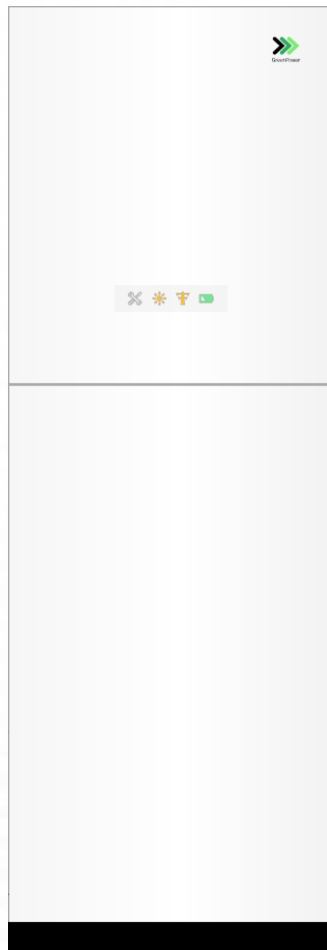




Installation Manual



Tesseract 5K14

Integrated Home Battery Storage System

Publisher

GreenPower Investment Pty Ltd

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Contents

About This Document	5
1 Safety Precautions	6
1.1 General Safety.....	6
1.2 Disclaimer	6
1.3 Personnel Requirements	7
1.4 Protect Labels.....	7
1.5 Installation.....	7
1.6 Electrical Connections	8
1.7 Operation	9
1.8 Maintenance and Replacement.....	9
2 Product Overview	10
2.1 Product Introduction	10
2.2 Appearance	11
2.3 Label Descriptions	13
3 Storage	15
4 System Installation	16
4.1 Pre-Installation Check	16
4.2 Tools and Instruments	16
4.3 Determining the Installation Position	18
4.4 Installing the Mounting Bracket	19
4.5 Wall-Mounted Installation	20
4.6 Installing the Tesseract 5K14	21
4.6.1 Battery Box Installation.....	22
4.6.2 Main Control Installation.....	23
5 Electrical Connections	25
5.1 Preparing Cables	25
5.2 Installing the Battery Box Cable	28
5.3 Installing the Main Control Box.....	30
5.3.1 Installing the DC Input Power Cable	31
5.3.2 Installing the AC Input/Output Power Cable (Grid)	33
5.3.3 Installing the EPS Cable.....	34
5.3.4 Installing the PE Cable	35
5.4 Installing the Cable between the Main Control Box and Battery Box.....	36
6 System Commissioning	39
6.1 Checking before Powering On.....	39
6.2 Powering on the System.....	40
6.3 Powering Off the System.....	41
7 Handling the Tesseract 5K14	3
7.1 Removing the Tesseract 5K14	3
7.2 Packing the Tesseract 5K14.....	3
7.3 Disposing of the Tesseract 5K14.....	3

8	Technical Specifications	4
8.1	DC Input.....	4
8.2	AC Output	4
8.3	Internal Charger.....	5
8.4	Efficiency	5
8.5	General Data	5
8.6	Dimensions	5

About This Document

Purpose

This document describes the Tesseract 5K14 Integrated Home Battery Storage Unit in terms of its installation, electrical connections, commissioning, maintenance, and troubleshooting. Before installing and operating the Tesseract 5K14, ensure that you are familiar with the features, functions, and safety precautions provided in this document.






Intended Audience

This document is intended for:

- Installers
- Users

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
 DANGER	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
 DANGER	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
 NOTE	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, or environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Version 1.0 (2020-02-15)

This issue is used for first office application (FOA).

1 Safety Precautions

1.1 General Safety

Before performing operations, read through this manual and follow all the precautions to prevent accidents. The "DANGER", "WARNING", "CAUTION", and "NOTICE" marks in this document do not represent all the safety instructions. They are only supplements to the safety instructions.

Only certified electricians are allowed to install, connect cables for, commission, maintain, and troubleshoot GreenPower products, and they must understand basic safety precautions to avoid hazards.

When operating GreenPower equipment, in addition to following the general precautions in this document, follow the specific safety instructions given by GreenPower. GreenPower will not be liable for any consequence caused by the violation of the safety operation regulations and design, production, and usage standards.

1.2 Disclaimer

GreenPower shall not be liable for any consequence caused by any of the following events:

- Transportation damage.
- The storage conditions do not meet the requirements specified in this document.
- Incorrect storage, installation or use.
- Installation or use by unqualified personnel.
- Failure to obey the operation instructions and safety precautions in this document.
- Operation in extreme environments which are not covered in this document.
- Operation beyond specified ranges.
- Unauthorised modifications to the product or software code or removal of the product.
- Device damage due to force majeure (such as lightning, earthquake, fire or storm).
- The warranty expires and the warranty service is not extended.
- Installation or use in environments which are not specified in related international standards.

1.3 Personnel Requirements

Only certified electricians are allowed to install, connect cables for, commission, maintain, troubleshoot, and replace the Tesseract 5K14.

- Operation personnel should receive professional training.
- Operation personnel should read through this document and follow all the precautions.
- Operation personnel should be familiar with the safety specifications about the electrical system.
- Operation personnel should understand the composition and working principles of the grid-tied PV system and local regulations.
- Operation personnel must wear proper personal protective equipment (PPE).

1.4 Protect Labels

- Do not scrawl or damage any labels on the Tesseract 5K14 enclosure because these labels contain important information about safe operation.
- Do not scrawl or damage the nameplate on the Tesseract 5K14 enclosure because it contains important product information.

1.5 Installation

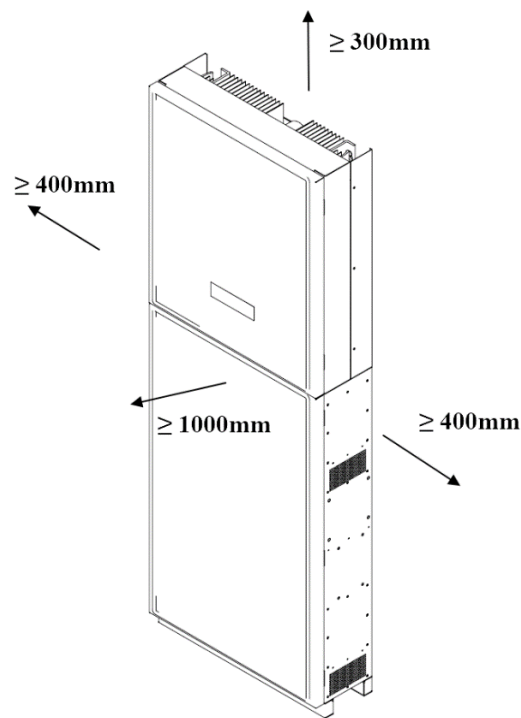


DANGER

Never operate the Tesseract 5K14 under power during installation.

- Ensure that the Tesseract 5K14 is not connected to a power supply or powered on before finishing installation.
- To allow proper heat dissipation and installation, maintain appropriate clearances between the Tesseract 5K14 and other objects, as shown in Figure 1-1. If you have any questions about the clearances, consult your local technical support engineers.

Figure 1-1 Installation space



- Ensure that the Tesseract 5K14 is installed in a well-ventilated environment.
- Ensure that the Tesseract 5K14 heat sinks are free from blockage.
- Do not open the front panel of the Tesseract 5K14.
- Do not remove the terminals and ports at the bottom of the Tesseract 5K14.

1.6 Electrical Connections



DANGER

Before connecting cables, ensure that the Tesseract 5K14 is secured in position and not damaged in any way. Otherwise, electric shocks or fire may occur.

-
- Ensure that all electrical connections comply with local electrical standards.
 - Obtain approval from the local utility company before using the Tesseract 5K14 to generate electricity in grid-tied mode.
 - Ensure that the cables used in a grid-tied PV system are properly connected and insulated, and meet all specification requirements.

1.7 Operation



DANGER

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the Tesseract 5K14 in operation. Strictly comply with the safety precautions in this document and associated documents when operating the Tesseract 5K14.

-
- When the Tesseract 5K14 is powered on for the first time, only certified electricians are allowed to perform quick setting. Incorrect settings may affect normal operation of the Tesseract 5K14 and cause it to conflict with the country certification.
 - When the Tesseract 5K14 is operating, do not disconnect under load.
 - Do not touch an energised Tesseract 5K14 because the heat sink has a high temperature.
 - Follow local laws and regulations when operating the equipment.

1.8 Maintenance and Replacement



DANGER

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the Tesseract 5K14 in operation. Prior to maintenance, power off the Tesseract 5K14 and strictly comply with the safety precautions in this document and associated documents to operate the Tesseract 5K14.

-
- Maintain the Tesseract 5K14 with sufficient knowledge of this document, proper tools, and testing equipment.
 - Before performing maintenance tasks, power off the Tesseract 5K14 and wait at least 5 minutes.
 - Temporary warning signs or fences must be placed to prevent unauthorized people from entering the site.
 - If the Tesseract 5K14 is faulty, contact your supplier.
 - The Tesseract 5K14 can be powered on only after all faults are rectified. Failing to do so may escalate faults or damage the device.
 - Observe ESD precautions and wear ESD gloves during maintenance.

2 Product Overview

2.1 Product Introduction

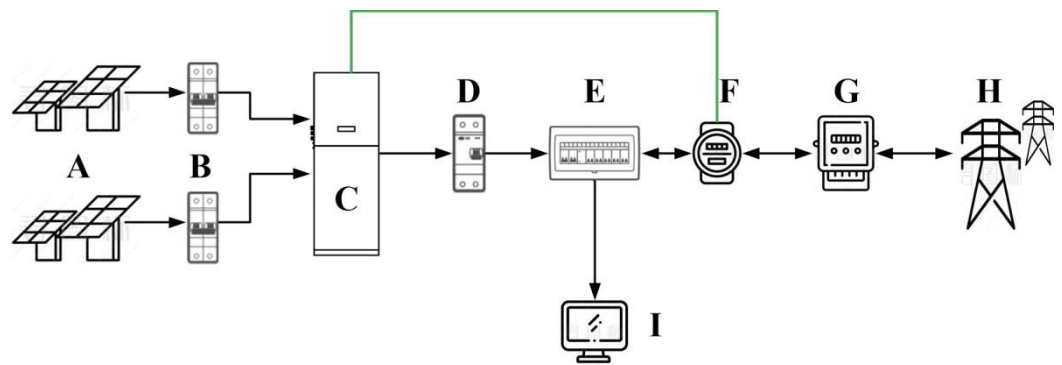
Function

The Tesseract 5K14 is a single-phase grid-connected PV string inverter and energy storage system. It can store the DC power generated by the PV string into the battery, or convert the DC power generated by the PV string or the stored energy of the battery into AC power. Power is input to the grid.

Networking Application

The Tesseract 5K14 applies to a residential rooftop grid-tied system. Typically, a grid-tied system consists of the PV string, grid-tied inverter, AC switch, and power distribution unit.

Figure 2-1 Network diagram



NOTE

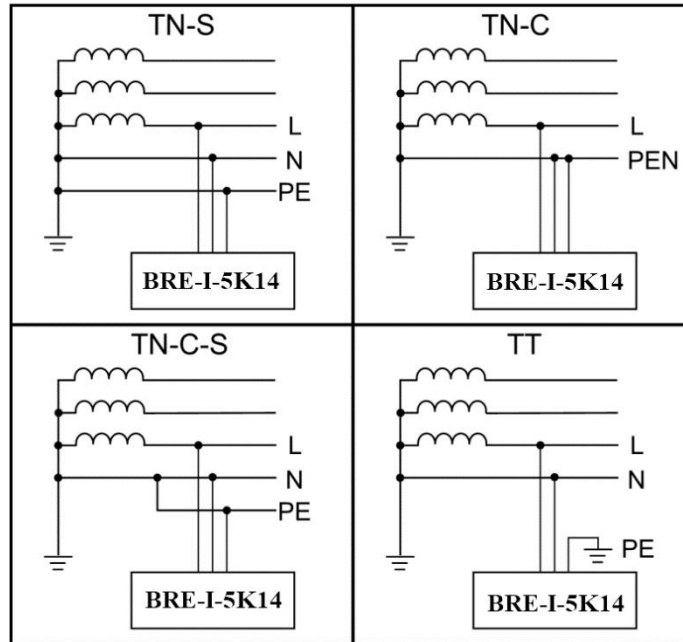
- indicates a power cable
- indicates the power flow direction
- indicates a signal cable

- A. PV string
- B. DC switch
- C. Tesseract 5K14
- D. AC switch
- E. Residential power distribution unit
- F. Energy meter
- G. Residential power meter
- H. Power grid
- I. Residential load

Supported Power Grid

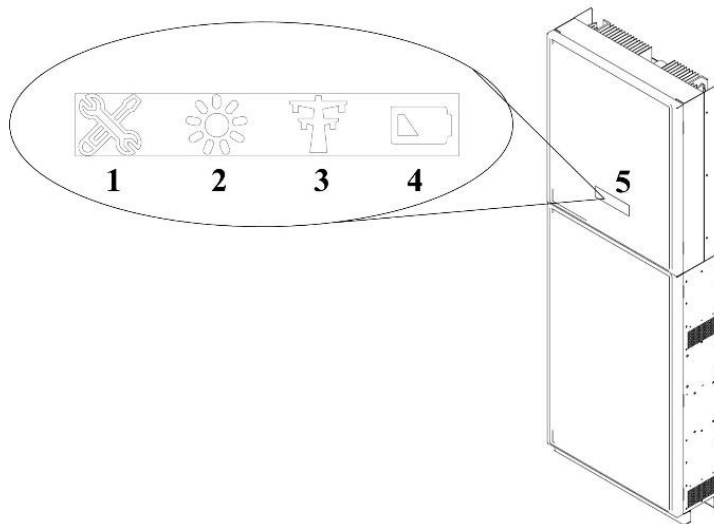
Power grid types supported by the Tesseract 5K14 include TN-S, TN-C, TN-C-S, and TT. In a TT power grid, the N-PE voltage should be lower than 30 V.

