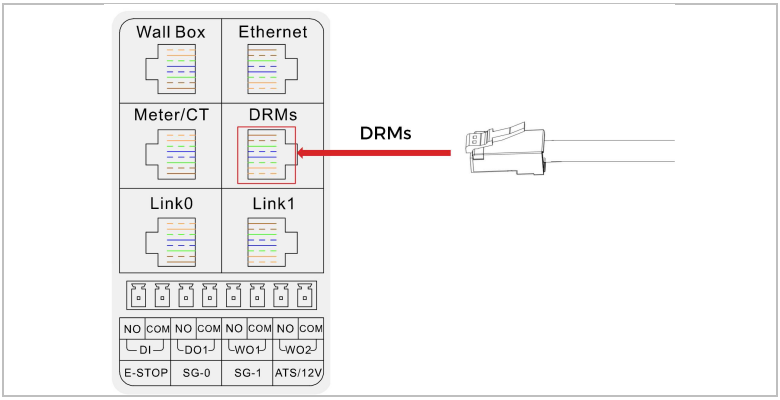



Figure 4-38 DRM connection(b)

**DRMs for AS/NZS 4777.2:2015 and AS/NZS 4777.2:2020**

Also known as Inverter Demand Response Modes (DRMs).

The inverter recognises all supported Demand Response commands and initiates the reaction within two seconds. The inverter will continue to respond while the mode remains asserted.

| Pin | Colour | Function |
|---|---|---|
| 1 | orange/white | DRM1/5 |
| 2 | orange | DRM2/6 |
| 3 | green/white | DRM3/7 |
| 4 | blue | DRM4/8 |
| 5 | blue/white | RefGen |
| 6 | green | DRM0 |
| 7 | brown/white | Internally shorted |
| 8 | brown | |

Method of asserting demand response modes:

| Mode | RJ45 socket Asserted by shorting pins: | | Real current limit (referenced to inverter rated per phase current) |
|---|---|---|---|
| **DRM0** | 5 | 6 | 0 |
| **DRM1** | 1 | 6 | Import=0 |
| **DRM2** | 2 | 6 | Import<50% |
| **DRM3** | 3 | 6 | Import<75% |
| **DRM4** | 4 | 6 | Not limited |
| **DRM5** | 1 | 5 | Generate=0 |
| **DRM6** | 2 | 5 | Generate<50% |
| **DRM7** | 3 | 5 | Generate<75% |
| **DRM8** | 4 | 5 | Not limited |

**Logic interface for VDE-AR-N 4105:2018-11**

This function serves to control and/or limit the output power of the inverter. The inverter can be connected to a radio ripple control receiver in order to dynamically limit the output power of all inverters within the system.

RCR: Ripple control receiver (RCR) is an interface between a PV system and power grid company.

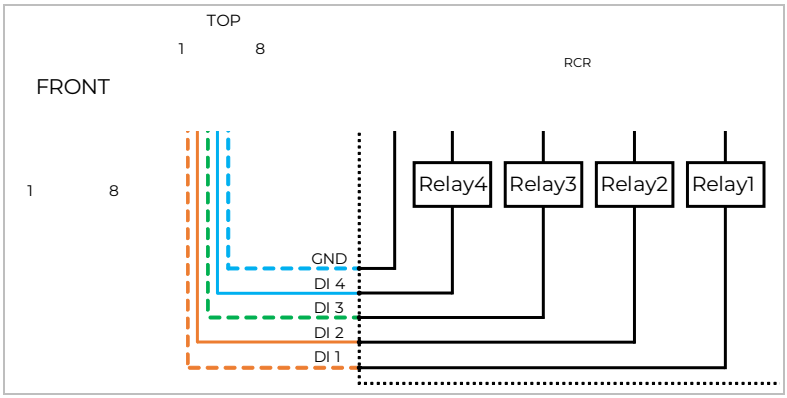



Figure 4-39 DRM connection(c)

The inverter is preconfigured on the following power levels:

| Pin | Name | Parameter | Preset Power Value* |
|---|---|---|---|
| 1 | DI 1 | Relay1 engaged | 0% |
| 2 | DI 2 | Relay2 engaged | 30% |
| 3 | DI 3 | Relay3 engaged | 60% |
| 4 | DI 4 | Relay4 engaged | 100% |
| 5 | GND | Internal signal | |

*) When using this function on your own, make sure that the normally open relay is disconnected before use, and provide the drive signal for the relay on your own.

*) Priority: DI 1> DI 2> DI 3> DI 4

**Logic interface for EN50549-1:2019**

The active power output can be ended within five seconds following a command to the input interface.

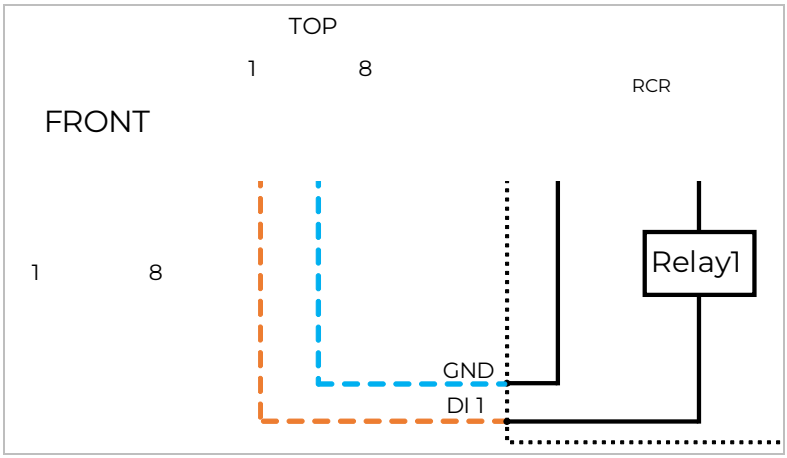



Figure 4-40 DRM connection(d)

**Functional description of the terminal**

| Pin | Name | Inverter | Preset Power Value* |
|---|---|---|---|
| **1** | DI 1 | Relay1 engaged | 0% |
| **5** | GND | Internal signal | |

## 4.19 Feed-in limitation function

The feed-in limitation function can be used to limit the power fed back into the grid. For this function, a power measurement device must be installed according to system A, B, or C.

**Feed-in limitation:** The sum of the feeding-in phases must not exceed the set power limitation value. The power of phases drawing power from the grid is disregarded here.

**3-phase limit:** The sum of the feed-in power of all three phases must not exceed the set power limit value. This setting is suitable for balancing metering, as is common in Germany, for example.

- For the 3-phase limit setting, the current sensors must be correctly assigned to phases L1, L2 and L3 on the electricity meter!
- If communication with the smart meter is interrupted, the inverter limits its output power to the set power limit value.

## 4.20 System monitoring

The ESI-5...12K-T1 inverters provide various communication methods for the system monitoring:
RS485 or WiFi stick (standard).

### 4.20.1 RS485

You can connect RS485-linked devices to your PC or a data logger via an RS485 USB adapter.

- The RS485 line may not be any longer than 1000 m
- Assign each inverter its own modbus address (1 to 31) via the LCD display

### 4.20.2 Wi-Fi/4G

When you have installed the stick logger, the inverters can directly upload your operating, energy and alarm data in the SolarCloud monitoring portal.

## 4.21 Installation of the WiFi

1. Remove the protective cap from the USB interface.
2. Install the WiFi stick.
3. Tighten the connecting nut.

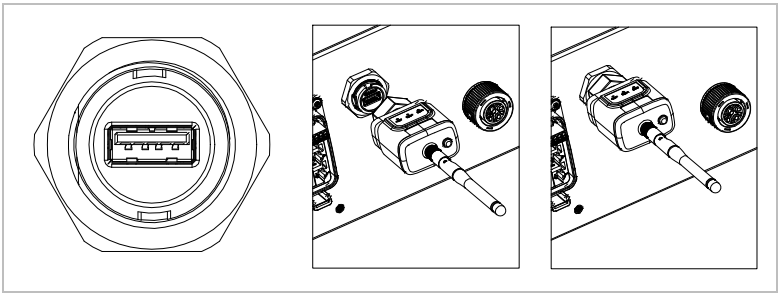


Figure 4-41 WiFi connection

### 4.21.1 Configuration of the WiFi stick via the web browser

**Preparation:** The WiFi stick is installed in accordance with the previous section and the SOFAR inverter must be in operation.

- WiFi network need to support 2.4 GHz mode. WiFi stick logger doesn't support 5 GHz network!
- The stick loggers are using outgoing TCP port 10000. In case your router has limited the ports please open it for the stick logger.

Carry out the following steps in order to configure the WiFi stick:

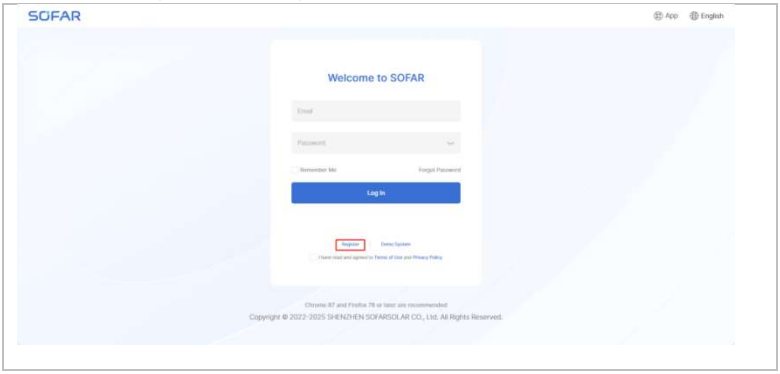
1. Connect your PC or smartphone with the WiFi network of the WiFi stick. The name of this WiFi network is "AP", followed by the serial number of the WiFi stick (see rating plate). When you are prompted for a password, you can find it on the label of the WiFi stick (PWD).
2. Open an Internet browser and enter the address **10.10.100.254**.
3. Enter the username and password, which are both set to **"admin"** by default. The "Status" page will be opened.
4. Click on the "Wizard" in order to configure the WiFi stick for Internet access.

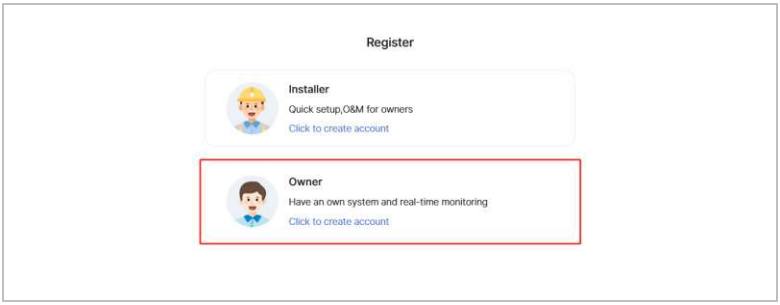
Result: The WiFi stick begins to send data to SofarCloud.

If you has never registered an account in the management system, you can register it through the Installer Registration function. Registering the first installer user also enrolls a company.

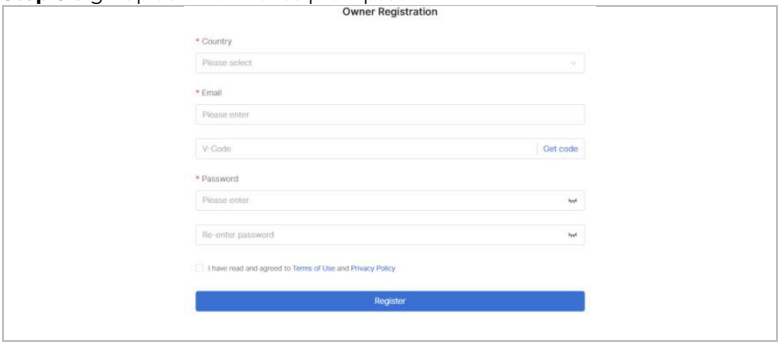
**Step 1** Open a web browser, enter https://eu.sofarcloud.com in the address box, and press **Enter**. The login page is displayed.

**Step 2** Click **Register**. The **Registration** page is displayed.




**Step 3** Sign up as an owner as prompted.



### 4.21.2 Setting up the WiFi stick with the app

To download the app, search for "SofarCloud" in the Apple or Google Play store, or use the following QR codes:

- **SofarCloud** (for end customers):

Scan the QR code on the inverter through the App or connect the inverter with Bluetooth to set the inverter data.