Figure 2-2 Power grid types



2.2 Appearance





Front View



1. LED 1
2. LED 2
3. LED 3
4. LED 4
5. Front panel

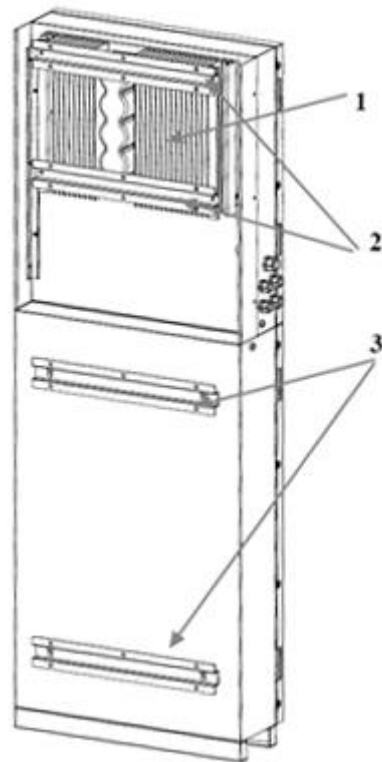
Table 2-3 LED descriptions

Type	Name	Status	Meaning
------	------	--------	---------

	Maintenance indicator	Red	BHSS failure or maintenance required
	Solar indicator	Orange	Solar equipment working
	Grid indicator	Green Orange Off	Feeding energy to the grid Absorbing energy from the grid Grid off
	Battery indicator	Green (steady) Orange Green (blinking)	Battery charging Battery discharging Waking up

Rear View

Figure 2-4 Rear view



1. Main control box mounting bracket
2. Battery box mounting bracket
3. Heat sink

Dimensions

Figure 2-5 Enclosure dimensions

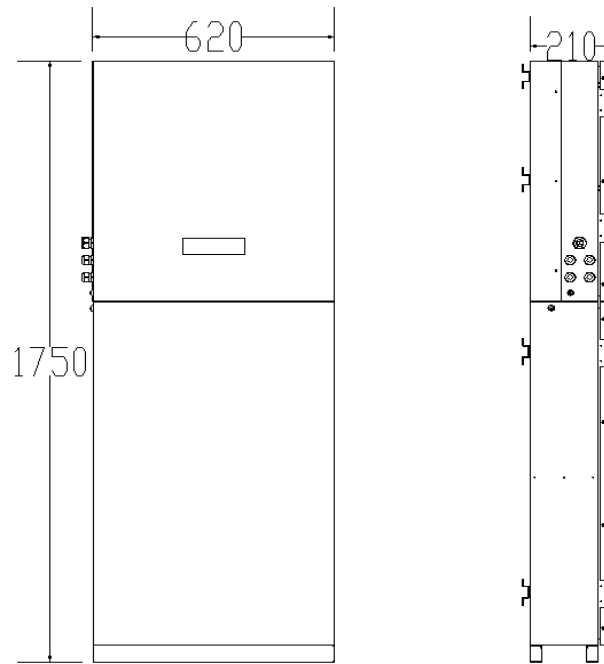


Figure 2-6 Main control box mounting bracket dimensions

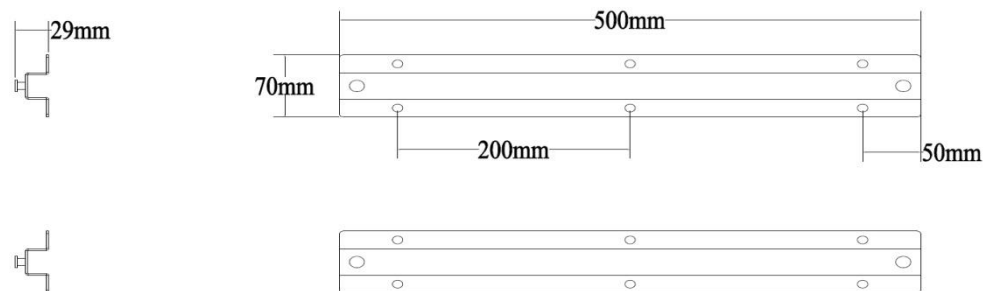
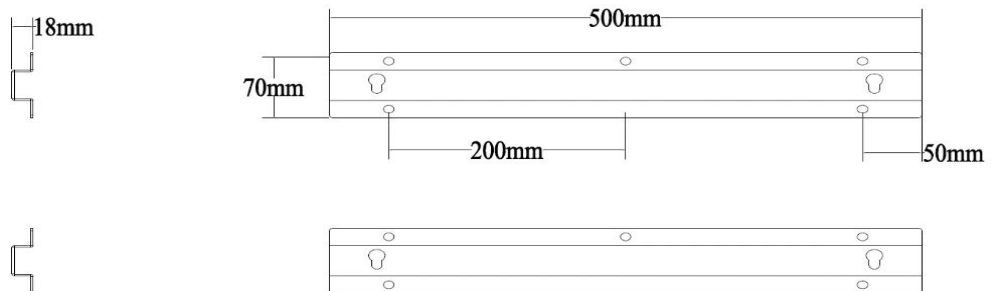









Figure 2-7 Battery box mounting bracket dimensions



2.3 Label Descriptions

Symbols

Symbol	Name	Meaning
	Burn warning	Do not touch a running Tesseract 5K14 because the shell is hot

		when the Tesseract 5K14 is running.
 	Delay discharge	<ul style="list-style-type: none"> High voltage exists after the Tesseract 5K14 is powered on. Only qualified and trained electrical technicians are allowed to perform operations on the Tesseract 5K14. Residual voltage exists after the Tesseract 5K14 is powered off. It takes 5 minutes for the Tesseract 5K14 to discharge to the safe voltage.
	Refer to documentation	Reminds operators to refer to the documents shipped with the Tesseract 5K14.
	Grounding	Indicates the position for connecting the protective earthing (PE) cable.
 <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <p>Do not disconnect under load! 禁止带负荷断开连接!</p> </div>	Operation warning	Do not remove the connector or antennawhen the Tesseract 5K14 is running.
 SN: xxxxxxxxxxxxxxxxxxxxx	SN label	Indicates the Tesseract 5K14 serial number.

 **NOTE** The labels are for reference only.

3 Storage

The following requirements should be met when the Tesseract 5K14 needs to be stored prior to installation:

- Do not unpack the Tesseract 5K14.
- Keep the storage temperature at -40°C to +70°C and the humidity at 5%–95% RH.
- The Tesseract 5K14 should be stored in a clean and dry place, and be protected from dust and water vapour corrosion.
- A maximum of two Tesseract 5K14s can be stacked. To avoid personal injury or device damage, stack Tesseract 5K14s with caution to prevent them from falling over.
- Regular inspection is required during the storage. Replace the packing materials when necessary.
- After long-term storage, an inspection and test conducted by qualified persons are necessary before the Tesseract 5K14 is put into use.

4 System Installation

4.1 Pre-Installation Check

Outer Packing Materials

Before unpacking the Tesseract 5K14, check the outer packing materials for damage, such as holes and cracks, and check the Tesseract 5K14 model. If any damage is found or the Tesseract 5K14 model is not what you requested, do not unpack the package and contact your supplier as soon as possible.



NOTICE

You are advised to remove the packing materials within 24 hours before installing the Tesseract 5K14.

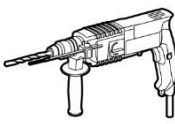
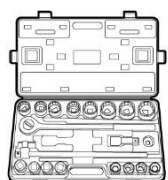

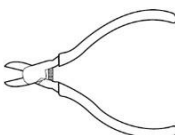
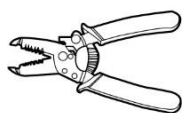
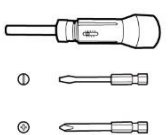
Package Contents


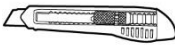
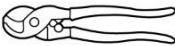
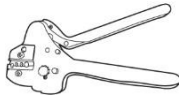





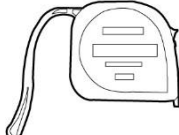

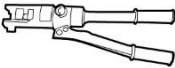






After unpacking the Tesseract 5K14, check that the contents are intact and complete. If any damage is found or any component is missing, contact your supplier.



NOTE For details about the number of contents, refer to the Packing List in the packing case.

4.2 Tools and Instruments

Category	Tools & Instruments		
Installation	 Hammer drill (with a $\Phi 10$ mm drill bit)	 Torque socket wrench (open end: 13 mm, applicable for M8 bolts; torque range: 0–15 N•m)	 Torque wrench (open end: 13 mm; torque range: 0–1.5 N•m)
	 Diagonal pliers	 Wire stripper	 Torque screwdriver (head: M4 or M6; torque range: 0–5 N•m)

Category	Tools & Instruments		
	 Rubber mallet	 Utility knife	 Cable cutter
	 Crimping tool (model: H4TC0001; manufacturer: Amphenol)	 Open-end wrench (model: H4TW0001; manufacturer: Amphenol)	 Cable tie
	 Vacuum cleaner	 Multimeter (DC voltage measurement range ≥ 600 V DC)	 Marker
	 Measuring tape	 Bubble or digital level	 Hydraulic pliers
	 Heat shrink tubing	 Heat gun	
PPE	 Safety gloves	 Safety goggles	 Anti-dust respirator
	 Safety shoes		

4.3 Determining the Installation Position

Basic Requirements

- The Tesseract 5K14 is protected to IP54 and can be installed indoors or outdoors.
- Do not install the Tesseract 5K14 in a place where a person can be easy to come into contact with its enclosure and heat sinks, because these parts are extremely hot during operation.
- Do not install the Tesseract 5K14 in areas with flammable or explosive materials.
- Do not install the Tesseract 5K14 in a place within reach of children.
- The Tesseract 5K14 will be corroded in salt areas, and the salt corrosion may cause fire. Do not install the Tesseract 5K14 outdoors in salt areas. A salt area refers to the region within 500 metres from the coast or prone to sea breeze. The regions prone to sea breeze vary depending on weather conditions (such as typhoons and monsoons) or terrains (such as dams and hills).

Installation Environment Requirements

- The Tesseract 5K14 must be installed in a well-ventilated environment to ensure good heat dissipation.
- When installed under direct sunlight, performance de-rate may be initiated due to additional temperature rise.
- Install the Tesseract 5K14 in a sheltered place or install an awning over the Tesseract 5K14.

Mounting Structure Requirements

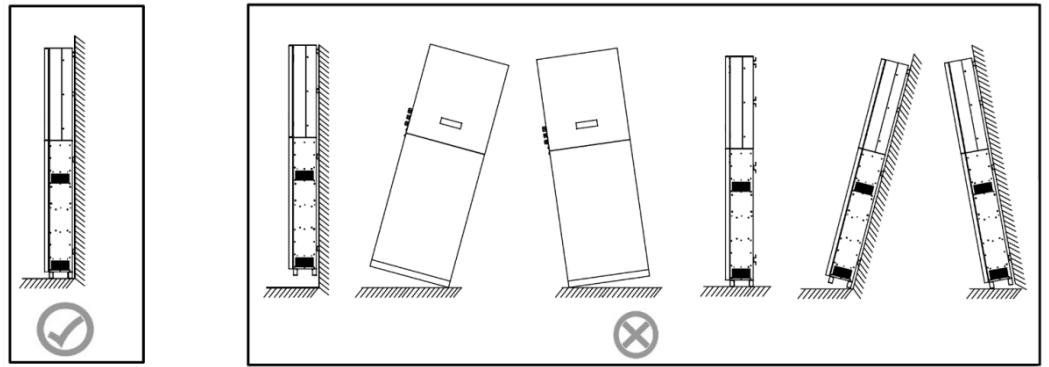
- The mounting structure where the Tesseract 5K14 is installed must be fireproof.
- Do not install the Tesseract 5K14 on flammable building materials.
- Ensure that the installation surface is solid enough to bear the weight load.
- In residential areas, do not install the Tesseract 5K14 on drywalls or walls made of similar materials which have a weak sound insulation performance because the noise generated by the Tesseract 5K14 is noticeable.

Installation Angle Requirements

The Tesseract 5K14 only can be wall-mounted. The installation angle requirements are shown in Figure 4-1.

- Install the Tesseract 5K14 vertically.
- Do not install the Tesseract 5K14 at forward-tilted, back-tilted, side-tilted, horizontal, or upside-down positions.

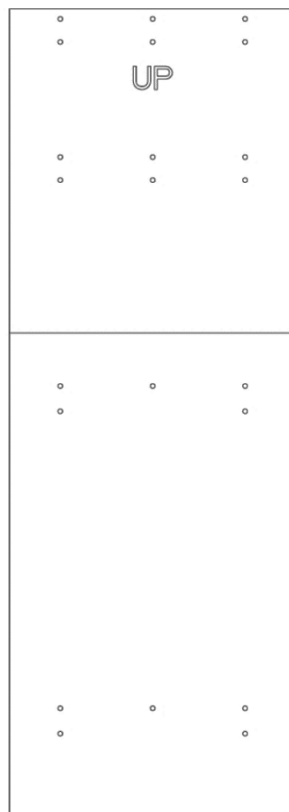
Figure 4-1 Installation angle



4.4 Installing the Mounting Bracket

There are four mounting brackets, which are installed through the mounting brackets provided with the product.

Figure 4-2 Opening position plate

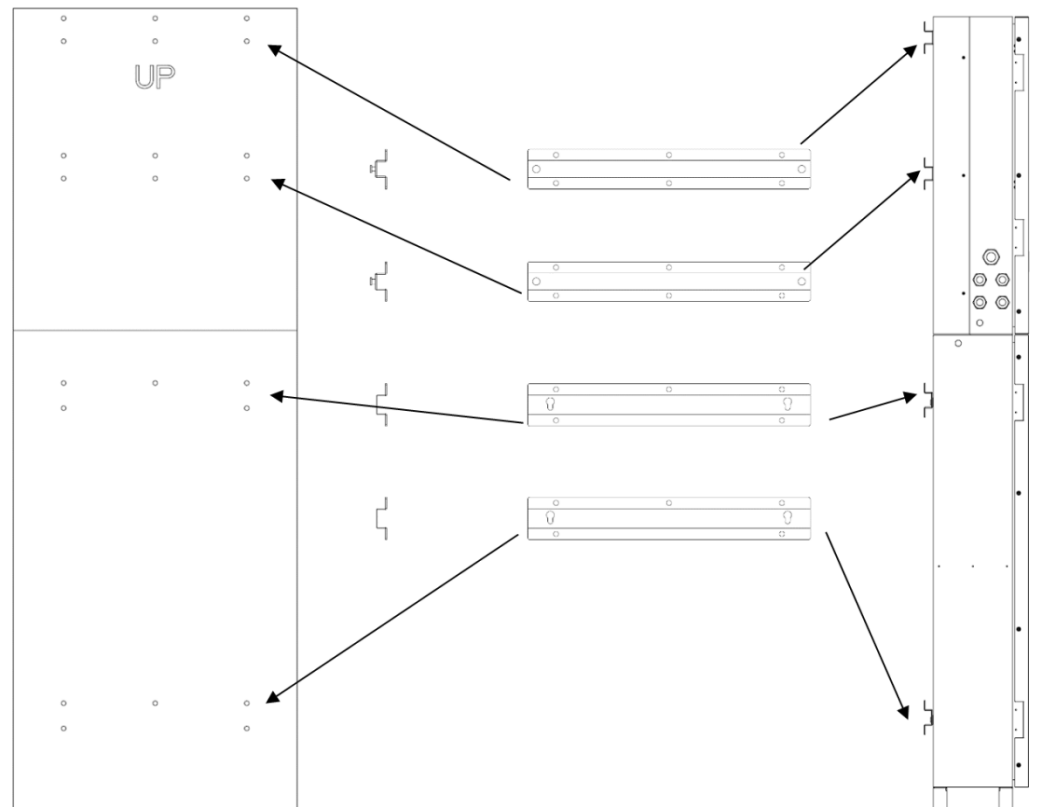


4.5 Wall-Mounted Installation

Procedure

- Step 1** Use the hole positioning plate to confirm the position of the hole. Use a bubble or digital level to adjust the position of the mounting holes and mark the position with a marker.

Figure 4-3 Determining hole positions



- Step 2** Install the expansion bolts.



DANGER

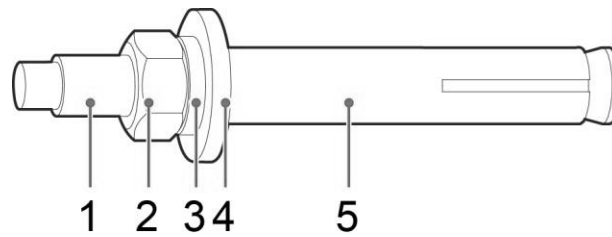
Avoid drilling holes in the utility pipes and/or cables attached to back of the wall.



NOTE

If the length or number of M8x80 expansion bolts supplied with the Tesseract 5K14 is not enough, prepare M8 stainless steel expansion anchor bolts.

Figure 4-4 Expansion bolt composition



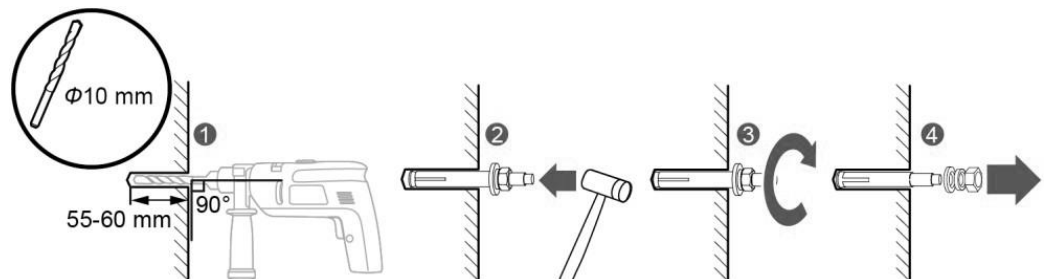
1. Bolt
2. Nut
3. Spring washer
4. Flat washer
5. Expansion sleeve



NOTICE

- To prevent dust inhalation or contact with eyes, wear safety goggles and an anti-dust respirator when drilling holes.
- Clean up any dust in and around the holes using a vacuum cleaner and measure the distance between holes. If the holes are inaccurately positioned, drill a new set of holes.
- Level the head of the expansion sleeve with the concrete wall after removing the bolt, spring washer and flat washer. Otherwise, the mounting bracket will not be securely installed on the concrete wall.

Figure 4-5 Installing an expansion bolt



Step 3 Secure the mounting bracket.

4.6 Installing the Tesseract 5K14

Procedure

The Tesseract 5K14 consists of a two-part structure: the main control box and the battery box. The battery box must be installed before installing the battery box.

- To prevent device damage and personal injury, keep balance when moving the Tesseract 5K14.
- Do not use the wiring terminals and ports at the bottom to support any weight of the Tesseract 5K14.
- When you need to place the Tesseract 5K14 on the ground temporarily, use foam, paper or other protection material to prevent damage to its cover.

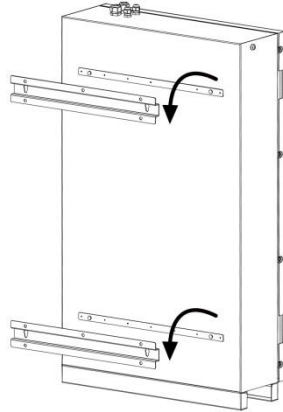


DANGER

4.6.1 Battery Box Installation

Step 1 Ensure the battery box is firmly affixed to the wall.

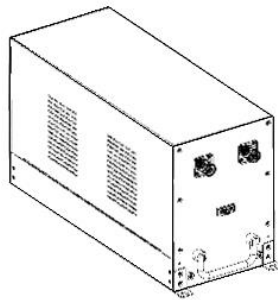
Figure 4-6 Mounting battery box



Step 2 Open the front panel.

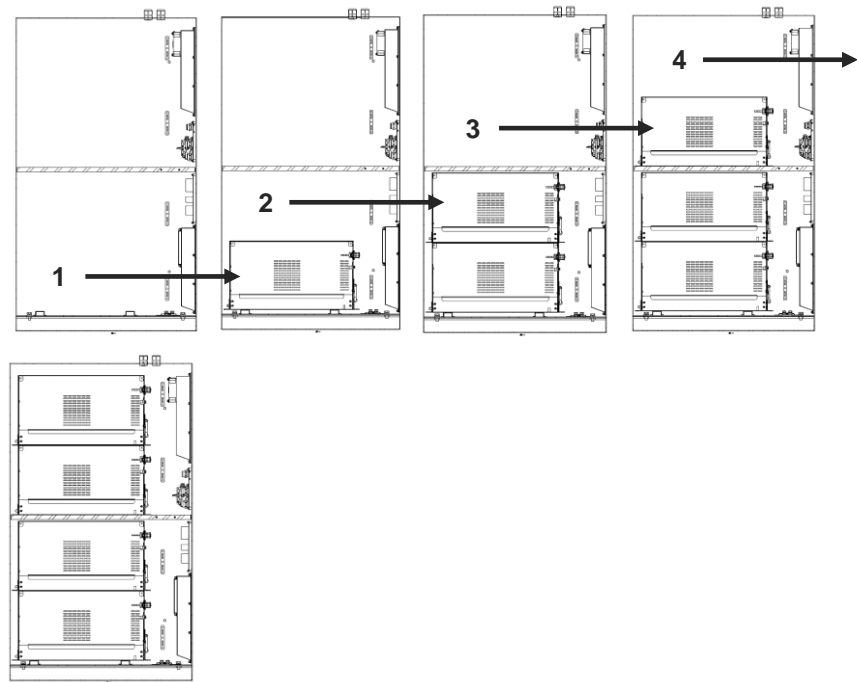
Step 3 Check the battery packs that will be installed in the battery box, and make sure that each battery pack is intact and has a number from 1 to 4.

Figure 4-7 Battery pack



Step 4 Place the battery pack in the battery compartment by numbers 1 to 4.

Figure 4-8 Installing the battery pack

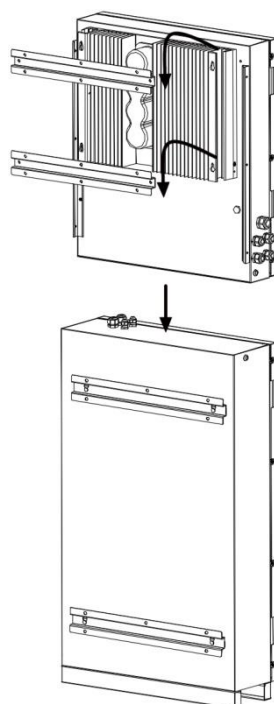


1. Battery pack #1
2. Battery pack #2
3. Battery pack #3
4. Battery pack #4

4.6.2 Main Control Installation

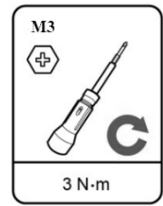
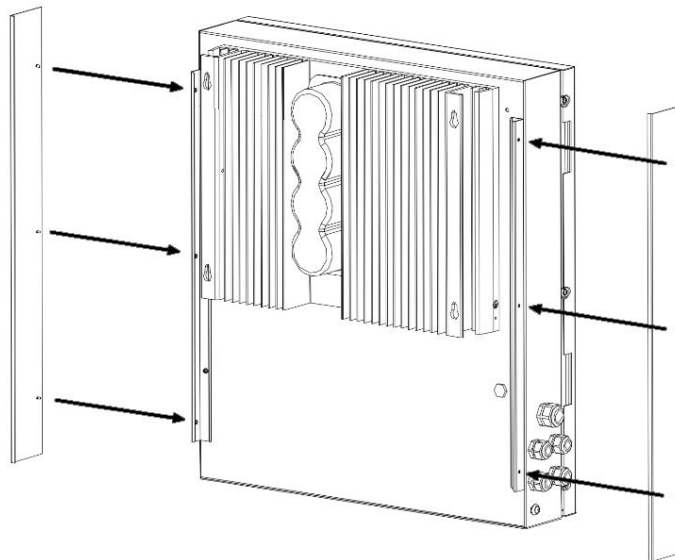
Step 1 Ensure the main control box is firmly affixed to the wall.