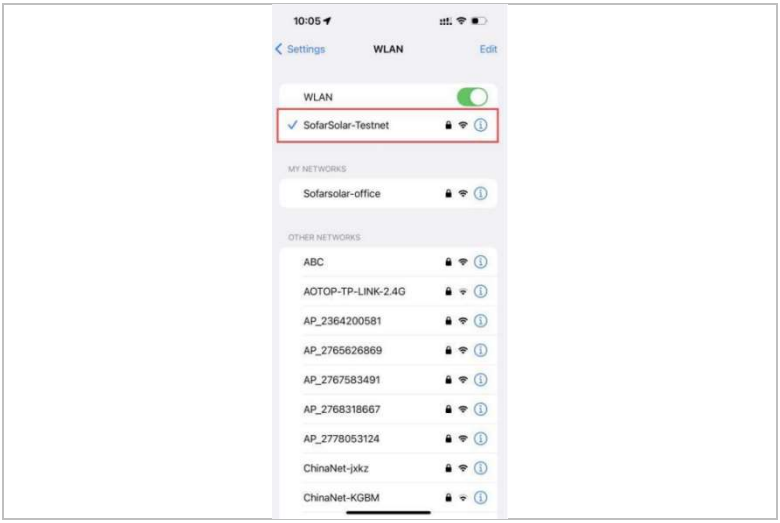
- If Bluetooth connection fails many times, please contact us.
- For additional App permissions like Firmware Upgrade or safety settings, please contact the local SOFAR service.

**Configuration steps**

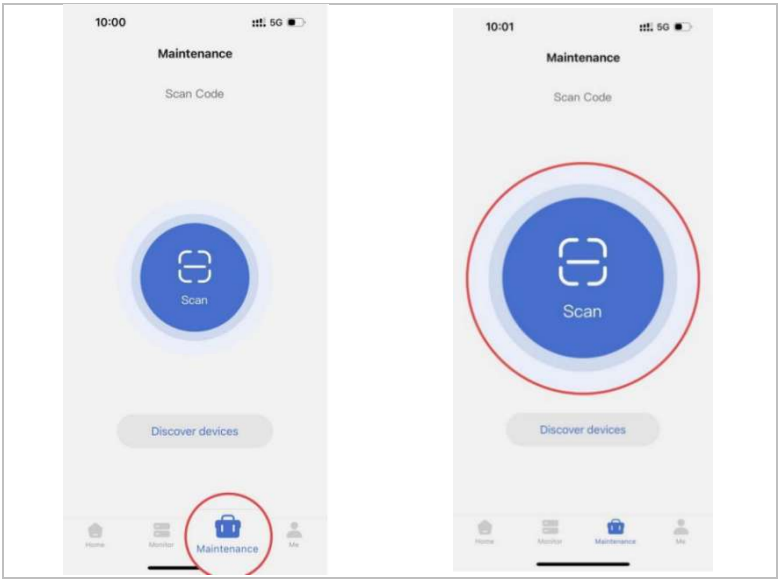
1. After starting the app, register as a new user or enter the current SofarCloud access data.
2. Create a new system and save the system data.
3. Scan the barcode of the stick logger to assign an inverter to the system.
4. Go to the newly created system in order to configure the stick logger (device/logger)
5. Press the button on the WiFi stick for 1 second to activate the WPS mode of the stick so that the smartphone can be connected to the WiFi stick.
6. Now, select your local WiFi network for Internet access and enter your WiFi password.
7. The WiFi stick is configured with the access data.

**WiFi Logger Configuration Network**

**Step 1** The phone connects to the wifi, but it should be noted that the wifi needs to be the same as the wifi that the logger is connected to.



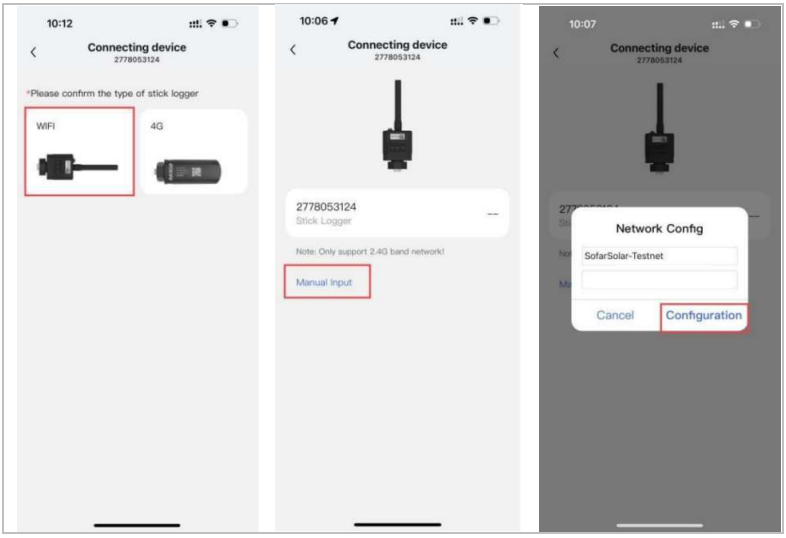

**Step 2** Open SofarCloud, go to “maintenance” and click “Scan”



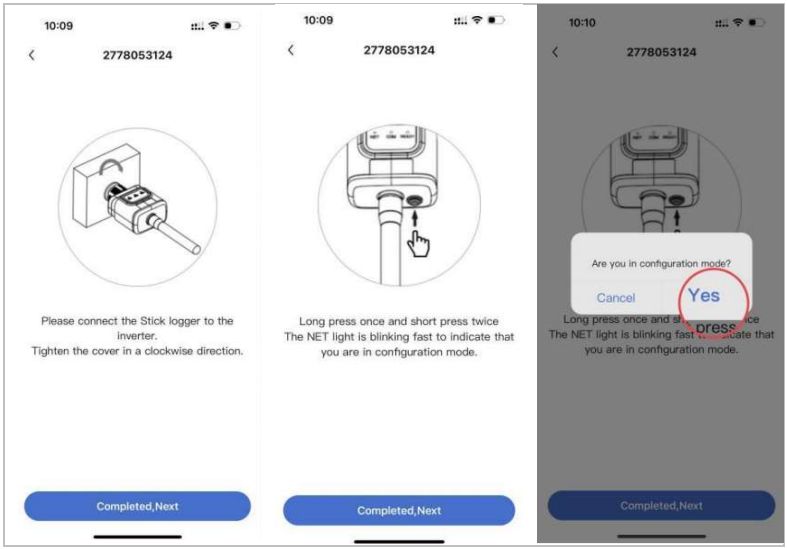
**Step3** The app aligns the QR code of the logger and scans it.



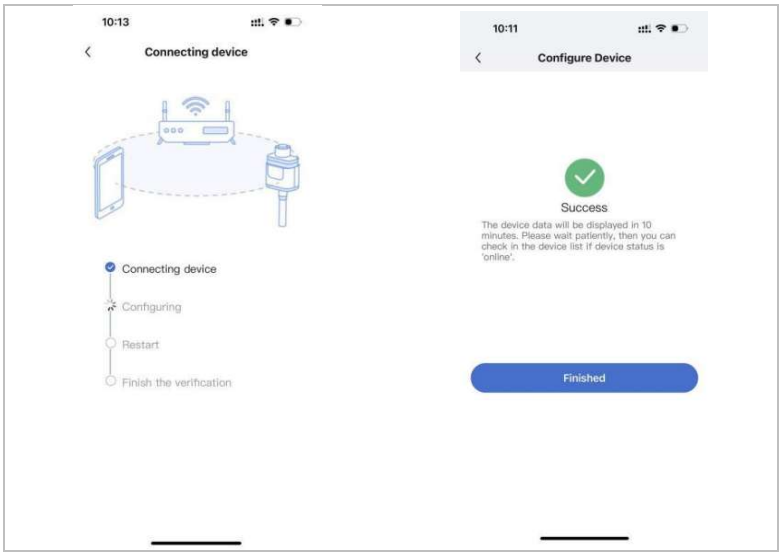

**Step 4** Select wifi logger and enter the wifi password manually.



**Step 5** Follow the instructions on the app step by step.




**Step 6** Waiting for the app to connect to the capture stick.After successful configuration, wait for about 5min for SofarCloud to have data reported.



**WiFi stick status**

The LEDs on the WiFi stick provide information regarding the status:

| LED | Status | Description |
|---|---|---|
| NET | Communication with the router | On: Connection to server successful |
| | | Flashing (1 sec.): Connection to router successful |
| | | Flashing (0.1 sec.): WPS mode active |
| | | Off: No connection to router |
| COM | Communication with inverter | Flashing (1 sec.): Communication with inverter |
| | | On: Logger connected to inverter |
| | | Off: No connection to inverter |
| READY | Logger status | Flashing (1 sec.): Normal status |
| | | Flashing (0.1 sec.): Reset running |
| | | Off: Error status |

**Reset button**

| Keystroke | Description |
|---|---|
| 1 sec. | WPS mode |
| 5 sec. | Restart |
| 10 sec. | Restart (reset) |

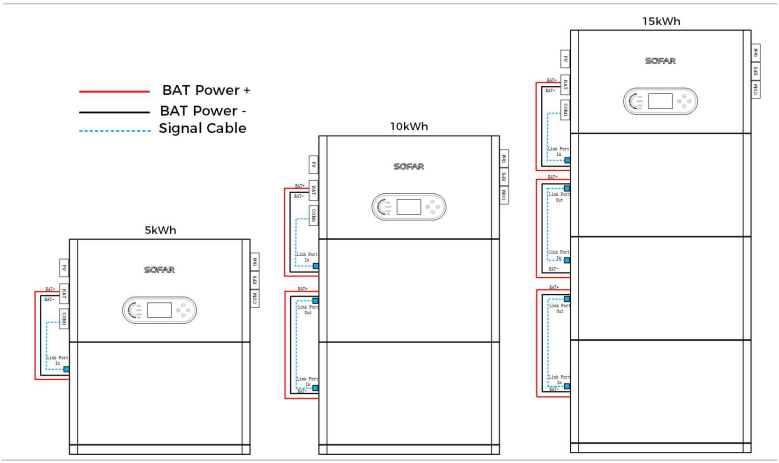
# 5 Energy storage system construction

- ESI series inverters have different control schemes when matched with different batteries, please select the corresponding battery in the inverter according to the software chapter.

## 5.1 Energy storage system with BTS 5K batteries

### 5.1.1 Configurations BTS Battery for Stacked Inverter

Stacked installation supports expansion of up to six batteries. One inverter module supports up to six batteries expansion modules. The BTS 5K battery system has a nominal capacity of 5.12 kWh and an ESI system is available in configurations from 5.12 kWh to 30.72 kWh.



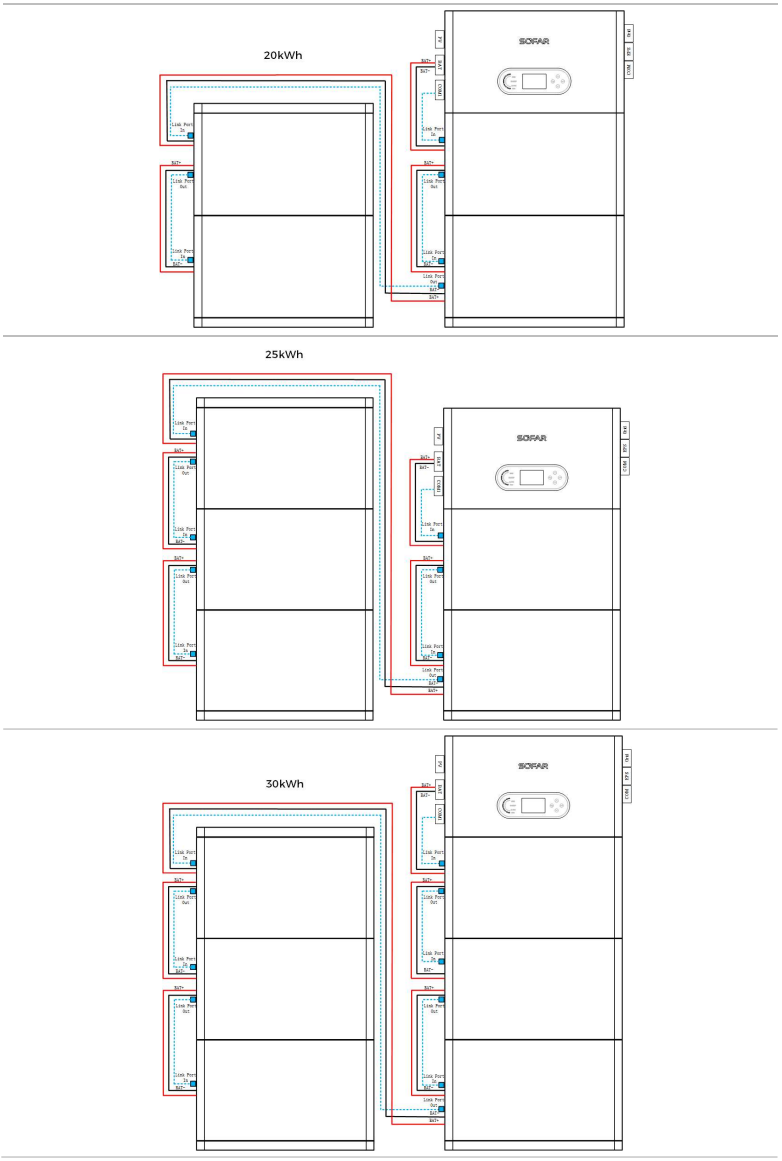



Figure 5-1 Number of battery modules and system capacity

### 5.1.2 Confirmation of mounting position

ESI series products can be stacked and installed with batteries to form a photovoltaic storage system. The location of the inverters and batteries needs to be evaluated at the beginning of the installation, as shown in the following diagram:

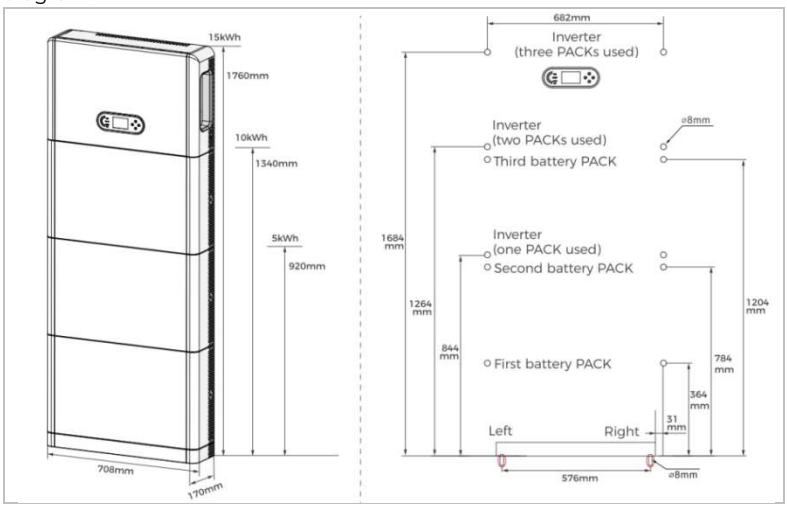



Figure 5-2 installation dimensions diagram

Stack the battery modules according to the battery installation manual and fasten the inverter according to the holes at the top.

### 5.1.3 Mounting battery base

1. Place the pedestal against a wall and keep it 10 to 25mm away from the wall. Adjust the hole positions using a level, and mark the hole positions using a marker.
2. To install the pedestal, remove the pedestal, drill holes using a hammer drill (φ 8mm, depth range 60-65 mm), and tighten expansion screws to ensure that the base is securely installed.
3. Use a marker to mark the holes for securing the battery module and inverter according to the dimensions shown in the figure below.

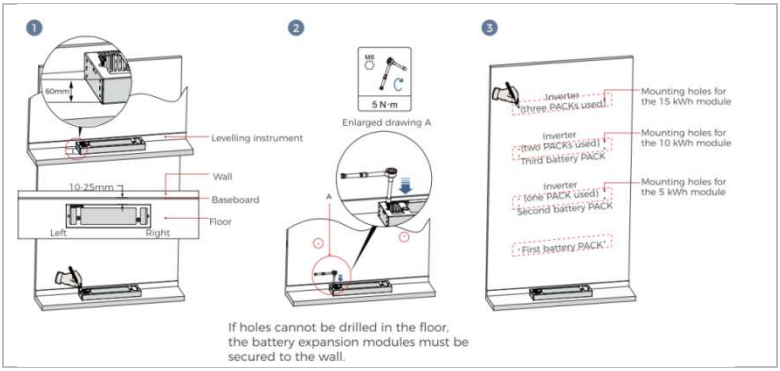



Figure 5-3 Pedestal installation

### 5.1.4 Stacked Batteries & Inverters

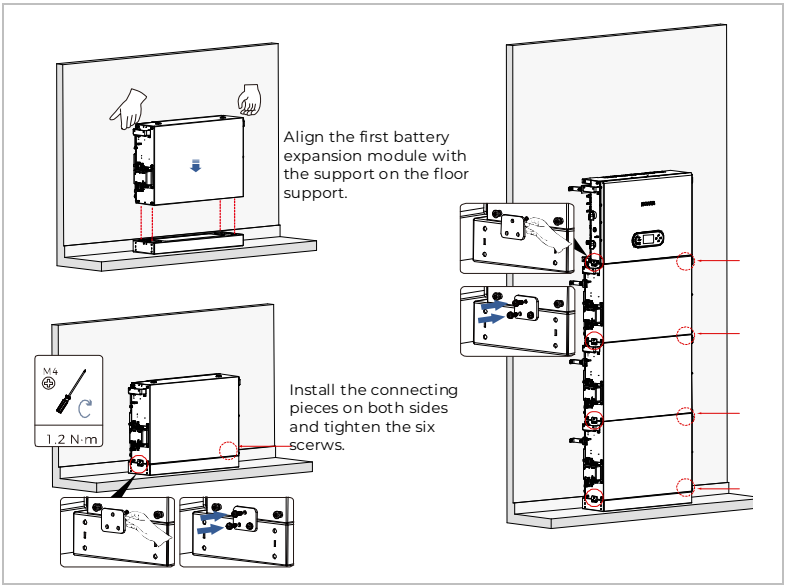



Figure 5-4 Battery module and inverter installation diagram

1. Place the first battery module on the base.
2. Install connectors on both sides and tighten the six screws with a cross screwdriver.

3. Install the remaining battery modules and BDU from bottom to top. (Before installing the next module, ensure that the screws on the side connectors of the previous module are firmly installed.)

### 5.1.5 Anti-tip bracket installation

1. Drill holes with a hammer drill (φ 8mm, depth range 60-65 mm).
2. Reposition and drill the holes, if the original one has a large deviation. Install the anti-tip bracket B on the wall, and fasten expansion bolt.
3. Adjust the anti-tip bracket A, make sure the holes are matched between anti-tip bracket A and anti-tip bracket B.
4. Connect and fix the anti-tip bracket A and anti-tip bracket B with M6*16 screws.

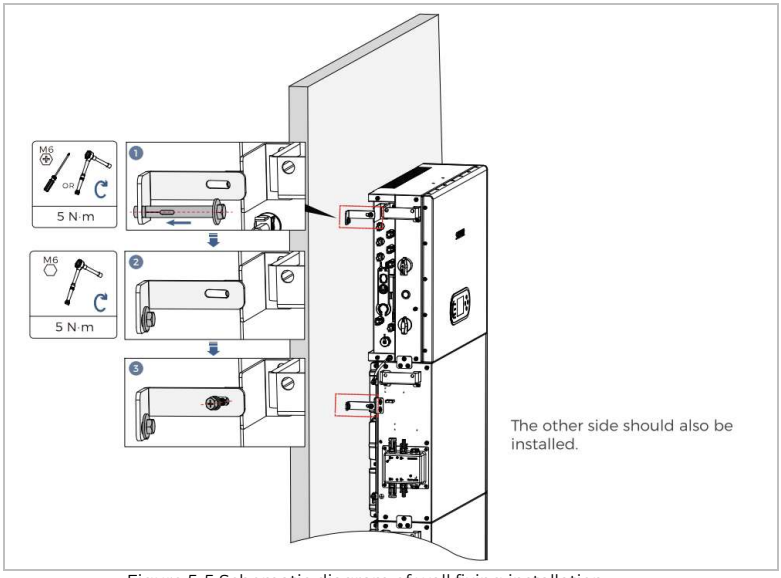



Figure 5-5 Schematic diagram of wall fixing installation

### 5.1.6 Installation of PE cable

The inverter accessory clock contains a ground wire connected to the battery.Install the crimped ring terminal and the washer with the M6 screws and tighten these with a torque of 5 N · m using an Allen key. All inverter and battery enclosures must be connected to an PE cable.

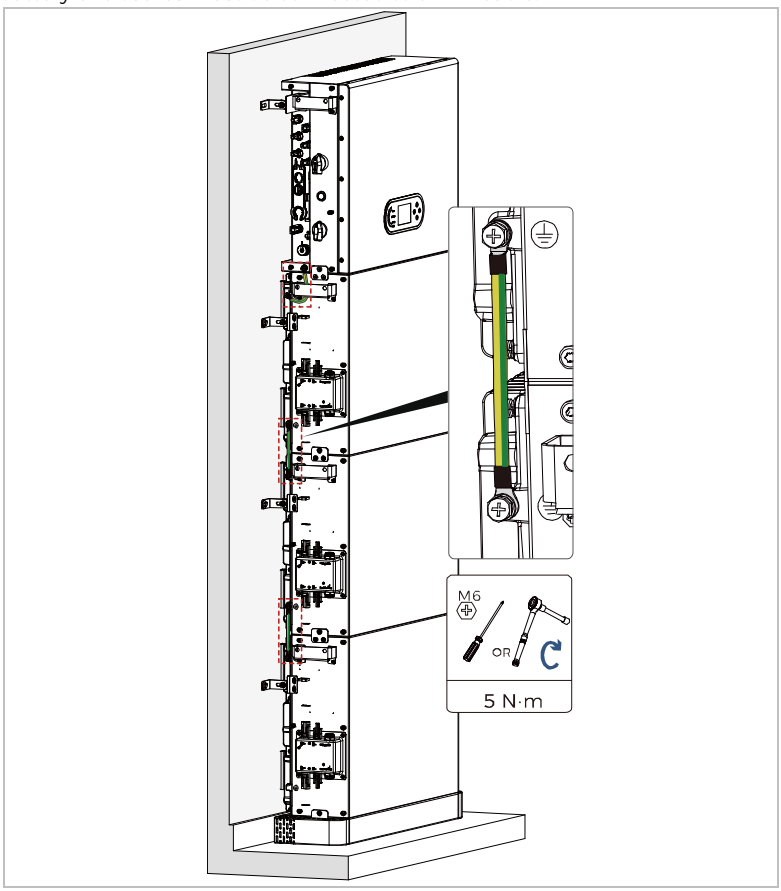



Figure 5-6 Connecting PGND cable(c)

The ground wire on the right side should be made by the installer. It is recommended.

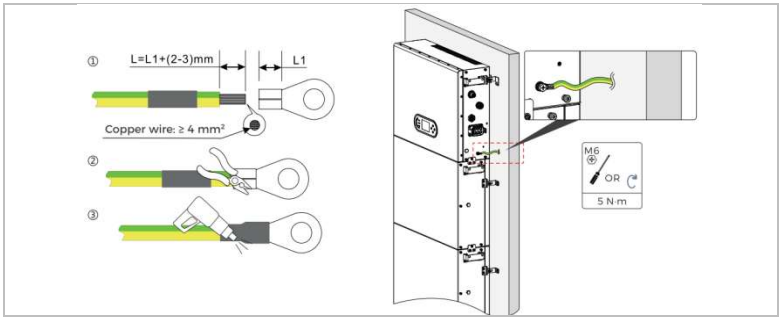



Figure 5-7 Connecting PGND cable(d)

### 5.1.7 Power cables connection

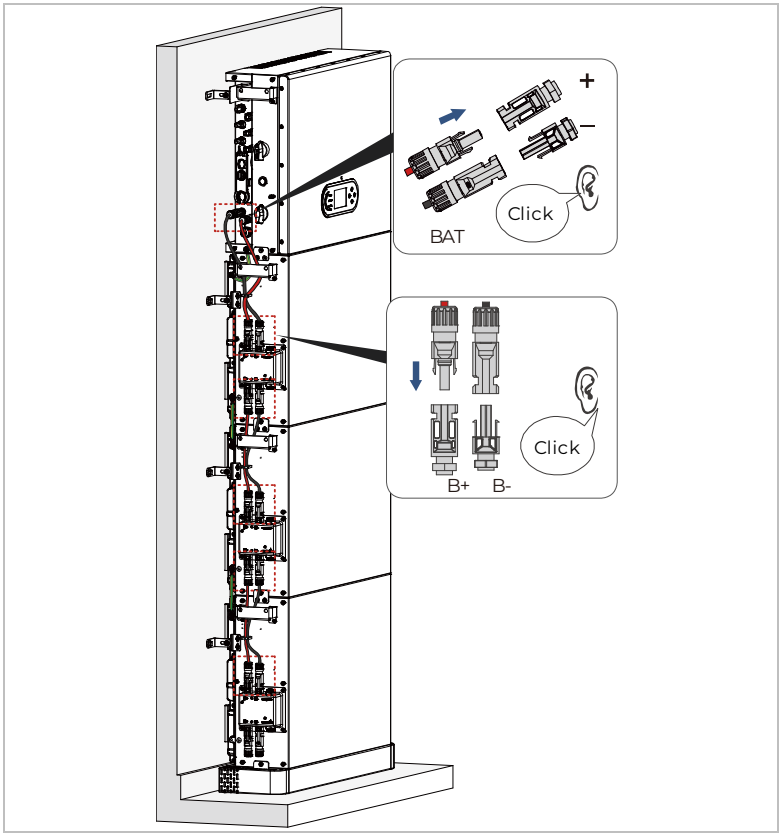



Figure 5-8 Connection of battery internal DC terminal

Connect the power ports (BAT+, BAT-) of the inverter to the cascading positive and negative power cables (B+, B-) of the battery module. Connect the remaining battery modules from top to bottom, and secure the cables with cable ties. Ensure that the cables are securely connected.