Figure 4-9 Mounting the main control box



Step 2 After verifying that the main control box is affixed, affix the side panels as shown in Figure 4-10.

Figure 4-10 Mounting the side panels



5 Electrical Connections



DANGER

Before connecting any cables, ensure that the DC switch on the Tesseract 5K14 and all the switches connecting to the Tesseract 5K14 are OFF. Otherwise, the high voltage of the Tesseract 5K14 may result in electric shocks.



DANGER

- Any equipment damage caused by incorrect cable connections will not be covered under any warranty.
- Only certified electricians are allowed to connect cables.
- Operation personnel must wear proper PPE at all times when connecting cables.

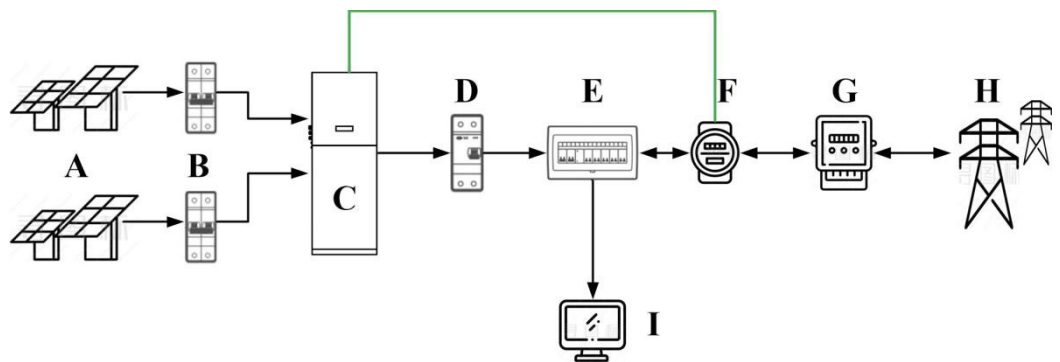


NOTE

The cable colours shown in the electrical connection diagrams provided in this chapter are for reference only. Select cables in accordance with local cable specifications (green and yellow cables are only used for PE).

5.1 Preparing Cables

Figure 5-1 Network diagram

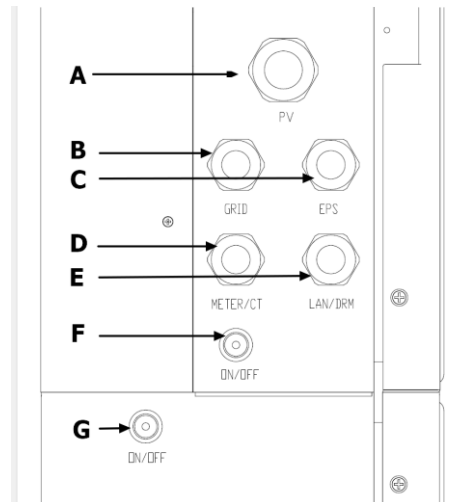


NOTE

- indicates a power cable
- indicates the power flow direction
- indicates a signal cable

- A. PV string
- B. DC switch
- C. Tesseract 5K14
- D. AC switch
- E. Residential power distribution unit
- F. Energy meter
- G. Residential power meter
- H. Power grid
- I. Residential load

Figure 5-2 Tesseract 5K14 cable connections



- A. PV connector
- B. Grid input/output
- C. EPS output
- D. Energy meter port
- E. Com port and dry contact
- F. Inverter ON/OFF button
- G. Battery ON/OFF button

Table 5-3 Component descriptions

No.	Component	Description	Source
1	PV string	A PV string is composed of the PV modules connected in series and works with an optimiser. The Tesseract 5K14 supports the input from two PV strings.	Prepared by the customer
2	DC switch	Recommended: DC circuit breaker with a rated voltage greater than or equal to 1000 V DC and a rated current of 20 A	Prepared by the customer
3	AC switch	Recommended: AC circuit breaker with a rated voltage greater than or equal to 250 V AC and a rated current of 25 A	Prepared by the customer
4	Energy meter	Energy meters that can connect to the Tesseract 5K14 are: <ul style="list-style-type: none"> • CHINT-DDSU666 • CCS-WNC-3Y-400-MB • Gavazzi-EM340DINAV23XS1X • Gavazzi-EM111DINAV81XS1X 	Prepared by the customer



NOTICE

- If the external AC switch can perform earth leakage protection, the rated leakage action current should be greater than or equal to 100 mA.
- If multiple Tesseract 5K14s connect to the general residual current device (RCD) through their respective external AC switches, the rated leakage action current of the general RCD should be greater than or equal to the number of Tesseract 5K14s multiplied by 100 mA.
- A knife switch cannot be used as an AC switch.

Table 5-4 Cable descriptions

No.	Cable	Type	Conductor Cross-sectional Area Range (mm ²)	Outer Diameter (mm)	Source
1	DC input power cable	Standard PV cable in the industry Recommended model: PV1-F	6	4.5–7.8	Prepared by the customer
2	Signal cable	Four-core outdoor shielded twisted pair	1	4–11	Prepared by the customer
3	AC output power cable	Not using the PE equipotential point at the AC output port: two-core (L and N) outdoor copper cable Using the PE equipotential point at the AC output port: three-core (L, N, and PE) outdoor copper cable	6	10–21	Prepared by the customer
4	PE cable	Single-core outdoor copper cable with an M6 OT terminal	10	N/A	Prepared by the customer

5.2 Installing the Battery Box Cable



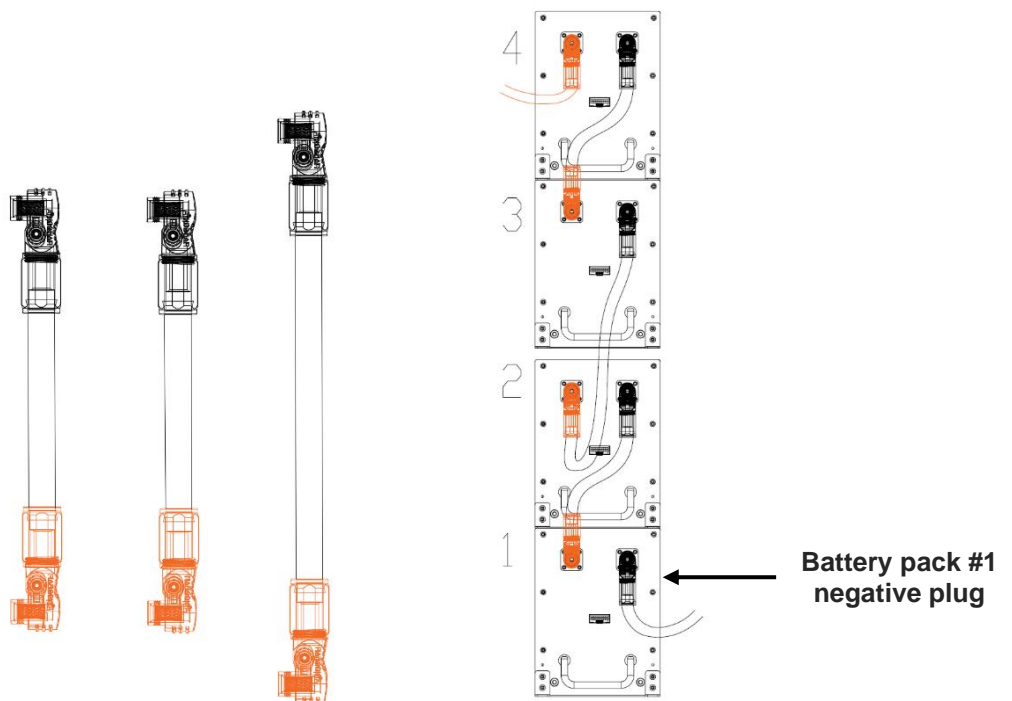
DANGER

Do not connect the negative plug (black) of battery pack #1 until the battery box is connected to the inverter.

Procedure

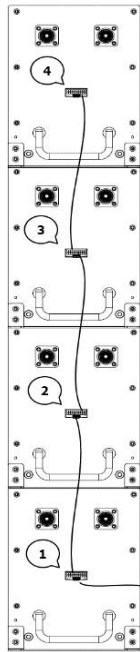
- Step 1** Insert the DC cable into the battery pack according to the left side of Figure 5-5. Pay attention to the colour of the plugs. The number on the cable head corresponds to the number of the battery pack.

Figure 5-5 DC cable installation



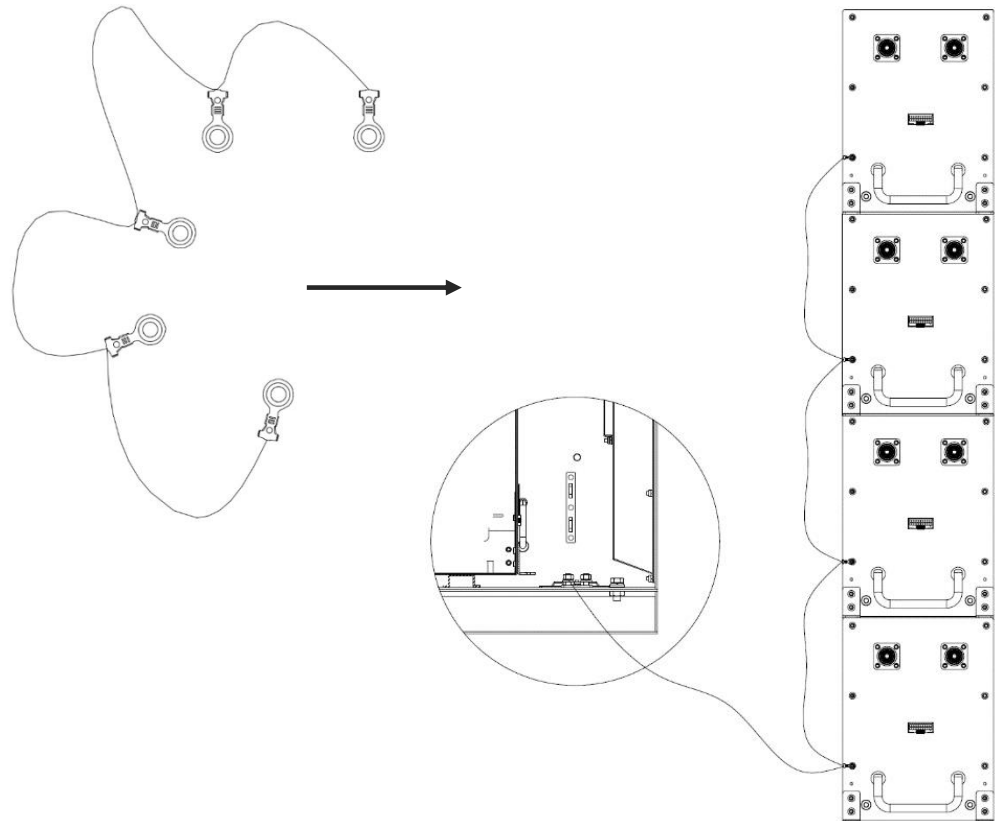
- Step 2** Insert the communication connector into the communication interface of each of four battery packs, corresponding by number as shown in Figure 5-6.

Figure 5-6 Communication cable installation



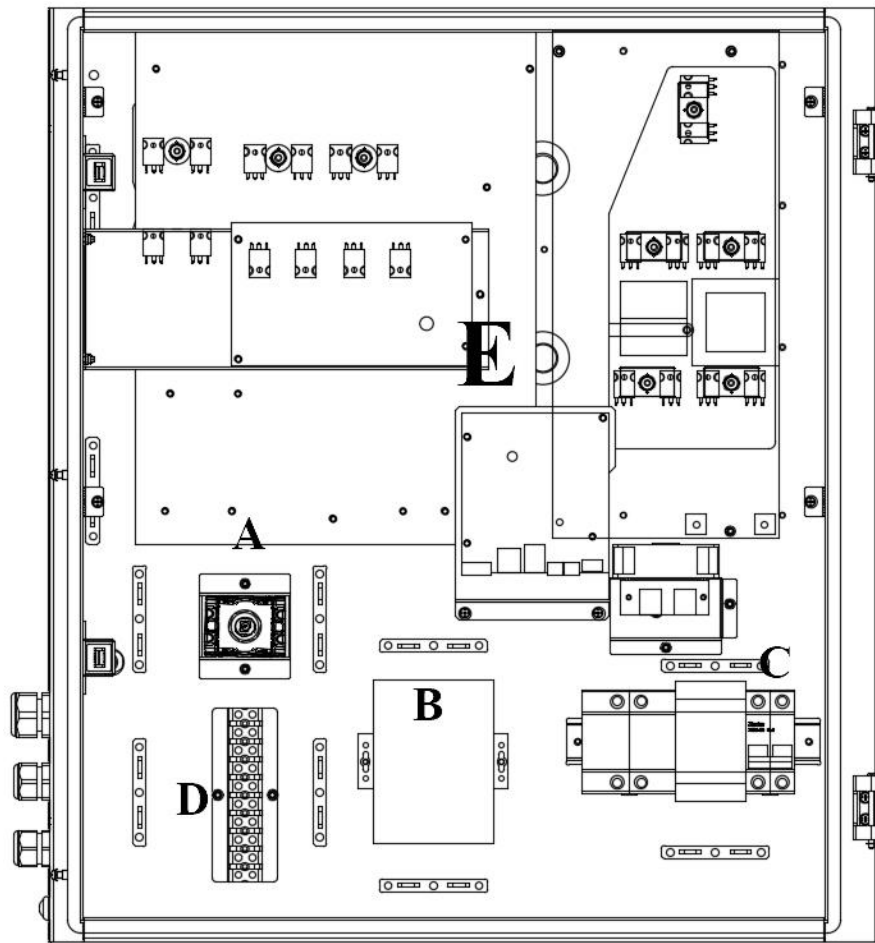
Step 3 Connect the PE cable as shown in Figure 5-7. Ensure that all battery packs are well grounded.

Figure 5-7 PE cable installation



5.3 Installing the Main Control Box

Figure 5-8 Main control box equipment layout



- A. DC switch
- B. 4G model
- C. Battery switch
- D. AC & PV terminal
- E. Inverter model

5.3.1 Installing the DC Input Power Cable



DANGER

- Before connecting the DC input power cable, ensure that the DC voltage is within the safe range (lower than 60 V DC) and that the DC switch on the Tesseract 5K14 is OFF. Failing to do so may result in electric shocks.
 - When the Tesseract 5K14 is operating, it is not allowed to work on a DC circuit, such as connecting or disconnecting a PV string or a PV module in a PV string. Failing to do so may cause electric shocks.
 - If no PV string connects to the DC input terminals, do not remove the watertight cap from the DC input terminals. Otherwise, the Tesseract 5K14 will not comply with its Ingress Protection Rating.
-



DANGER

Ensure that the following conditions are met. Otherwise, the Tesseract 5K14 will be damaged, or even become a fire hazard.

- The open-circuit voltage of each PV string is always lower than or equal to 600 V DC.
 - The positive and negative terminals of a PV string connect to corresponding positive and negative DC input terminals of the Tesseract 5K14.
 - If polarity of the DC input power cable is reversed and the DC switch is ON, do not turn off the DC switch immediately or unplug positive and negative connectors. Wait until the solar irradiance declines at night and the PV string current reduces to below 0.5 A, and then turn off the DC switch and remove the positive and negative connectors. Correct the string polarity before reconnecting the string to the Tesseract 5K14.
-



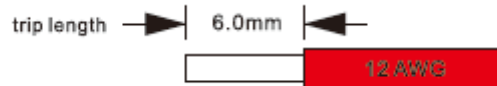
NOTICE

- Since the output of the PV string connected to the Tesseract 5K14 cannot be grounded, ensure that the PV module output is well insulated to ground.
 - During the installation of PV strings and Tesseract 5K14, the positive or negative terminals of PV strings may be grounded if power cables are not properly installed or routed. In this case, an AC or DC short circuit may occur and damage the Tesseract 5K14. This damage is not covered under any warranty or service agreement.
-

Procedure

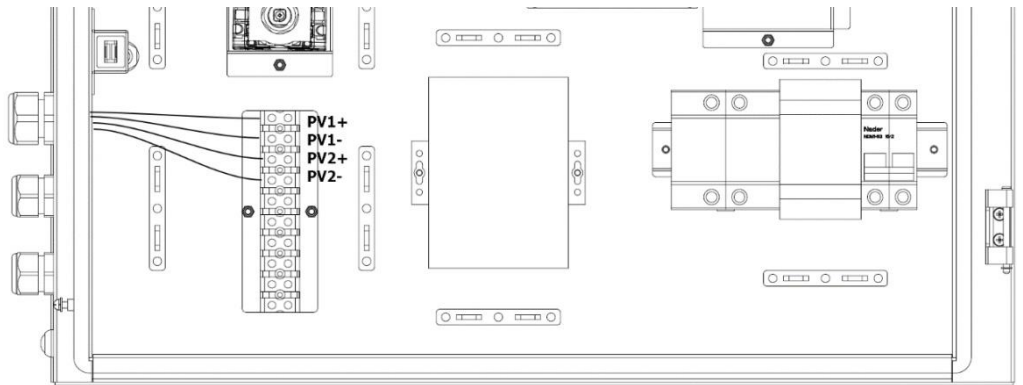
- Step 1** Disconnect the PV switch.
- Step 2** Select the 12 AWG wire to connect the PV module.
- Step 3** Strip 6 mm of insulation from the wire end as shown in Figure 5-9.

Figure 5-9 Stripped length



- Step 4** Connect the cable through the waterproof connector and connect the terminal in the main control box as shown in Figure 5-10.

Figure 5-10 PV cable installation



5.3.2 Installing the AC Input/Output Power Cable (Grid)



DANGER

Do not connect any load between the Tesseract 5K14 and the AC switch.

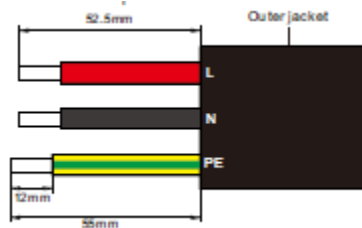
Procedure

Step 1 Check the grid voltage and compare with the permissible voltage range (see technical data).

Step 2 Disconnect the circuit-breaker from all the phases and secure against reconnection.

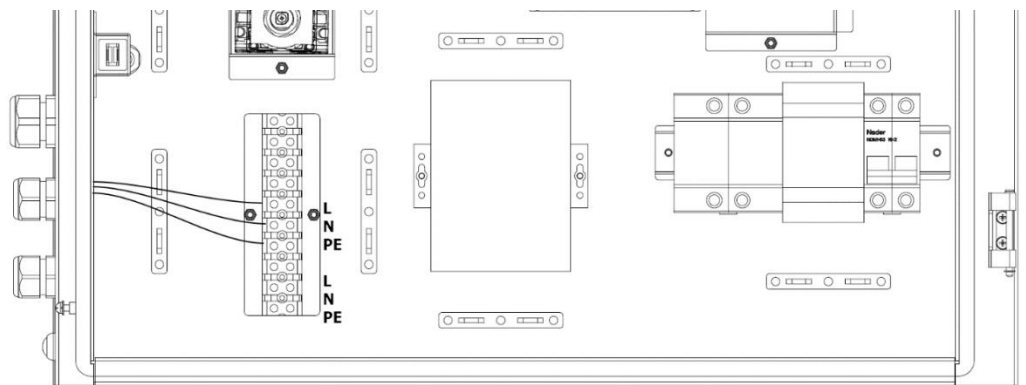
Trip the PE wire to 55 mm and all other wires to 52.5 mm. Use the crimping pliers to trip 12 mm of insulation from all wire ends as shown in Figure 5-11.

Figure 5-11 Stripped length



Step 3 Connect the AC cables into the “GRID” connection as shown in Figure 5-12.

Figure 5-12 AC cable connection



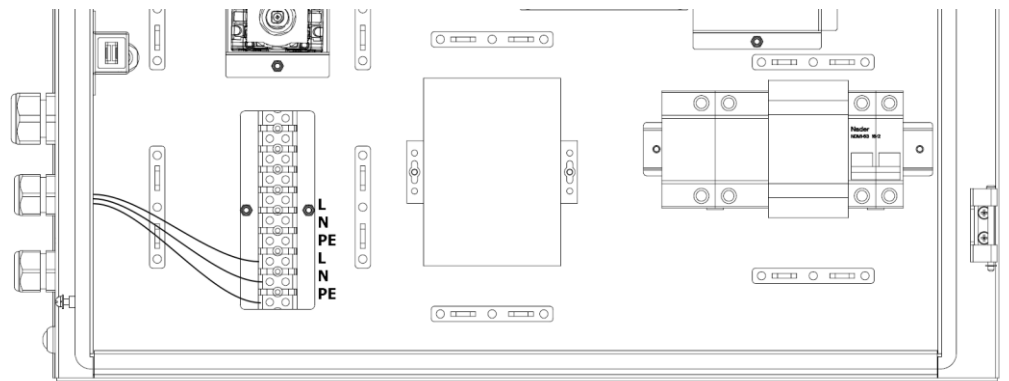
5.3.3 Installing the EPS Cable

The system has on and off grid function. It will have output through the grid output when the grid is on, and will have output through the EPS output when the grid is off.

Procedure

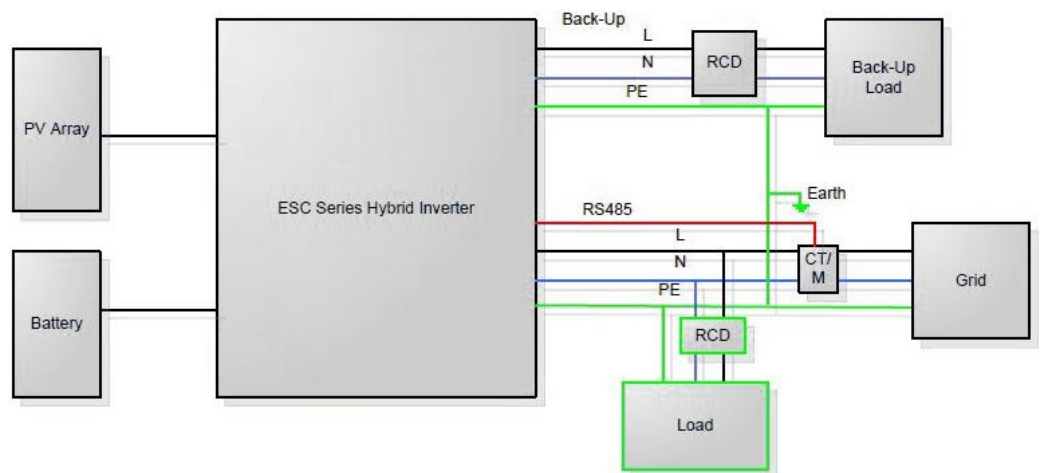
- Step 1** Insert the tripped end of each of the three wires (L, N and PE) as shown in Figure 5-13 and tighten them.

Figure 5-13 EPS cable installation



The diagram shown in Figure 5-14 is for reference based on different local wiring rules. Please follow your local rules for the external wiring to choose a suitable wiring mode.

Figure 5-14 EPS wiring diagram



5.3.4 Installing the PE Cable



DANGER

Do not connect the neutral wire to the enclosure as a PE cable as this will cause an electric shock.