### 5.1.8 BMS communication cable connection

Connect the inverter “BAT CAN” to the battery module Link Port in. Connect the communication terminals of the inverter and the battery module from top to bottom according to the diagram below and secure them with cable ties. For the communication cables, tighten the large nut first, then the small nut. In addition, install a matching termination resistor on the communication port of the last battery module in the system.

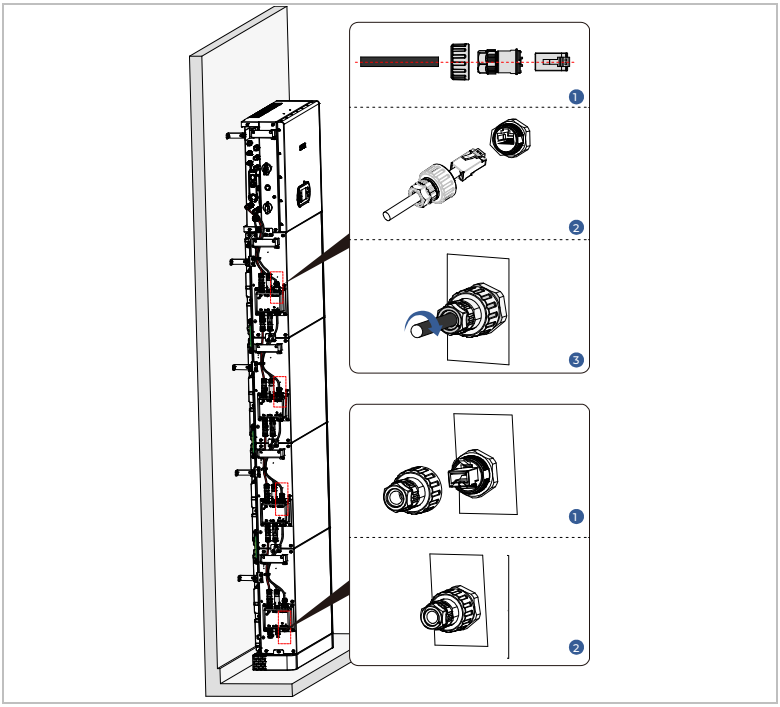


Figure 5-9 Internal signal cable connection

- The battery inputs of different inverters should not be connected in parallel.

### 5.1.9 Install the cover

After electrical connections are complete and cable connections are correct and reliable, install the external protective cover and secure it using screws.

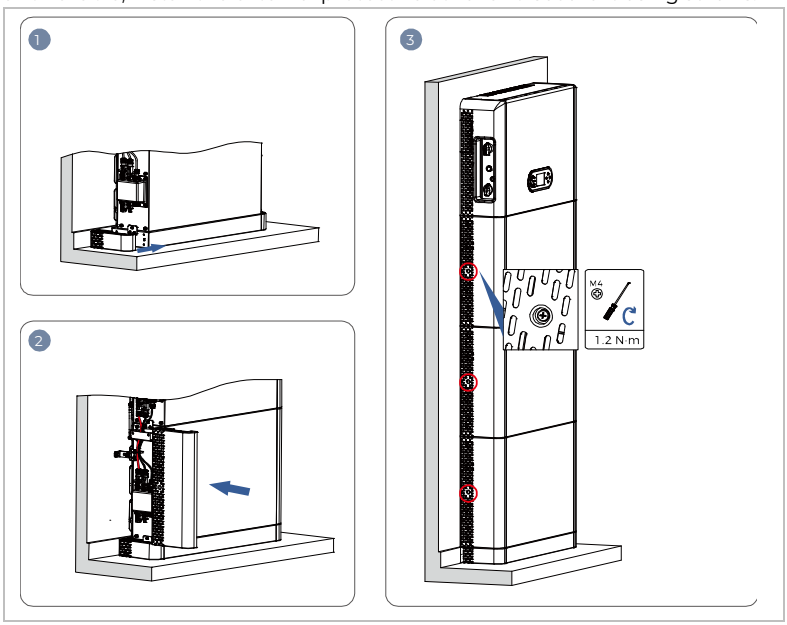



Figure 5-10 Install the cover

# 6 Commissioning the inverter

## 6.1 Safety test before commissioning

| NOTICE |
| --- |
| **Check the voltage range**<br>▸ Ensure that the DC and AC voltages are within the permissible range of the inverter. |

## 6.2 Double Check

Please ensure that the inverter and all the wiring are installed correctly, securely, and reliably, and that all environment requirements are met.

1. Inverter is firmly fastened to the wall.
2. PV+/PV- wires are firmly connected, polarity and voltage are correct.
3. BAT+/BAT- wires are firmly connected, polarity and voltage are correct.
4. DC isolator is correctly connected between battery & inverter, DC isolator: OFF.
5. GRID /BACKUP cables are firmly / correctly connected.
6. AC circuit breaker is correctly connected between inverter GRID port & GRID, circuit breaker: OFF.
7. AC circuit breaker is correctly connected between inverter BACKUP port & critical load, circuit breaker: OFF.
8. For lithium battery, please ensure that the communication cable has been correctly connected.

## 6.3 Starting the inverter

Please follow below steps to switch the inverter ON.

1. Make sure there's no power generation in inverter from grid.
2. Turn ON DC switch.
3. Turn ON DC isolator between battery & inverter. Switch ON the battery.
4. Turn ON AC circuit breaker between the inverter GRID port & GRID.

5. Turn ON AC circuit breaker between the inverter BACKUP port & critical load.
6. Inverter should start to operate now.

## 6.4 Initial setup

You need to set the following parameters before inverter starts to operate.

| Parameter | Note |
|---|---|
| **1.** Language setting | The default is English |
| **2.** System time setting | If you are connected to the server or using the App, the time is set to the local time automatically |
| **3.** Safety parameter import | Refer to the country code table below and select country and code. |
| **4.** Application scenario setting | According to the user application scenario configuration, set the parameters of PV port, BAT port, GRID port and BACKUP port |
| **5.** Work mode setting | Set different working modes, and configure parameters for different working modes (Self-use, Feed-in Priority, Peak Shaving, Time-of-use, Passive), and set battery energy storage parameters (Charge Cut-off SOC, On-grid Discharge Cut-off SOC,Off-grid Discharge Cut-off SOC,Off-grid Discharge Recovery SOC). |

The default operating mode is the Self-use Mode.

### 6.4.1 Configuring the battery setup

The ESI-5...12K-T1 models have one battery input (max. current 25 A).

### 6.4.2 Configuring Parallel Inverter System

To increase the system's BACKUP and grid power, the ESI-5...12K-T1 can be parallelly connected at the Grid port and the BACKUP port.

For the communication setup, please follow the following steps:

1. Set the Master unit

2. Set the Slave units

- Each inverter must have a unique parallel address

**Setting the country code**

- Different distribution network operators in various countries have differing requirements for the grid connection of grid-coupled PV inverters.
- Ensure that you have selected the correct country code according to regional authority requirements, and consult a qualified electrician or employees of electrical safety authorities.
- SOFAR is not responsible for the consequences of selecting the incorrect country code.
- The selected country code influences the device grid monitoring. The inverter continuously checks the set limits and, if required, disconnects the device from the grid.

# 7 Operation of the device

This chapter describes the LCD and LED displays of the ESI-5...12K-T1 inverter.

## 7.1 Control panel and display field

### 7.1.1 Buttons and display lights




**Buttons**

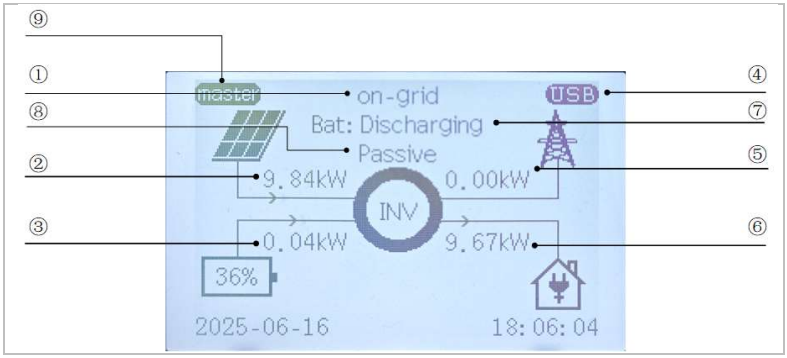
| Button | Name | Description |
|---|---|---|
|  | Back | Previous screen, enter menu |
|  | Up | Select previous menu item, increase setting value |
|  | Down | Select next menu item, decrease setting value |
|  | Enter | Enter Menu item, select next digit, confirm setting |

**LEDs**

| State | Colour | State |
|---|---|---|
| On-grid | Green | Normal |
| | Green (flashing) | Standby |
| Off-grid | Green | Normal |
| | Green (flashing) | Standby |
| Alarm | Red | Error |

## 7.2 Standard display

The screen shows all relevant information of the inverter:




| | |
|---|---|
| **① Current state of the inverter** | Used to display the current working status of the inverter, including grid-connected, off-grid and standby. |
| **② PV Power** | For displaying photovoltaic power. |
| **③ Battery Power** | For displaying BAT charge or discharge power. No battery marking here if no battery is connected |
| **④ Accessory** |  This is used to display the accessories currently connected to the inverter, including the capture stick, USB, and smart meter. |
| **⑤ Grid Power** | Power flowing into or out of the grid |

| | | |
|---|---|---|
| **⑥ Home Consumption** | Energy consumed by household loads | |
| **⑦ PV channel enable state** | Used to display the current number of PV input channels open | |
| **⑧ Work Mode** | Displays the current operating mode of the inverter, the specific operating mode is described in 7.3 | |
| **⑨ Master-slave state** | master | Used to connect multiple inverters in parallel, indicating whether the current inverter is in the master or slave position. |
| | slave | |

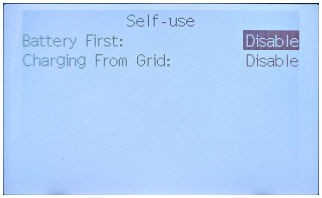
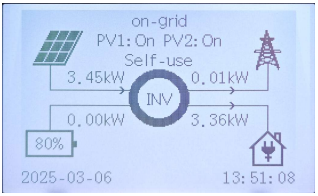
## 7.3 Work modes

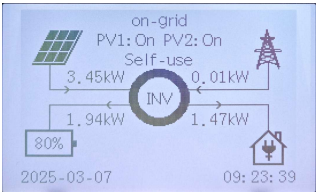
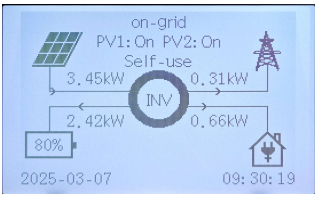
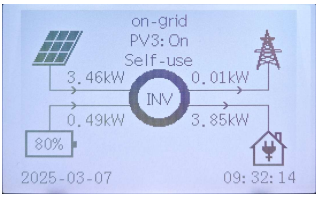
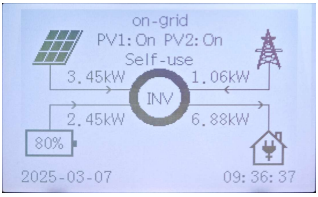
The ESI-5...12K-T1 comes with several integrated energy management modes.