Procedure

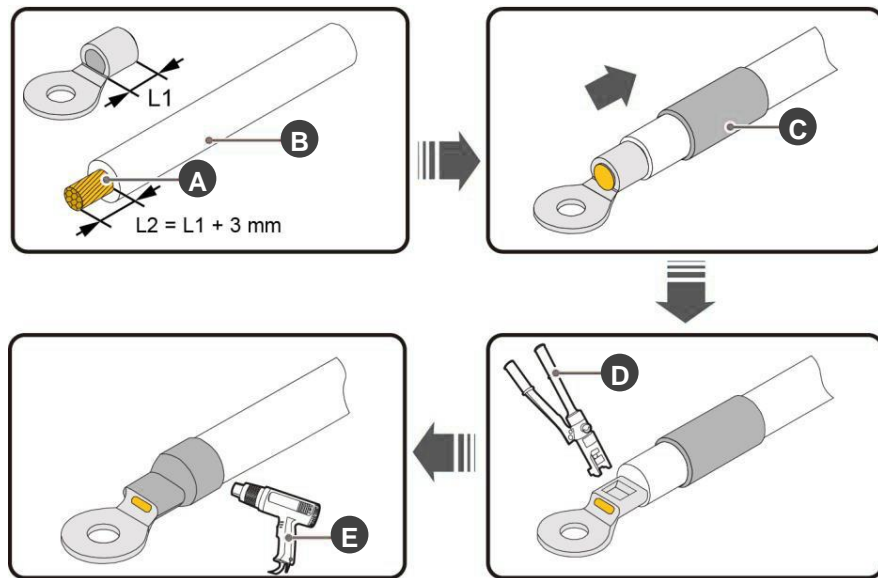
Step 1 Crimp the OT terminal as shown in Figure 5-15.

- Pay attention not to damage the core wire when stripping a cable.
- The cavity formed after the conductor crimp strip of the OT terminal is crimped must wrap the core wires completely. The core wires must contact the OT terminal closely.
- Wrap the wire crimping area with heat shrink tubing or PVC insulation tape. (Heat shrink tubing is used as an example in Figure 5-15.)
- When using the heat gun, protect devices from being scorched.



NOTICE

Figure 5-15 Crimping an OT terminal



- A. Core wire
- B. Insulation layer
- C. Heat shrink tubing
- D. Hydraulic pliers
- E. Heat gun

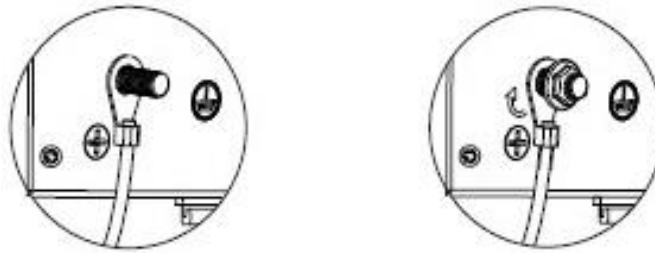
Step 2 Connect the PE cable as shown in Figure 5-16.



NOTICE

Ensure that the PE cable is connected securely.

Figure 5-16 Connecting a PE cable



NOTE

- The PE point at the AC output port is used only as a PE equipotential point, and cannot be substituted for the PE point on the enclosure.
- To enhance the corrosion resistance of a ground terminal, apply silica gel or paint around the terminal after connecting the ground cable.
- Earth fault Alarm: There is the earth fault alarm as the additional detection. When this alarm is detected, the system buzzer will sound and the red indicator light will flash. Impedance of the PV arrays is less than 30KΩ. External connection between PIN1 and PIN2 or RELAY2 must be within the range of 300V 2A

5.4 Installing the Cable between the Main Control Box and Battery Box

Before use, the battery box's DC cables and communication cables need to be connected to the main control box.



DANGER

Do not connect the negative plug (black) of battery pack #1 until the battery box is connected to the inverter.

Procedure

Step 1 Install the communication cable (Can cable). The communication cable is pre-installed in the battery box, to locate the cable to be connected to the RJ45 connector.

Step 2 Insert one RJ45 side of the cable into the BMS port of the control box.



DANGER

Ensure you select the correct specification cables for installation, otherwise the power will make the cable hot or burnt, and can result in serious injury or death.

Step 3 Connect one side of the battery connect wire to the position shown in Figure 5-17.

Step 4 Connect the positive side of the battery connect wire to the positive side of the battery.

Step 5 Connect the negative side of the battery connect wire to the negative side of the battery.

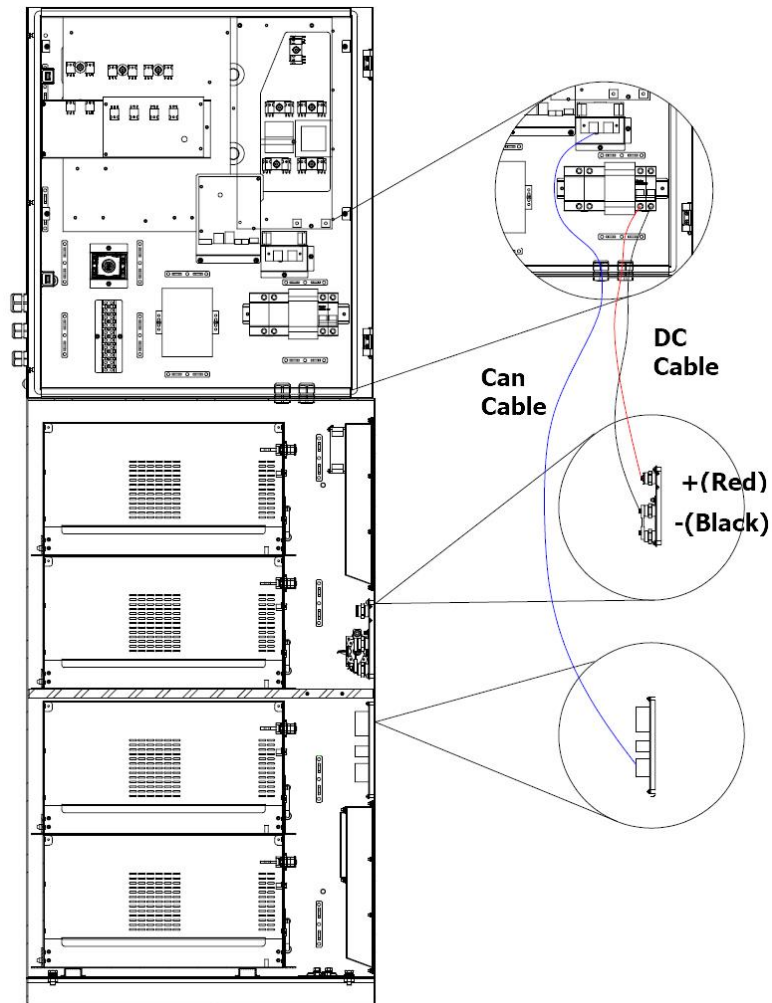
Step 6 Make sure the positive and negative sides of the battery are connected.



NOTICE

- Ensure that the exposed core wire is totally inserted into the cable hole.
- Ensure that the signal cables are connected securely.
- Ensure that the cable is not twisted.
- If a connector needs to connect to only one signal cable, block the unused cable hole on the seal using a cap and tighten the cable gland.
- If a connector needs to connect to two signal cables, ensure that the cables have the same outer diameter.

Figure 5-17 Connecting the battery connect wire



6 System Commissioning

6.1 Checking before Powering On

Table 6-1 Installation checklist

No.	Check Item	Acceptance Criteria
1	Tesseract 5K14 installation	The Tesseract 5K14 is installed correctly, securely and reliably.
2	Cable layout	Cables are routed properly as required by the customer.
3	Cable tie	Cable ties are secured evenly and no burr exists.
4	Grounding	The ground cable is connected correctly, securely and reliably.
5	DC switch	The DC switch and all the switches connecting to the Tesseract 5K14 are OFF.
6	Cable connections	The AC output power cable, DC input power cable, battery cable, and signal cable are connected correctly, securely and reliably.
7	Unused terminals & ports	Unused terminals and ports are locked by watertight caps.
8	Installation environment	The installation space is proper, and the installation environment is clean and tidy without foreign matter.

6.2 Powering on the System

Before turning on the AC switch between the Tesseract 5K14 and the power grid, check that the AC voltage on the power grid side of the AC switch is within the specified range.

- If the DC is on and the AC is off, the Tesseract 5K14 reports a Grid Failure alarm. The Tesseract 5K14 starts normally only after the fault is rectified.
- The Tesseract 5K14 will recover automatically when it detects the grid recovered. When the AC is off, the Tesseract 5K14 will shut off from the grid and provide power to EPS load automatically
- If the AC is on and the battery is off, the Tesseract 5K14 reports a Battery Abnormal alarm.
- If the Tesseract 5K14 is connected to the battery, after turning on the AC switch:
- If the DC switch is turned on within 1 minute, the Tesseract 5K14 will run properly in grid-tied mode.
- If the DC switch is not turned on within 1 minute, the Tesseract 5K14 will enter the night-time grid-tied mode. Then, after the DC switch is turned on, the Tesseract 5K14 will shut down and then restart to run in grid-tied mode.



NOTICE





First Start

- Step 1** Confirm that battery switch (Figure 5-8) is off.
- Step 2** Connect the #1 battery pack negative plug (Figure 5-5).
- Step 3** Confirm that the Battery ON/OFF button LED (Figure 5-2) is lit.
- Step 4** Turn on battery switch (Figure 5-8).
- Step 5** Start the procedure.

Procedure

- Step 1** Turn on the AC switch between the Tesseract 5K14 and the power grid.
- Step 2** Turn on the DC switch for PV (Figure 5-8 "A").
- Step 3** Turn on the DC switch between the PV string and the Tesseract 5K14 if there is any.
- Step 4** Turn on the DC switch at the bottom of the Tesseract 5K14.
- Step 5** Observe the LEDs to check the Tesseract 5K14 operating status.

Table 6-2 LED descriptions

Type	Name	Status	Meaning
	Maintenance indicator	Red	BHSS failure or maintenance required
	Solar indicator	Orange	Solar equipment working
	Grid indicator	Green	Feeding energy to the grid
		Orange	Absorbing energy from the grid
		Off	Grid off
	Battery indicator	Green (steady)	Battery charging
		Orange	Battery discharging
		Green (blinking)	Waking up

6.3 Powering Off the System



DANGER

- After the Tesseract 5K14 powers off, the remaining electricity and heat may still cause electric shocks and body burns. Therefore, put on protective gloves and begin servicing the Tesseract 5K14 5 minutes after the power-off.
- If the Tesseract 5K14 is connected to the battery, ensure that a shutdown command is sent from the app. Power off the system after the Tesseract 5K14 has shut down. If no shutdown command is sent from the app, the Tesseract 5K14 will shut down after the power grid is powered off. Then, the Tesseract 5K14 will wait for 1 minute and restart (not grid-tied) to charge the battery, which poses the risk of turning off the DC switch with power.

Procedure

- Step 1** Press the battery ON/OFF button (Figure 5-2) for 5 seconds to turn off the battery;
- Step 2** Turn off the AC switch between the Tesseract 5K14 and the power grid.
- Step 3** Turn off the DC switch at the bottom of the Tesseract 5K14.
- Step 4** Turn off the DC switch between the PV string and the Tesseract 5K14 if there is any.
- Step 5** If a battery connects to the battery port, turn off the battery switch.

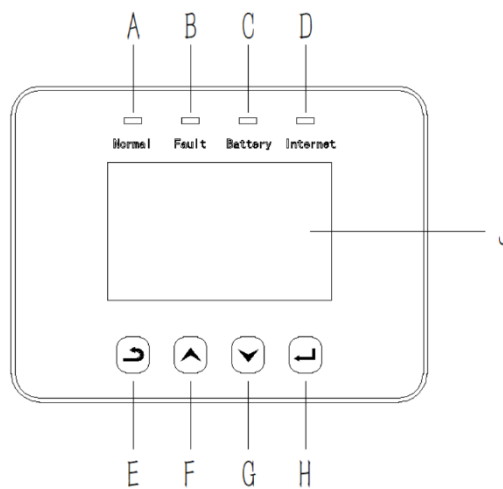
6.4 Operation Method

Context



NOTICE

- The machine will be set up when it is installed to the house by install engineer with a handle debugging tool (a handle control panel). Non-professionals are not allowed to use.

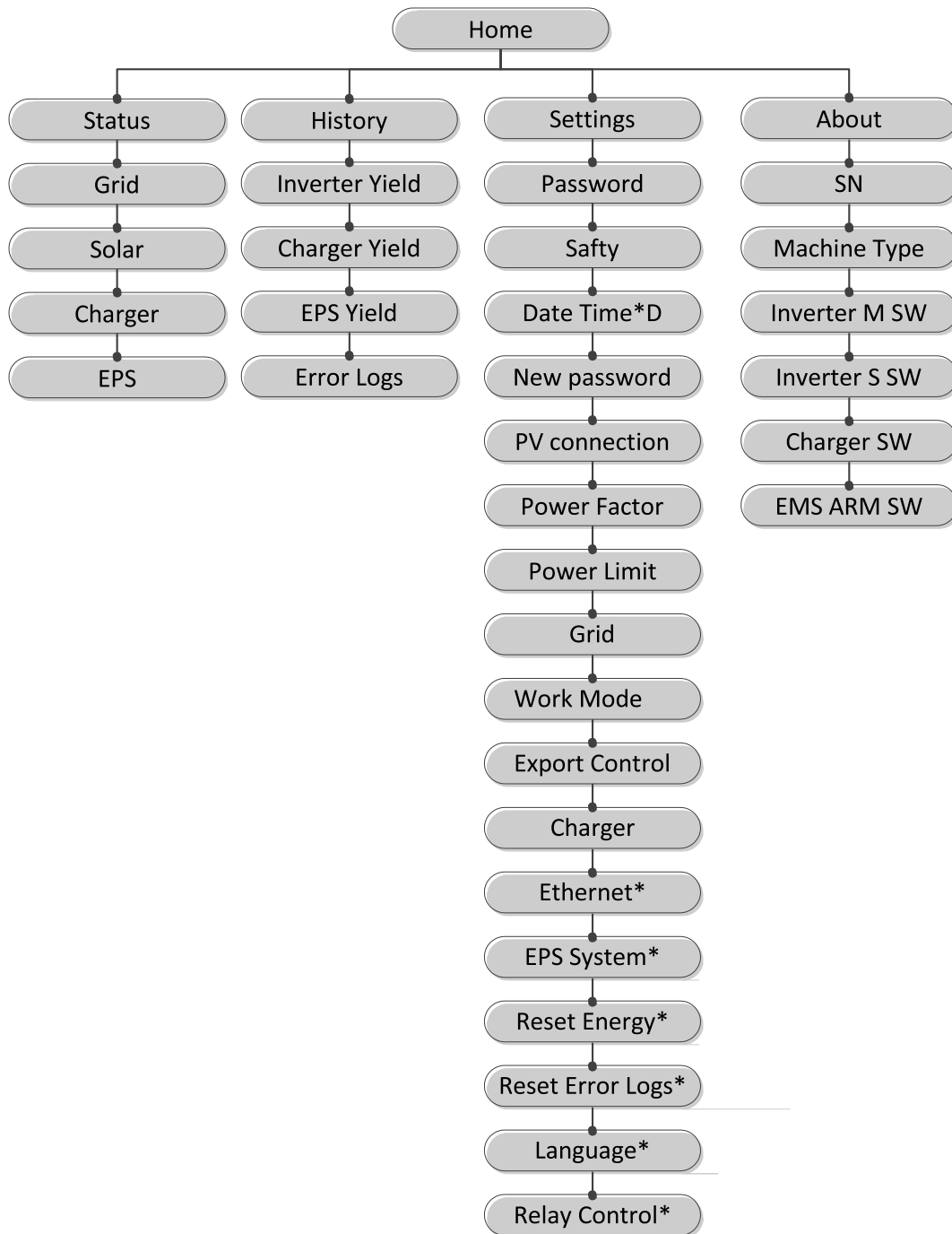


- Control Panel

Object	Name	Description
A	Indicator LED	Green: Normal working Status.
B		Red: Error
C		Blue: Battery charging or discharging
D		Yellow: Communication status.
E	Function Button	ESC button: Leave from current interface or function.
F		Up button: Move cursor to upside or increase value.
G		Down button: Move cursor to downside or decrease value.
H		OK button: Confirm the selection.
J	LCD Screen	Display the information of the inverter.

- LCD Function

Menu structure

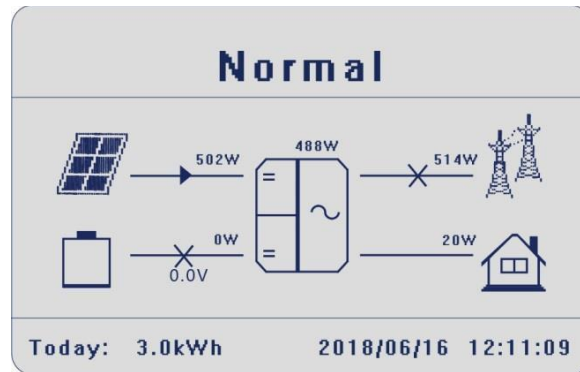


Note: * Can be set by end user. Others can only be set by the technician or installer with the installer password.

- LCD Operation
 - LCD Digital Display

The main interface is the default interface, and the inverter will automatically jump to this interface when the system starts up successfully or be not operated for a period of time.

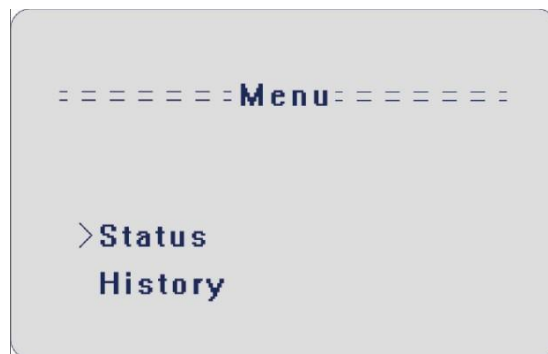
The information of the interface is as below. “Today” means the power generated within the day. “Normal” show the status of the inverter.



- Menu Interface

The main interface is a transfer interface for user to get into the other interface to finish the setting or to get the information.

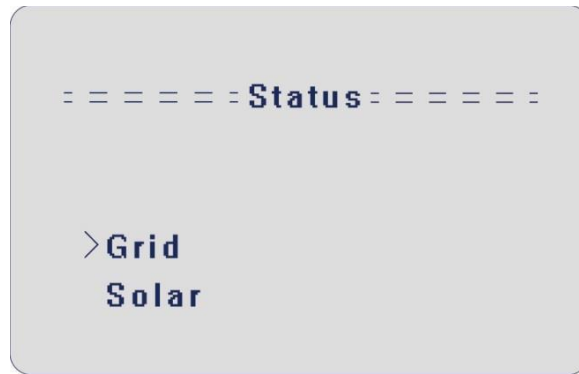
- User can get into this interface by pressing “OK” button when the LCD displays the main interface.
- User can select interface by moving the cursor with the function button, and press “OK” to confirm.



- Status

The status function contains four aspects of the inverter, grid , solar, battery and EPS.

Press up and down to select and press “OK” to confirm the selection, press “ESC” to return to the Menu.

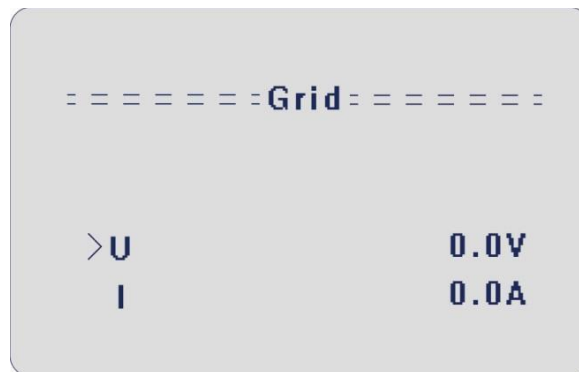


A) Grid

This status shows the real time grid condition such as voltage, current, output power and the local consumed power. Pout measures the output of the inverter, Pgrid measures the export to or import from the grid. Positive value means the energy feed into grid.

Negative value means the energy used from grid.

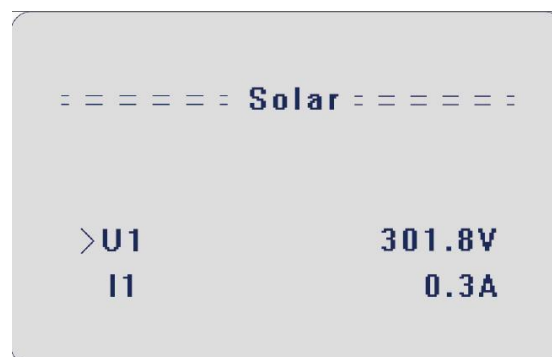
Press up and down button to review the parameter. Press" ESC" to return to status.



B) Solar

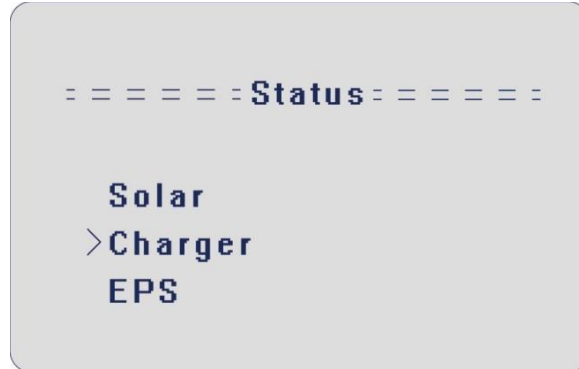
This status shows the real time PV condition of the system. The input voltage, current and power situation of each PV input.

Press up and down button to review the parameter. Press" ESC" to return to Status.



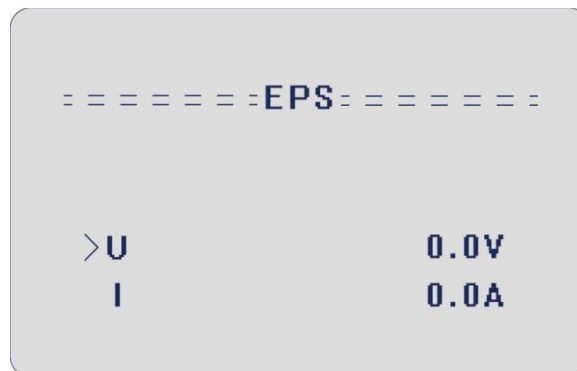
C) Charger

This status shows the charger situation of the system. Include the battery voltage, charge or discharge current. Charge or discharge power, battery capacity and battery temperature. “+” means in charging; “-” means in discharging. Press up and down button to review the parameter. Press “ESC” to return to Status.



D) EPS

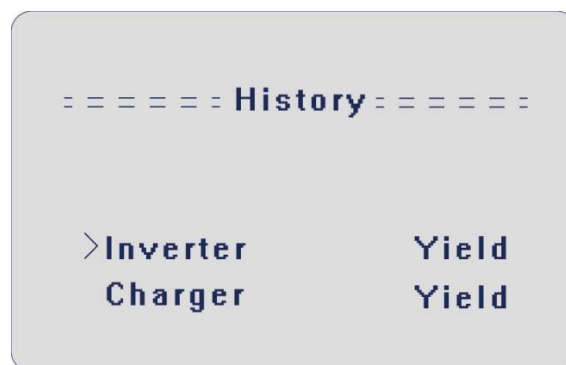
EPS will only have data when the inverter is working in EPS mode, it will show the real time data of the EPS output. As voltage , current , power, frequency. Press up and down button to review the parameter. Press”ESC” to return to Status.



- History

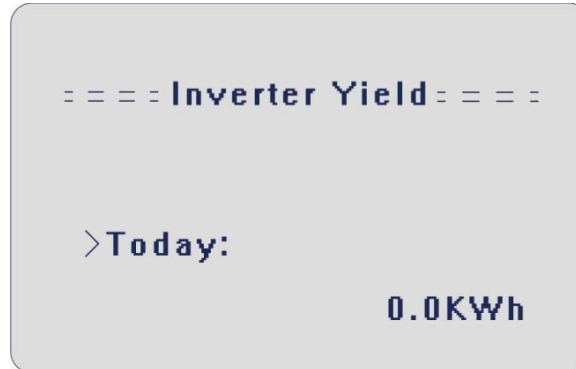
The history function contains three aspects of the information: inverter yield, charger yield and error log.

Press up and down to select, and press” OK” to confirm the selection, press”ESC” to return to the Menu.



A) Inverter Yield

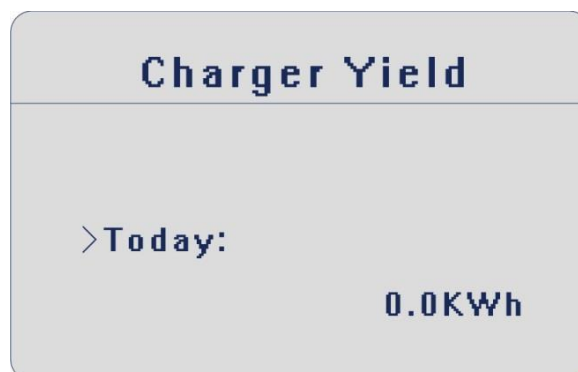
The inverter yield function contains the energy generated by today, yesterday, this month, last month and total. Press up and down button to review the parameter. Press "ESC" to return to History.



B) Charger Yield

The charger Yield function contains the energy generated from battery by today, yesterday, this month, last month and total.