### 7.3.1 Self-use Mode

In the Self-use mode, the inverter will automatically charge and discharge the battery according to the following rules:

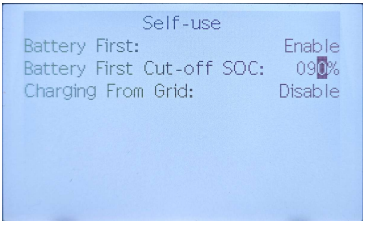
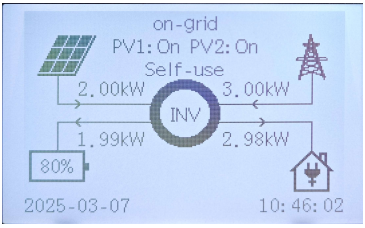
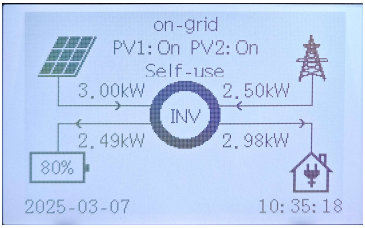
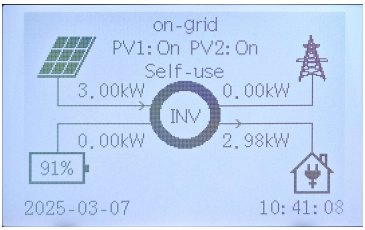
**Setting Method 1:** Battery First: Disabled; Charging From Grid: Disabled The priority of power supply: PV, Battery, Grid. The priority of power consumption: Loads, Battery, Grid.

| | |
|---|---|
|  | **Set Self-use Mode 1** |
|  | If PV generation equals the load consumption (ΔP < 100 W), the inverter won't charge or discharge the battery |

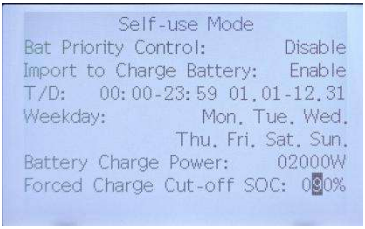
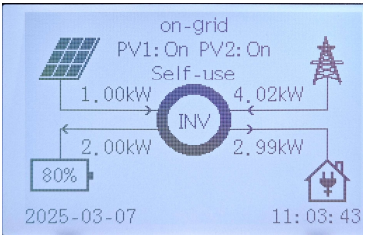
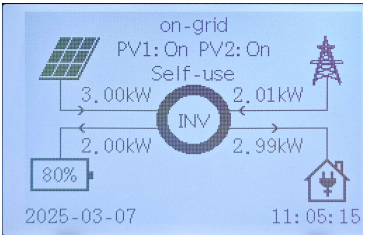
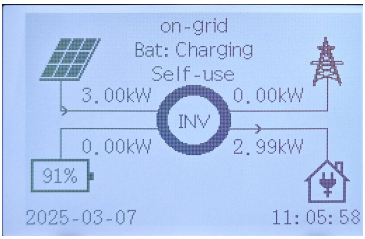
| | |
|---|---|
|  | If PV generation is larger than the load consumption, the surplus power is stored in the battery |
|  | If the battery is full or at maximum charging power, the excess power will be exported to the grid |
|  | If the PV generation is less than the load consumption, it will discharge the battery to supply power to the load. |
|  | If PV generation plus Battery discharge power is less than the load, the inverter will import power from the grid. |

- If it is not allowed to export power to the grid, an energy meter and/or CT needs to be installed, and the "feed-in limitation" function needs to be enabled.

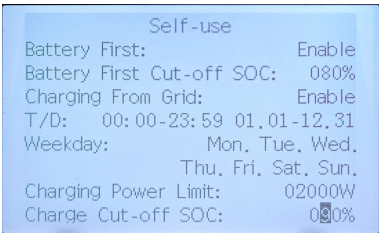
**Setting Method 2:** Battery First : Enabled, Battery First Cut-off SOC : 90%; Charging From Grid: Disabled. The priority of power supply: PV, Battery, Grid. The priority of power consumption: Loads, Battery, Grid.

| | |
|---|---|
|  | **Set Self-use Mode 2** |
|  | If the PV power is less than or equal to the battery charging power and the battery SOC is less than 90%, the inverter prioritizes charging the battery and the grid supplies power to the household loads. |
|  | If the PV generation power is greater than the battery charging power and the battery SOC is less than 90%, the inverter prioritizes charging the batteries, and the remaining energy generated by the PV power is used with the grid to power the household loads. |
|  | If the batteries continue to charge and and the battery SOC reaches 90%, the inverter stops charging the batteries and all of the energy generated by the PV power is supplied to the household loads. |

**Setting Method 3:** Bat Priority Control : Disabled; Import to Charge Battery : Enabled. When the inlet battery charging enable is turned on, the user can set the amount of specific charging time range, the maximum battery charging power, and the maximum cut-off SOC for forced charging through the LCD.

| | |
|---|---|
|  | **Setting Method 3** |
|  | If the PV power is less than the battery charging power and the battery SOC is less than 90%, the inverter gives priority to charging the battery while taking power from the grid to charge the battery, and the load power is provided by the grid. |
|  | If the PV generation power is greater than the battery charging power and the battery SOC is less than 90%, the inverter prioritizes charging the batteries, and the remaining energy generated by the PV power is used with the grid to power the household loads. |
|  | If the batteries continue to charge and the battery SOC reaches 90%, the inverter stops charging the batteries and all of the energy generated by the PV power is supplied to the household loads. |

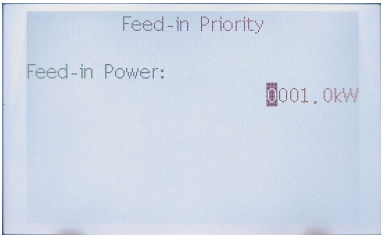
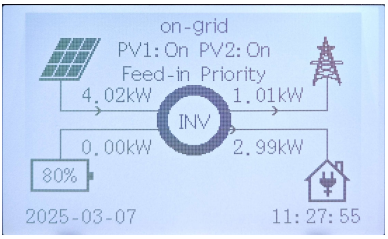
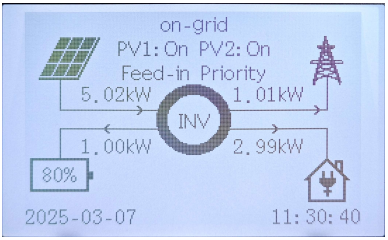
**Setting Method 4:** Battery First : Enabled; Charging From Grid : Enabled. In this mode, the Battery First and Battery First Cut-off SOC functions are in effect at the same time, see Setting Method2, 3 for details.




**Setting Method 4**

### 7.3.2 Feed-in Priority Mode

With the Feed-in Priority Mode, In this mode, the user can set the maximum feeder power, which is used to generate the remaining energy after the PV power meets the load consumption.

| | |
|---|---|
|  | **Feed-in Priority Mode** |
|  | In this mode, the user can set the maximum feeder power, when the PV power minus the load consumption power is less than or equal to the feeder power (for example, 1KW), the excess energy generated by the PV power generation is delivered to the grid. |
|  | In this mode, the user can set the maximum feeder power, when the PV power minus the load consumption power is greater than the feeder power (for example, 1KW), the extra energy will be used to charge the battery. |

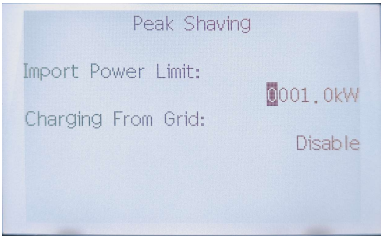
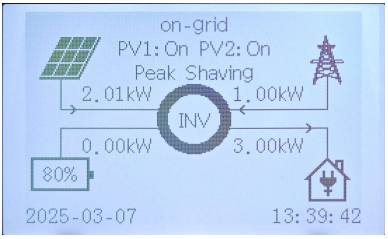
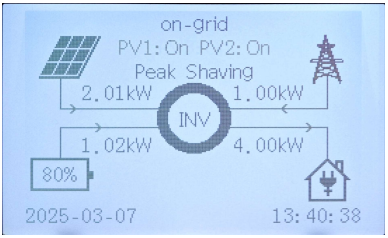
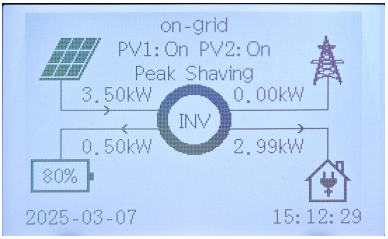
### 7.3.3 Peak Shaving Mode

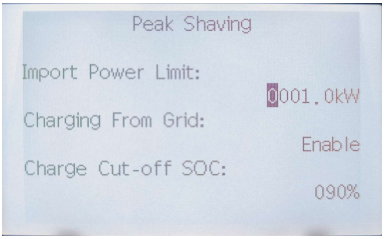
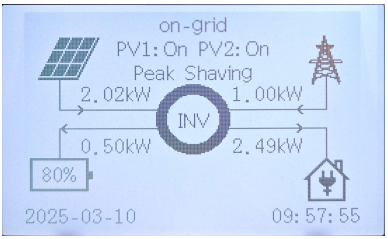
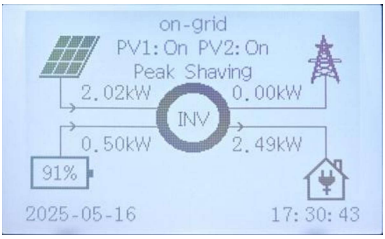
Used to limit the maximum power priority purchased from the grid. The maximum purchasing power can be set in this mode. When the system preferentially buys more power from the grid than the set value, the battery starts discharging and stabilizes the system power at the set value.

**Application:**

Peak Shaving Mode allows the grid to supply power to the load first. Applicable to the occasions where electricity price is charged according to electricity

consumption and the occasions where the power grid is weak. In the weak grid situation, batteries start only when the load power exceeds a certain value, which reduces the maximum power of the connecting point and prolongs the battery life.

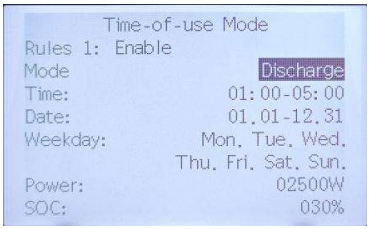
| | |
|---|---|
|  | Charging From Grid：Disable |
|  | When the PV power is not enough to supply the load consumption, the grid starts to supply power to the load, and the maximum power taken from the grid does not exceed the Priority Import Power. |
|  | When the PV power and Priority Import Power are also insufficient to supply the load consumption, the battery starts discharging to supply the load consumption at the same time. |
|  | When the photovoltaic power generation is greater than the load consumption, the excess energy to charge the battery, when the battery SOC is greater than the set value, the excess energy flows to the power grid. |

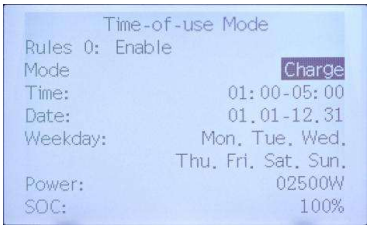
| | |
|---|---|
|  | Charging From Grid：Enable |
|  | When “Charging From Grid” is enabled and there is not enough PV power to supply the load and the load consumes less than the Import Power Limit, the grid starts to supply power, which is less than then Import Power Limit setting. |
|  | When the battery SOC is greater than the set value, the battery and the PV supply power to the load at the same time. |

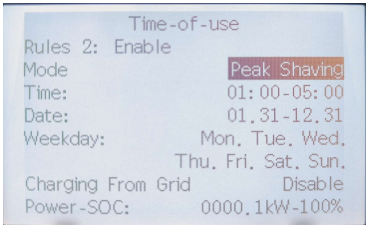
### 7.3.4 Time-of-use Mode

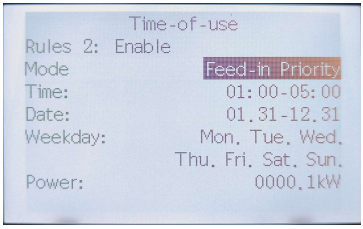
Under the Time-of-use Mode, the work modes that can be selected in the rule entries include: Charge, Discharge, Self-use, Feed-in Priority, Peak Shaving.

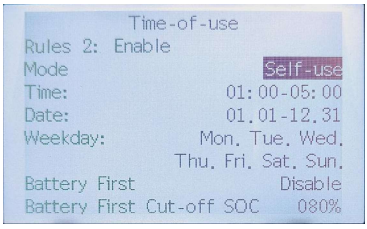
With the Discharge or Charge Mode, you can define fixed times of the day to charge or discharge the battery with a certain power. For details on how to use the other modes, please refer to the corresponding mode descriptions in sections 7.3.1 - 7.34.



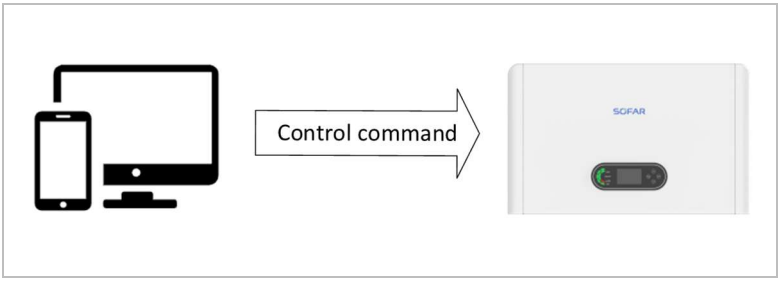




In the above Discharge/Charge example, Rule 0: the battery will be charged with 2.5 kW between 1 and 5 o'clock at night, and Rule1: discharged with 2.5 kW between 1 and 5 o'clock. In case of conflict between Rule 0 and Rule 1, Rule 0 takes precedence.

### 7.3.5 Passive Mode

The passive mode is used in systems with external energy management systems. The inverter's operation will be controlled by the external controller using the Modbus RTU protocol. Please contact SOFAR if you need the Modbus protocol definition for this device.

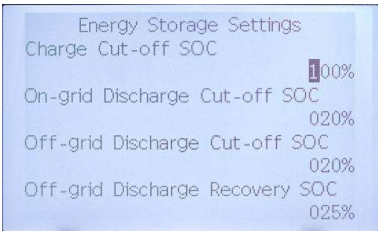






### 7.3.6 Energy Storage Settings

In this interface the user can set four battery charging and discharging states, Charge Limit SOC, On-grid Discharge Limit SOC, Off-grid Discharge Limit SOC, Off-grid Recovery Discharge SOC.




## 7.4 Menu structure

Press the button to bring up the main menu.

### 7.4.1 Main menu

| |
|---|
| **System Information** |
| **Real-time Information** |
| **Event List** |
| **Energy Statistic** |
| **System Settings** |
| **Advanced Settings** |
| **Firmware Upgrade** |

- The menu layout may vary according to different firmware versions.

### 7.4.2 “System Information” menu

| | |
|---|---|
| **1.Inverter** | |
| Inverter(1) | Serial Number, Rated Power, Firmware Version, Grid Code |
| Inverter(2) | Bat Channel, PV Channel 1, PV Channel 2, PV Channel 3 |
| Inverter(3) | Work Mode, RS485 Address, BACKUP, IV Curve Scan |
| Inverter(4) | Logic Interface, Power Factor, Feed-in Limit, Insulation Resistance |
| Inverter(5) | Parallel, Automatic Battery Active, Unbalanced Support |
| Inverter(6) | Safety Parameter |
| **2.Battery** | |
| Battery (1) | Battery Type, Max Charge Current, Max Discharge Current |
| Battery (2) | Charge Limit SOC, On-grid Discharge Limit SOC, Off-grid Discharge Limit SOC, Off-grid Recovery Discharge SOC |
| Battery (3) | Serial Number |
| Battery (4) | Firmware Version |

### 7.4.3 "Real-time Information" menu

| | |
|---|---|
| **1.PV** | |
| 1.1 PV(1) | PV1 Voltage, PV1 Current, PV1 Power, PV2 Voltage, PV2 Current, PV2 Power |
| 1.2 PV(2) | PV3 Voltage, PV3 Current, PV3 Power, External PV Power |
| **2.BAT** | |
| 2.1BAT Port Info | Voltage, Current, Power, SOC, State |
| 2.2BAT real info | Voltage, Current, Power, SOC, Max Charge Current, Max Discharge Current, Max Cell Temp, Min Cell Temp |
| **3.GRID** | Voltage R, Voltage S, Voltage T, Power R, Power S, Power T, Frequency |
| **4.BACKUP** | Voltage R, Voltage S, Voltage T, Power R, Power S, Power T, Frequency |
| **5.Normal Load** | Power |
| **6.Total Load** | Power |
| **7.Wallbox** | |
| 7.1Wallbox(1) | Communication, State, Power, Total Energy, Fault Code |
| 7.2 Wallbox(2) | Voltage R, Voltage S, Voltage T, Current R, Current S, Current T |

### 7.4.4 "Event List" menu

The event list is used to display the real time event recordings, including the total number of events and each specific ID no. and event time. The most recent events are listed at the top.

| **Event list** | |
|---|---|
| **1、Current Event List** | Show latest event |
| **2、History Event List** | Show event history |
| **Fault information** | 001 ID04 06150825<br>(display of the event sequence number, event ID number and time |

| | |
|---|---|
| | that the event takes place. Press"<Enter>"to toggle between event name and trigger time.) |

### 7.4.5 "Energy Statistics" menu

In this menu, you can view the PV, battery, load, and grid energy usage status of different channels in real time and different years, months and days.

| | |
|---|---|
| Today | Press Down button to move between items<br>Shows PV, Load, Export, Import, Charge, Discharge Energy (kWh) for the selected period |
| Month | |
| Year | |
| Lifetime | |

### 7.4.6 "System Settings" menu

In this menu you can do the basic settings which are needed to operate the device.

| | |
|---|---|
| **1.Language** | **Sets the display language** |
| **2.Date & Time** | Sets the date and time of the inverter |
| **3.Grid Code** | Sets the country and grid code |
| **4.Device Port Management** | Sets the parameters about PV port, BAT port, GRID port, BACKUP port. |
| **4.1 PV** | Set PV port. |
| **4.1.1 PV1** | Set PV input: Select 'PV' for photovoltaic scenarios, otherwise set to disabled. |
| **4.1.2 PV2** | |
| **4.1.3 PV3** | |
| **4.2 BAT** | Set battery port: Select 'BTS 5K' for battery operation scenarios, otherwise set to disabled. |
| **4.3 GRID** | Set grid port mode to grid connection or generator connection |
| **4.3.1 GRID** | Set grid port mode to grid-connected. |
| **4.3.2 GEN** | Set grid port mode to generator. |
| **4.3.2.1 Manual** | Set the generator to manual mode, then configure its rated power. |
| **4.3.2.1 Auto** | Set generator to auto mode with start/stop SOC and rated power. |

| | |
|---|---|
| **4.4 BACKUP** | Enable / disable the off-grid mode. It is only available if a battery is connected |
| **5.Work Mode** | Sets the work mode and energy storage setting |
| **5.1 Work Mode** | Select between Self-use(Standard), Feed-in Priority, Peak Shaving, Time-of-use, Passive. See "7.3 Work Modes" chapter for details. |
| **5.2 Energy Storage Settings** | Sets Charge Limit SOC, On-grid Discharge Limit SOC, Off-grid Discharge Limit SOC, Off-grid Recovery Discharge SOC. |
| **6.Auto test** | Selection of Italian rapid and standardized tests for functional verification. |
| **7.RS485 Communication** | Enter the Modbus address (when several inverters require simultaneous monitoring), standard: 01<br>Baud Rate: The default baud rate is 9600 |
| **8.Wallbox** | Setting up the different operating modes of the Wallbox. |
| **8.1 Charge Now** | Sets Wallbox Control, Charging Current, Charging From Battery. |
| **8.2 Scheduled** | Sets different rules, Charing Start Time, Charing End Time, Charging Current, Charging From Battery. |
| **8.3 ECO Mode** | Sets Charging From Battery. |

### 7.4.7 “Advanced Settings” menu

**Password**

- Several settings require a password to be entered (the standard password is 0715/0001).

In this menu you can do advanced settings.

| | |
|---|---|
| **1.Battery** | |
| **1.1 30 Days SOC Calibration** | Enable / Disable.<br>When the BTS-5K battery is connected, if "SOC Calibration" is enabled, the inverter will forcibly charge until it is fully charged once a month. |
| **1.2 Battery Active** | Sets Auto Active Control and Force Active. (Only available for BTS battery type.) |
| **1.2.1 Auto Active** | Enable / Disable.<br>If Automatic activation is enabled, the inverter will activate the battery when the inverter need to discharge or charge the battery according to the operational mode settings.<br>If automatic activation is disabled, battery activation can be performed once via ‘Once Manual Active’. |
| **1.2.2 Once Manual Active** | Select ‘Once Manual Active’ for a one-time battery activation. |
| **2.Feed-in Limit Control** | Activates or deactivates the feed-in power function of the inverter and sets the maximum feed-in power. This function must be used together with an external current transformer or the smart meter. Details regarding this can be found in the “Communications interfaces” chapter of this manual. |
| **2.1Feed-in Limitation Mode** | Disable: Do not use this function<br>Three phase Sum limit: the sum of all phases is regulated (balancing counting as is common in Germany).<br>Feed-in Limitation: the power of the feeding-in phases is limited. |
| **2.2Feed-in Limit Power** | Set the power size of the inverter flowing to the grid, when detecting a |

| | |
|---|---|
| | current flowing to the grid (reverse current), reduce the output power of the inverter, so that the power flowing from the inverter to the grid is always connected to a state smaller than the set value, so as to realize the anti-reverse current and not to send the excess power to the grid. |
| **2.3 Hard Limit Control** | This feature is required by Australian safety standards. |
| **3.IV Curve Scan** | (Only set with PV channel.)<br>Cyclical scanning of the IV curve in order to find the global point of the maximum output. Advisable in the case of shaded solar generators |
| **3.1 Scan Control** | Enable / disable IV curve scan function |
| **3.2 Scan Period** | Set scan period in minutes |
| **3.3 Once Manual Scan** | Manually start IV curve scanning |
| **4.Logic interface** | Activates or deactivates logical interfaces. Details regarding this can be found in the "Communications interfaces" chapter of this manual |
| **5.Restore Factory Settings** | Resets stored data in the inverter |
| **5.1 Clear energy Data** | Clears total power production |
| **5.2 Clear Events** | Clears historical events |
| **5.3 Reset Settings** | Restore parameters to factory default settings. |
| **6.Parallel setting** | Defines configuration for parallel inverter operation (Master/Slave) |
| **6.1 Parallel Control** | For inverters connected with Link port to each other, you set Parallel Control to "Enable" |
| **6.2 Master-Slave** | One Inverter need to be set as Master, all other inverters need to be set to Slave. |
| **6.3 Parallel Address** | Set each inverter with an individual parallel address. (It is an independent number from Modbus ID) |
| **7.Switch On / Off** | The inverter can be switched on, switched off, set to standby or set to normal operating mode, which can be useful for installation or maintenance work |

| | |
|---|---|
| **8.Unbalanced Support** | Default setting: disabled<br>In situations where the customer only wants to support the local loads or has a zero-export limit across all three phases. When used in conjunction with the supplied three-phase energy meter and with this option set to "enable", the per phase output current of the inverter will respond independently.<br>Important: for this function to operate properly, the phase on the energy meter must correlate to the corresponding phase when it is wired into the inverter. |
| **9.PCC Import Limit** | PCC Import Limit Control: Control whether the PCC power control function is enabled.<br>PCC Import Limit Power: Power upper limit, that is, the maximum power that can be purchased from the PCC. (When the load is greater than the maximum power purchased from the PCC, the load power priority is higher to meet the load power priority.) |
| **10.Set PCC Power Offset** | Calibration for PCC power calculation. |
| **11.BACKUP GFCI** | Activates RCD type B monitoring in off-grid mode (300 mA) |
| **12.Neutral Point Grounding** | When using off-grid mode, ensure that neutral ground is enabled. For Australia, South Africa, and New Zealand, neutral ground is turned off by default, refer to 5.3 System Overview |
| **13.E-STOP** | Enable / disable Emergency Power Off function |
| **14.SG Ready** | Timed control mode: set the start time and stop time, turn on the smart load within the start time range and turn off the smart load outside the start time range.<br>Intelligent control mode: set the start time and stop time in the start time range, generating power - ordinary load power > 500W (hysteresis loop parameter reservation can be set), after 1 minute to turn on the intelligent load; generating power - ordinary load |

| | |
|---|---|
| | power < 0W, after 5 seconds to turn off the intelligent load. |
| **15.ATS/12V Control** | (The inverter is not allowed to set for the slave machine.) |
| **15.1 Disable** | No use this function |
| **15.2 Generator Control** | Can start and stop a generator |
| **15.3 Off-grid: 12V Turn On** | In off-grid mode, the dry contact interface will output a 12V signal; otherwise, the output is disabled. |
| **15.4 Off-grid: 12V Turn Off** | In off-grid mode, the output is disabled; otherwise, the dry contact interface will output a 12V signal. |
| **16.PCC Meter/CT** | Enable / disable PCC Meter/CT function |

- The inverter has built-in relays to control the short circuit of the load N line to ground when off-grid.
- When the inverter is off-grid and the load N line and PE line are short-connected, if the power grid is restored and the load N line and PE line are still short-connected, leakage protection will be triggered and explosion hazard will not be caused.

### 7.4.8 "Firmware Upgrade" menu

The user can update the software via the USB flash drive. SOFAR will provide the firmware upgrade when it is required.

- If you want to do a firmware upgrade, please upgrade with PV input or grid status, the update will fail if only the battery is connected.

1. Insert the USB stick into the computer.
2. SOFAR will send the firmware upgrade to the user.
3. Unzip the file and copy the original file to a USB stick. Attention: The firmware upgrade file must be in the "firmware" subfolder!
4. Press the "Back" on the main interface to enter the main menu page, and select "2.Advanced Settings - Switch On/Off -Switch Off". Make the inverter shut down safely.

5. Insert the USB flash drive into the USB interface of the inverter.
6. Go to menu item "7.Firmware Upgrade" on the LCD display.
7. Enter the password (the standard password is 0715) and then select "Firmware Upgrade".
8. Enter the password (the standard password is 0715) and then select "Inverter" or "Battery".
9. The system will then sequentially update all parts. Pay attention to the displays.
10. If an error message appears, please upgrade again. If this continues many times, contact technical support for help.
11. After the update is complete, Go to menu item "Advanced Settings - Switch On/Off - Switch On" to make the inverter start up and run.
12. You can check the current firmware version in item "Inverter(1)" of the “System information” menu.

# 8 Troubleshooting handling

## 8.1 Troubleshooting

This section contains information and procedures pertaining to the remedying of potential problems with the inverter.

To carry out troubleshooting, proceed as follows:

- Check the warnings, error messages or error codes displayed on the screen of the inverter.
- If no error information is displayed on the screen, check whether the following requirements have been fulfilled:
- Has the inverter been set up in a clean, dry, well-ventilated area?
- Is the DC switch set to ON?
- Are the cables sufficiently dimensioned and short enough?
- Are the input connections, output connections and the wiring all in good condition?
- Are the configuration settings for the relevant installation correct?
- Are the display field and the communication cables correctly connected and undamaged?

Follow the steps below to view recorded problems: Press “Back” to enter the main menu in the normal interface. In the interface screen select "Event List", then press “OK” to enter events.

### 8.1.1 Shutdown procedure

If the inverter needs to be shut down for electrical inspection, please follow the following steps:

1. Press the "Back" on the main interface to enter the main menu page, and select Advanced Settings - Switch On/Off - Switch Off. Make the inverter shut down safely.
2. Disconnect the AC circuit breaker connecting the inverter power grid port to the power grid.
3. Disconnect the AC breaker connecting the inverter load port to the emergency load.

4. Disconnect the PV side DC switch.
5. Turn off the battery and disconnect the DC switch between the battery and the inverter.
6. Wait for 5 minutes before checking the inverter.

- After using the menu setting to shut down the inverter, the inverter should be checked and reenergising, it still needs to be on the main menu page. Select advanced Settings - Switch On/Off- Switch On. start up to enable the inverter to start up and run.

### 8.1.2 Earth fault alarm

This inverter is compliant with IEC 62109-2 Clause 13.9 and AS/NZS 5033 for earth fault protection.

If an earth fault alarm occurs, the error is displayed on the LCD screen, the red light illuminates and the error can be found in the error history log.

When the inverter is connected to the battery system, when the battery system has ground fault/leak alarm in accordance with AS/NZS 5139, the inverter will also alarm. The alarm method is the same as above.

- In the case of devices equipped with a stick logger, the alarm information can be viewed on the monitoring portal and retrieved via the smartphone app.

## 8.2 Error list

### 8.2.1 Inverter error list

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 001 | GridOVP | The voltage of the power grid is too high | If the alarm occurs occasionally, the possible cause is that the electric grid is abnormal occasionally. Inverter will automatically return to normal operating status when the electric grid's back to normal.<br>If the alarm occurs frequently, check whether the grid voltage/frequency is within the acceptable range. If yes, please check the AC circuit breaker and AC wiring of the inverter.<br>If the grid voltage/frequency is NOT within the acceptable range and AC wiring is correct, but the alarm occurs repeatedly, contact technical support to change the grid over-voltage, under-voltage, over-frequency, under-frequency protection points after obtaining approval from the local electrical grid operator. |
| 002 | GridUVP | The voltage of the mains is too low | |
| 003 | GridOFP | The mains frequency is too high | |
| 004 | GridUFP | The mains frequency is too low | |
| 005 | GFCI | Charge Leakage Fault | Check for inverter and wiring. |
| 008 | IslandFault | Island protection fault | If the alarm occurs occasionally, the possible cause is that the electric grid is abnormal occasionally. Inverter will automatically return to normal operating status when the electric |
| 009-010 | GridOVPInstant1/2 | Transient overvoltage of mains voltage 1/2 | |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 011 | VGridLineFault | Power grid line voltage error | grid's back to normal.<br>If the alarm occurs frequently, check whether the grid voltage/frequency is within the acceptable range. If yes, please check the AC circuit breaker and AC wiring of the inverter.<br>If the grid voltage/frequency is NOT within the acceptable range and AC wiring is correct, but the alarm occurs repeatedly, contact technical support to change the grid over-voltage, under-voltage, over-frequency, under-frequency protection points after obtaining approval from the local electrical grid operator. |
| 012 | InvVoltFault | Inverter overvoltage | Internal faults of inverter, switch OFF inverter, wait for 5 minutes, then switch ON inverter. Check whether the problem is solved.<br>If no, please contact technical support. |
| 013 | RefluxFault | Feed-in Limit function is faulty | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 032 | N-PE fault | Neutral ground fault | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 033 | SpiCommFault (DC) | SPI communication is fault (DC) | |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 034 | SpiCommFault (AC) | SPI communication is fault (AC) | Internal faults of inverter. Switch OFF inverter, wait for 5 minutes, then switch ON inverter. Check whether the problem is solved.<br>If no, please contact technical support. |
| 038 | InvSoftStartFail | Inverter failed to output | |
| 039 | ArcShutdownAlarm | Arc shutdown protection | |
| 040 | LowLightChkFail | Low light detection failed | |
| 041 | RelayFail | Relay detection failure | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 042 | IsoFault | Insulation resistance is too low | Check the insulation resistance between the photovoltaic array and ground (ground), if there is a short circuit, the fault should be repaired in time. |
| 043 | PEConnectFault | Earth fault | Check the PE conductor for function |
| 044 | InputConfigError | Incorrect input mode configuration | Check the input mode (parallel/independent mode) Settings for the inverter. If not, change the input mode. |
| 045 | CTDisconnect | CT error | Check that the wiring of the current transformer is correct. |
| 046 | ReversalConnect | The PV is connected reversedly | Check whether the PV wiring is correct. |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 047 | ParallelFault | Master does not exist or is duplicate | Check the parallel mode settings for the inverter. Check whether the wiring is correct. |
| 049 | TempErrBat | Battery temperature error | For Inner BMS battery, make sure that the battery NTC cable is properly connected. Make sure the inverter is installed where there is no direct sunlight. Please ensure that the inverter is installed in a cool/ well-ventilated place. Ensure the inverter is installed vertically and the ambient temperature is below the inverter temperature limit. |
| 050-055 | TempErrHeatSink1-6 | Temperature error heat sink 1-6 | For AC inverter, make sure that the inverter NTC cable is properly connected. Make sure the inverter is installed where there is no direct sunlight or other heat source<br>Please ensure that the inverter is installed in a cool/ well-ventilated place. Ensure the inverter is installed vertically and the ambient temperature is below the inverter temperature limit. |
| 057-058 | TempErrEnv1/2 | Temperature error ambient temperature 1/2 | |
| 059-061 | TempErrInv1-3 | Module 1-3 Temperature protection | |
| 065 | BusRmsUnbalance | Asymmetrical bus voltage RMS | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 066 | BusInstUnbalance | The transient value of the bus voltage is unbalanced | |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 067 | BusUVP | The DC bus voltage is too low during mains connection | |
| 068 | BusZVP | The DC bus voltage is too low | |
| 069 | PVOVP | The PV input voltage is too high | Check whether the PV series voltage (Voc) is higher than the maximum input voltage of the inverter. If this is the case, adjust the number of PV modules in series. After the correction, the inverter automatically returns to its normal state. |
| 070 | BatOVP | Battery overvoltage | Check whether the voltage of the battery is higher than the maximum input voltage of the inverter. If this is the case, adjust the number of battery modules in series. |
| 071 | LLCBusOVP | LLC Bus overvoltage protection | |
| 072 | SwBusRmsOVP | Inverter bus voltage RMS Software overvoltage | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again. If the error persists, contact technical support. |
| 073 | SwBusIOVP | Inverter bus voltage instantaneous Software overvoltage | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again. |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 081 | SwBatOCP | Software overcurrent protection of the battery | If the error persists, contact technical support.<br>Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 082 | DciOCP | Dci overcurrent protection | |
| 083 | SwIOCP | Instantaneous output current protection | |
| 085 | SwAcRmsOCP | Output RMS current protection | |
| 086 | SwPvOCPInstant | PV overcurrent software protection | |
| 087 | IpvUnbalance | PV flows in uneven parallelism | |
| 088 | IacUnbalance | Unbalanced output current | |
| 089 | SwPvOCP | PV software overcurrent protection | |
| 090 | IbalanceOCP | Balanced current protection | |
| 096 | EPSLoadShort Circuit | Inverter bus hardware overvoltage | |
| 098 | HwBusOVP | Inverter bus hardware overvoltage | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again. |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 100 | HwBatOCP | Battery hardware overflow | If the error persists, contact technical support. |
| 102 | HwPVOCP | PV hardware overflows | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again. If the error persists, contact technical support. |
| 103 | HwACOCP | Mains current is too high and has triggered hardware protection | |
| 105 | MeterCommFault | Communication fault with meter unit | Check whether the meter is connected correctly. |
| 110-112 | Overload1-3 | Overload protection 1-3 | Please check whether the inverter is operating under overload. |
| 113 | OverTempDerating | The inverter has throttled due to too high a temperature | Make sure that the inverter has been installed in a cool and well-ventilated place without direct sunlight. Make sure the inverter is installed vertically and the ambient temperature is below the temperature limit of the inverter. |
| 114 | FreqDerating | AC frequency is too high | Make sure that the mains frequency and voltage are within the permissible range. |
| 124 | BatDchgProhibit | The battery is low | Please check if the battery soc of the inverter is too low. |
| 125 | BatLowVoltShut | No battery protection | Please check if the battery voltage of the inverter is too low. |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 128 | BatReversalConnect | The battery is connected reversedly | Check whether the battery wiring is correct. |
| 129 | PermHwAcOCP | Mains current is too high and has caused an unrecoverable hardware fault | Internal error of the inverter. Switch off the inverter, wait 5 minutes and then switch the unit on again.<br>If the error persists, contact technical support. |
| 145 | USBFault | Device cannot read data from USB stick.The USB stick has been damaged. Or the format of the USB stick is not compatible with the device. | Switch off the inverter, wait 5 minutes and then switch the unit on again.If the error persists, contact technical support. |
| 147 | BluetoothFault | The device's Bluetooth communication has failed | Switch off the inverter, wait 5 minutes and then switch the unit on again.If the error persists, contact technical support. |
| 151 | BatPartOffline | A portion of the battery's communication is lost | Switch off the inverter, wait 5 minutes and then switch the unit on again.If the error persists, check the communication line or the connection of the battery and the inverter for errors. |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 152 | SafetyVerFault | The safety version is inconsistent with the internal safety version | Check whether safety regulations comply with local standards and import correct safety parameters. |
| 153 | SCILose(DC) | SCI communication error (DC) | Upgrade software |
| 154 | SCILose(AC) | SCI communication error (AC) | Upgrade software |
| 156 | SoftVerError | Inconsistent software versions | Download the latest firmware from the website and launch the software update. If the error persists, contact technical support. |
| 157-158 | BMS1-2CommFault | Lithium battery 1-2communication error | Make sure your battery is compatible with the inverter.<br>CAN communication is recommended.<br>Check the communication line or the connection of the battery and the inverter for errors. |
| 162 | RemoteShutdown | Remote shutdown | The inverter is shut down remotely. |
| 163 | Drms0Shutdown | DRM 0 shutdown | The inverter is running with a Drms0 shutdown. |
| 177 | BMS OVP | BMS overvoltage alarm | Internal error in the connected lithium battery. Switch off the inverter and the lithium battery, wait 5 minutes and then switch the components on again. |
| 178 | BMS UVP | BMS Undervoltage alarm | |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 179 | BMS OTP | BMS High temperature warning | If the error persists, contact technical support. |
| 180 | BMS UTP | BMS low temperature warning | |
| 181 | BMS OCP | BMS overload warning during charging and discharging | |
| 182 | BMS Short | BMS Short circuit alarm | Please contact technical support. |
| 185 | BMS CAN VerLow | Inconsistent software versions | Download the latest firmware from the website and launch the software update. If the error persists, contact technical support. |
| 186 | BatDischargeHTP | BAT High temperature warning when discharging. | Internal error in the connected lithium battery. Switch off the inverter and the lithium battery, wait 5 minutes and then switch the components on again. If the error persists, contact technical support. |
| 187 | BatDischargeLTP | BAT low temperature warning when discharging. | |
| 188 | BatChargeHTP | BAT High temperature warning when charging. | |

| ID | Code Name | Description | Solution |
|---|---|---|---|
| 189 | AFCICommLose | AFCI communication error | Please ensure proper installation of the AFCI breaker. |
| 190 | BatChargeLTP | BAT low temperature warning when charging. | Internal error in the connected lithium battery. Switch off the inverter and the lithium battery, wait 5 minutes and then switch the components on again. If the error persists, contact technical support. |
| 328 | AcStartTimeOut | BAT active failed. | Internal error in active lithium battery. Check the power line and CAN line between inverter and battery, and then try again. If the error persists, please contact technical support |
| 379 | AFCICheckError | AFCI chip self-test abnormality | Switch off the inverter, wait 5 minutes and then switch the unit on again.If the error persists, contact technical support. |
| 401 | AFCI0 | Arcing detected in AFCI channel | |

### 8.2.2 Battery error list

| ID | Name | Description | Solution |
|---|---|---|---|
| 808 | HS1HighTempWarning | Radiator 1 high temperature alarm | Check whether the number of batteries is set correctly. If the setting is correct, please contact technical support to upgrade software. |
| 809 | EnvHighTempWarning | Ambient high temperature alarm | Please make sure the battery is installed in a cool wel-ventilated place. |

| ID | Name | Description | Solution |
|---|---|---|---|
| 813 | StopChgWarning | Charging prohibition alarm | If the battery is almost fully, no action is required. Otherwise, please contact technical support. |
| 814 | StopDchgWarning | Discharging prohibition alarm | If the battery is almost empty, no action is required. Otherwise, please contact technical support. |
| 864 | HS1OverTempFault | Over temperature protection of radiator 1 | Power off and wait for 2 hours. If the problem is not solved, please contact technical support. |
| 865 | OverTempFault_Env | Over temperature protection of ambient temperature | |
| 866 | SciCommFault | Internal communication failure of battery | If this fault occurs occasionally, wait a few minutes to see whether the problem is solved. If this fault occurs frequently, please contact technical support. |
| 867 | Can1CommFault | Can1 communication failure | If this fault occurs occasionally, wait a few minutes to see whether the problem is solved. If this fault occurs frequently, please contact technical support. |
| 872 | SwBusInstantOVP | Bus software overvoltage | If this fault occurs occasionally, wait a few minutes to see whether the problem is solved. If this fault occurs frequently, please contact technical support. |
| 873 | SwBusInstantUVP | Bus software undervoltage | |
| 874 | SwBatInstantOVP | Battery software overvoltage | |
| 875 | SwBatInstantUVP | Battery software undervoltage | |
| 879 | HwOCP | Hardware overcurrent | |
| 880 | unrecoverBusAvgOV | Permanent bus overvoltage | Restart the battery and wait for minutes. If the problem is not resolved, please contact technical support. |
| 883 | unrecoverHwOCP | Permanent hardware overcurrent | |

| ID | Name | Description | Solution |
|---|---|---|---|
| 893 | unrecoverBusSCP | Permanent short-circuit protection | Restart the battery and wait for minutes. If the problem is not resolved, please contact technical support. |
| 894 | unrecoverBatActFail | Permanent battery activation failed | |
| 895 | unrecoverBusRPP | Permanent bus reverse connection | Check whether the wiring is correct and restart the battery. If the problem is not resolved, please contact technical support. |
| 899 | BMSOVOCP | BMS overvoltage and overcurrent fault | If this fault occurs occasionally, wait a few minutes to see whether the problem is solved. If this fault occurs frequently, please contact technical support. |
| 900 | SwBatAvgOCP | Battery average overcurrent protection | |
| 901 | SwAvgOverloadP | Average overload protection | |
| 902 | SwBusInstantOCP | Bus software overcurrent | |
| 903 | SwCBCOCP | Software CBC overcurrent protection | |
| 905 | StartupBusSCP | Start up short circuit protection | Restart the battery and wait for minutes, Check if the power line is short circuited ,If the problem is not resolved, please contact technical support. |
| 906 | SwBusAvgUVP | Bus average undervoltage | Restart the battery and wait for minutes. If the problem is not resolved, please contact technical support. |
| 907 | ChipClockFault | Clock failure of the chip | Restart the battery and wait for minutes. If the problem is not resolved, please contact technical support. |
| 908 | PCSCanCommFault | Faulty CAN communication between battery and inverter | Make sure your battery is compatible with the inverter.<br>CAN communication is recommended. Check the communication line or the connection of the battery and the inverter for errors. |

| ID | Name | Description | Solution |
|---|---|---|---|
| 909 | HeatsinkLowTempFault | Heatsink low temperature fault | Please make sure that the heatsink temperature is not lower than the temperature limit of the battery. |
| 910 | EnyLowTempFault | Low ambient temperature, battery failure | Please make sure that the ambient temperature is not lower than the temperature limit of the battery. |
| 911 | ADOffsetCalibrateFault | Sample Offset Calibration Failure | Restart the battery and wait for minutes. If the problem is not resolved, please contact technical support. |

## 8.3 Maintenance

Inverters do not generally require daily or routine maintenance. Before carrying out cleaning, ensure that the DC switch and AC circuit breaker between the inverter and power grid have been switched off. Wait at least 5 minutes before carrying out cleaning.

### 8.3.1 Cleaning the inverter

Clean the inverter using an air blower and a dry, soft cloth or a soft bristle brush. Don't clean the inverter with water, corrosive chemicals, cleaning agents etc.

### 8.3.2 Cleaning the heat sink

In order to help guarantee correct long-term operation of the inverter, make sure that there is sufficient space for ventilation around the heat sink. Check the heat sink for blockages (dust, snow etc.) and remove them if present. Please clean the heat sink using an air blower and a dry, soft cloth or a soft bristle brush. Do NOT clean the heat sink with water, corrosive chemicals, cleaning agents etc.

# 9 Datasheet

- The following parameters may change without notice，please refer to the user manual and Datasheet on our website.

| Model | ESI-5K-T1 | ESI-6.5K-T1 | ESI-8K-T1 | ESI-9.9K-T1-A | ESI-10K-T1 | ESI-12K-T1 |
|---|---|---|---|---|---|---|
| PV Input | | | | | | |
| Recommended Max. PV Power | 10 kWp | 13kWp | 16 kWp | 20 kWp | 20 kWp | 24 kWp |
| Max. Input Voltage | 1000 Vd.c. | | | | | |
| Start-up Voltage[1] | 200 Vd.c. | | | | | |
| Rated Input Voltage | 600 Vd.c. | | | | | |
| MPP Voltage Range | 160-950 Vd.c. | | | | | |
| Number of MPPT | 3 | | | | | |
| Max. Number of Input Strings per MPPT | 1/1/1 | | | | | |
| Max. Input Current | 20/20/20 A | | | | | |
| Max. Isc | 25/25/25 A | | | | | |
| Battery | | | | | | |
| Voltage Range | 350-435 Vd.c. | | | | | |
| Number of Battery Input Channels | 1 | | | | | |
| Max. Charging Power[3] | 10 kW | | | | | |
| Max. Discharging Power | 5 kW | 6.5 kW | 8 kW | 9.9 kW | 10 kW | 10 kW |
| Max. Charging Current | 25 A | | | | | |
| Max. Discharging Current | 15 A | 19.5 | 24 A | 29.7 A | 30 A | 30 A |
| Battery Type[2] | Lithium-ion | | | | | |
| BMS Communication | CAN | | | | | |
| AC Backup | | | | | | |
| Rated Output Voltage | 3N~+PE,380/400/415 Va.c. | | | | | |
| Rated Output Frequency | 50/60 Hz | | | | | |
| Rated Output Power | 5 kW | 6.5 kW | 8 kW | 9.9 kW | 10 kW | 12 kW |
| Rated Output Current | 7.6/7.2/6.9 A | 9.9/9.4/9.0 A | 12.1/11.6/11.1 A | 15.0/14.3/13.8 A | 15.2/14.5/13.9 A | 18.2/17.4/16.7 A |
| Rated Apparent Power | 5 kVA | 6.5 kVA | 8 kVA | 9.9 kVA | 10 kVA | 12 kVA |
| Max. Apparent Power | 5.5 kVA | 7.15 kVA | 8.8 kVA | 9.9 kVA | 11 kVA | 13.2 kVA |
| Max. Output Current | 8.3/8.0/7.6 A | 10.9/10.3/9.9 A | 13.3/12.8/12.2 A | 15.0/14.3/13.8 A | 16.7/15.9/15.3 A | 20.0/19.1/18.3 A |

| Model | ESI-5K-T1 | ESI-6.5K-T1 | ESI-8K-T1 | ESI-9.9K-T1-A | ESI-10K-T1 | ESI-12K-T1 |
|---|---|---|---|---|---|---|
| Peak Output Apparent Power[3] | 2 times of rated power, 10s | | | | | |
| THDv(@ linear load) | <3% | | | | | |
| Switching Time | 10 ms default | | | | | |
| Asymmetric load | Yes, Supports 100% three-phase unbalanced load | | | | | |
| AC Grid | | | | | | |
| Rated Voltage | 3(N)~+PE,380/400/415 Va.c. | | | | | |
| Rated Frequency | 50/60 Hz | | | | | |
| Rated Output Power | 5 kW | 6.5 kW | 8 kW | 9.9 kW | 10 kW | 12 kW |
| Rated Output Current | 7.6/7.2/6.9 A | 9.9/9.4/9.0 A | 12.1/11.6/11.1 A | 15.0/14.3/13.8 A | 15.2/14.5/13.9 A | 18.2/17.4/16.7 A |
| Rated Apparent Power | 5 kVA | 6.5 kVA | 8 kVA | 9.9 kVA | 10 kVA | 12 kVA |
| Max. Apparent Power | 5.5 kVA | 7.15 kVA | 8.8 kVA | 9.9 kVA | 11 kVA | 13.2 kVA |
| Max. Output Current | 8.3/8.0/7.6 A | 10.9/10.3/9.9 A | 13.3/12.8/12.2 A | 15.0/14.3/13.8 A | 16.7/15.9/15.3 A | 20.0/19.1/18.3 A |
| Max. Input Current | 15.2/14.5/13.9 A | 19.8/18.8/18.1 A | 24.2/23.2/22.2 A | 30.3/29.0/27.8 A | 30.3/29.0/27.8 A | 33.3/31.9/30.6 A |
| THDi | <3% | | | | | |
| Power Factor Range | 0.8 lagging-0.8 leading | | | | | |
| Efficiency | | | | | | |
| Max. MPPT Efficiency | 99.9% | | | | | |
| Max. Efficiency | 98.0% | 98.0% | 98.0% | 98.2% | 98.2% | 98.2% |
| European Efficiency | 97.0% | 97.0% | 97.0% | 97.5% | 97.5% | 97.5% |
| Max. Efficiency of Charging/Discharging[4] | 97.6% | 97.6% | 97.6% | 97.8% | 97.8% | 97.8% |
| Protection | | | | | | |
| DC Switch | Yes | | | | | |
| PV Reverse Connection Protection | Yes | | | | | |
| Battery Reverse Connection Protection | Yes | | | | | |
| Output Short Circuit Protection | Yes | | | | | |
| Output Overcurrent Protection | Yes | | | | | |
| Output Overvoltage Protection | Yes | | | | | |
| Insulation Impedance Detection | Yes | | | | | |
| Residual Current Detection | Yes | | | | | |
| Anti-island Protection | Yes | | | | | |
| Surge Protection[5] | PV:Type II, AC:Type II | | | | | |

| Model | ESI-5K-T1 | ESI-6.5K-T1 | ESI-8K-T1 | ESI-9.9K-T1-A | ESI-10K-T1 | ESI-12K-T1 |
|---|---|---|---|---|---|---|
| General Parameter | | | | | | |
| Inverter Topology | Non-Isolation | | | | | |
| Protective Class | Class I | | | | | |
| IP Rating | IP66 | | | | | |
| Overvoltage Category | AC III, DC II | | | | | |
| Operating Temperature Range | -30℃ to +60℃ (derating above +45℃) | | | | | |
| Relative Humidity Range | 5%-95% | | | | | |
| Max. Operating Altitude | 4000 m (derating above 2000 m) | | | | | |
| Standby Self-consumption[6] | <10 W | | | | | |
| Installation Method | Wall Mounted | | | | | |
| Dimensions(W*H*D) | 708*440*170 mm | | | | | |
| Cooling Mode | Natural | | | | | |
| Weight | 30 kg | | | | | |
| Communication | RS485,Optional:WiFi/4G/LAN | | | | | |
| Display | LCD & APP | | | | | |

[1] Minimum PV voltage to start MPPT operation.
[2] Please refer to document “SOFAR inverter Model compatible battery list”.
[3] Full battery and sun.
[4] Battery-AC maximum efficiency of battery charge and discharge.
[5] According to EN/IEC 61643-11.
[6] Standby loss at rated input voltage.

Version 1.0

ENERGY TO POWER YOUR LIFE

**ADDRESS**
11th Floor, Gaoxingqi Technology Building,
District 67, Xingdong Community, Xin'an Street,
Bao'an District, Shenzhen, China

**EMAIL**
info@sofarsolar.com

**WEBSITE**
www.sofarsolar.com

SOFARSOLAR