Press up and down button to review the parameter. Press "ESC" to return to History.



C) Error Logs

The Error logs contain the error information happened, which can record for three items.

Press up and down button to review the parameter. Press "ESC" to return to History.



- Settings

Setting function is used for set the inverter for time, connection, battery, Ethernet, Grid and so on.

Since the function will change the inverter's parameter, the end user with the user password as "0000" have the limited authority to change the settings. We need installer password to do the most of professional setting.



A) Password

The default password is "0000" for end user , which only allow the user to review the current setting and some easy settings. If professional change is needed , please contact with the distributor or factory for the installer password.

B) Safety

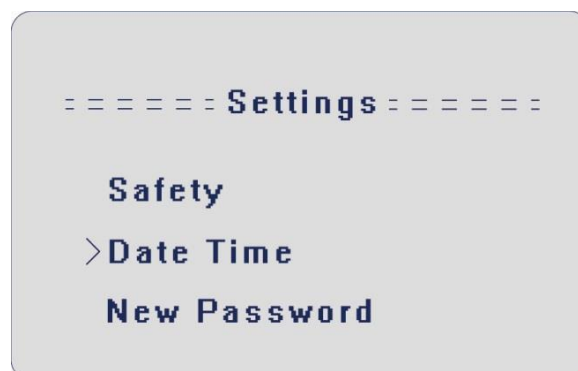
User can set safety standard according to different counties and grid tied standards. There are 19 standards for choice. (May change without notice)

All parameters are shown below.

Item	Standard	Country
1	VDE 0126	German
2	ARN 4015	German
3	AS 4777	Australia
4	G83/2	UK
5	G59/3	UK
6	C10_11	Belgium
7	OVE/ONORME 8001	Austria
8	EN 50438_NL	Netherland
9	EN 50438_DK	Danmark
10	CEB	UK
11	CEI 0-21	Italy
12	NRS097_2_1	South Africa
13	VDE0126_Greece	Greece
14	UTE_C15_712_Fr	France
15	IEC61727_In	India
16	VFR_2014_Fr	France
17	C15-712-is-60	France
18	C15-712-is-50	France
19	VDE 0126-Gr-is	Greece

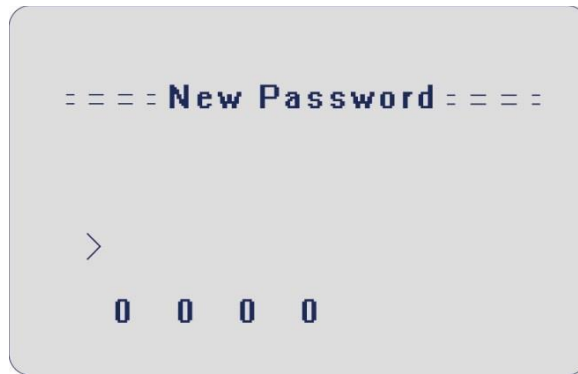
C) Date time

This interface is for user to set the system date and time. Increase or decrease the word by pressing up or down button. Press “OK” to confirm and alternate to the next word. After all the words are confirmed. Press “OK” to enter the date and time.



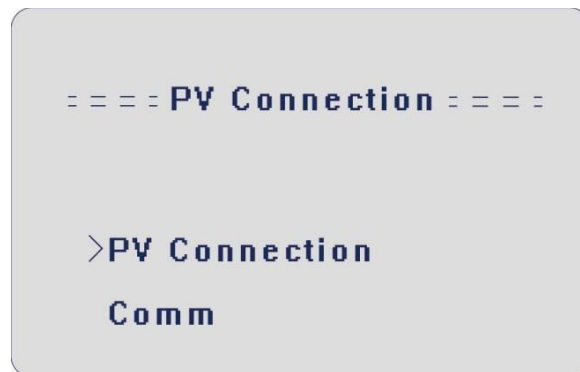
D) New Password

User can set the new password here. We need to increase or decreased the word by pressing up or down button, Press “OK” ” to confirm and alternate to the next word. After all the words are confirmed. Press “OK” to reset the password.



E) PV Connection

This function can set the mode of PV input. There are two modes for choice; Comm and Multi. The “Comm” mode means single MPP tracking, 2 MPPT working together; “Multi” means multi-MPP tracking, 2 MPPT work independently. Press up or down button to select and press “OK” to confirm.



F) Power Factor (For specific country if required by the local grid.)

There are 5 modes for selecting: Off, Under-Excited, Over-Excited, Curve, Q(u).
All parameters are shown below.

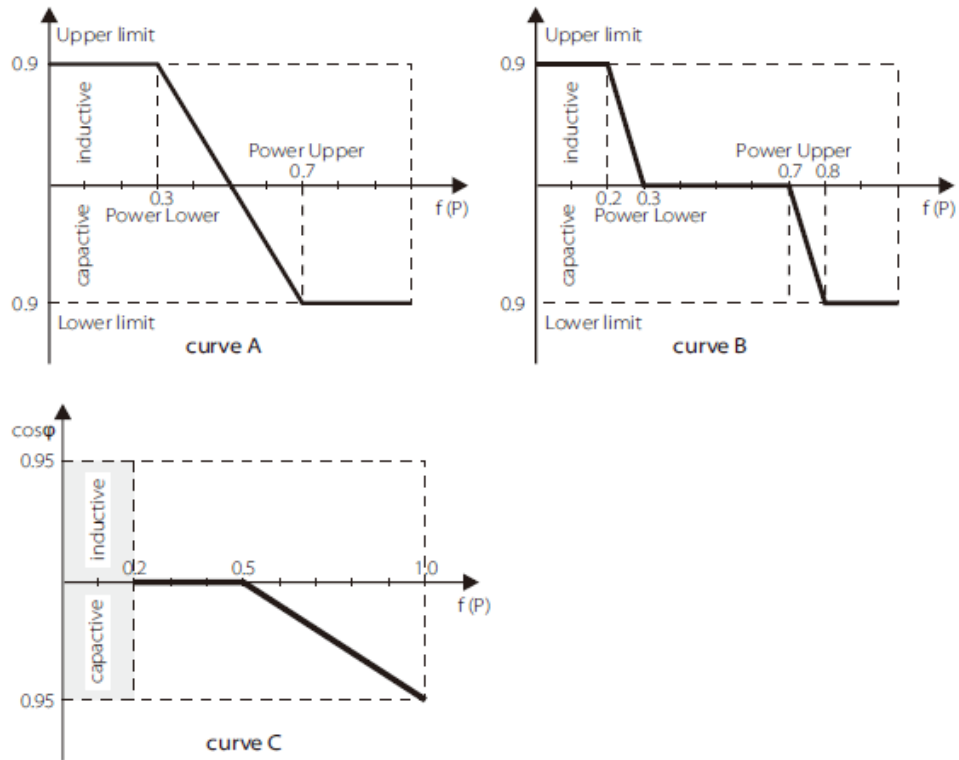
Mode	Comment
Off	-
Under-Excited	PF value
Over-Excited	PF value
Curve	Upper limit
	Lower limit
	Power Upper
	Power Lower
	PFLockInPoint (CEI 0-21 only)
	PFLockOutPoint (CEI 0-21 only)
Q(u)	QuVupRate (EN50438_NL / EN50438_DK / E8001 only)
	QuVlowRate (EN50438_NL / EN50438_DK / E8001 only)

Reactive power control, Reactive standard curve $\cos\phi=f(P)$

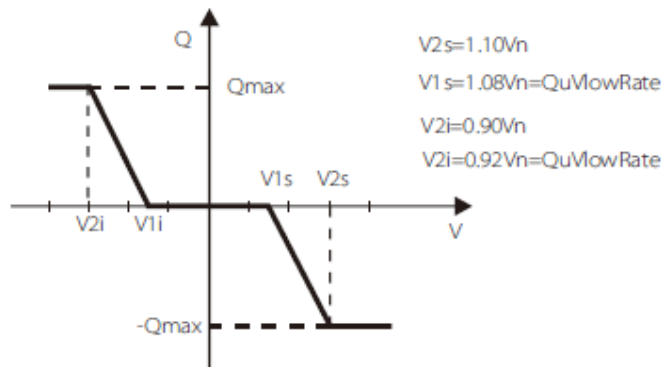
For VDE ARN 4105, curve $\cos \phi = f(P)$ should refer to curve A. default values of setting are as shown in curve A.

For E 8001, curve $\cos \phi = f(P)$ should refer to curve B. default values of setting are as shown in curve B.

For CEI 0-21, default value of PFLockInPoint is 1.05, when $V_{ac} > 1.05V_n$, and $P_{ac} > 0.2 P_n$, curve $\cos \phi = f(P)$ should refer to curve C. Default value of PFLockOutPoint is 0.98, when $V_{ac} < 0.98 V_n$, $\cos \phi = f(P)$ will exit curve C.

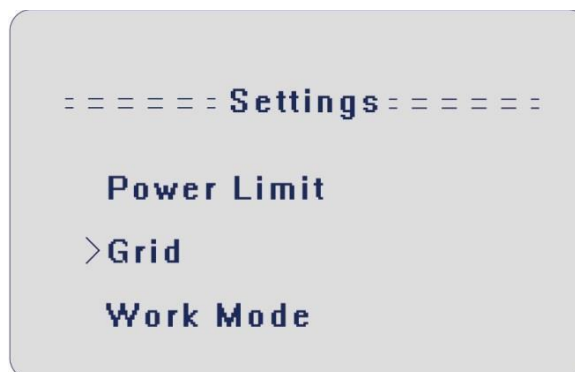


Reactive power control, Reactive standard curve $Q = f(V)$



G) Power limit

User can set the output power limitation of the inverter here, the setting value is from 0.00-1.00.



H) Grid

Usually end users do not need to set the grid parameters. All default values have been set before leaving factory according to safety rules.

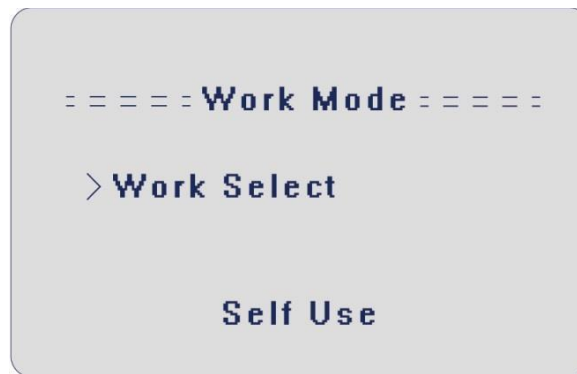
If need to reset, any changes should according to the requirement of local grid. All parameters are shown below.

Parameter	Comment
Normally	
Vac upper	Voltage high protect
Vac lower	Voltage low protect
Vac upper slow	Voltage high slow protect
Vac lower slow	Voltage low slow protect
Fac upper	Frequency high protect
Fac lower	Frequency low protect
Fac upper slow	Frequency high slow protect
Fac lower slow	Frequency low slow protect
Vac 10m avg	10 min voltage high protect
Apply to Italy(CEI0-21) only.	
Tuvp_Fast	Overvoltage protect fast time
Tovp_Fast	Undervoltage protect fast time
Tufp_Fast	Overfrequency protect fast time
Tofp_Fast	Underfrequency protect fast time
Tuvp_Slow	Overvoltage protect slow time
Tovp_Slow	Undervoltage protect slow time
Tufp_Slow	Overfrequency protect slow time
Tofp_Slow	Underfrequency protect slow time
FreDrpDlyTime	Frequency droop delay time
Apply to EN50438_NL / EN50438_DK / CE8001.	
FreqSetPoint	Frequency set point
FreqDropRate	Frequency droop rate

l) Work mode

The default work mode of the inverter is Self-Use mode. User can set the work mode as Self Use or Force Time Use here as describe in 3.1.

For the Force Time Use. User can set 2 periods of the start and end time of charger or discharge. Also can select if charging from grid for each charging period.



Parameter	Comment
Charger start time1	The start time of the first charger period.
Charger end time1	The end time of the first charger period.
Charger start time2	The start time of the second charger period.
Charger end time2	The end time of the second charger period.
Discharger start time1	The start time of the first discharger period.
Discharger end time1	The end time of the first discharger period.
Discharger start time2	The start time of the second discharger period.
Discharger end time2	The end time of the second discharger period.

J) Export control

With this function the inverter can control the energy exported to the grid. There are user value and factory value. The factory value is default which cannot be changed by user. The user value setting by installer must be less than the factory value. Press up and down button to select and press “OK”to confirm.

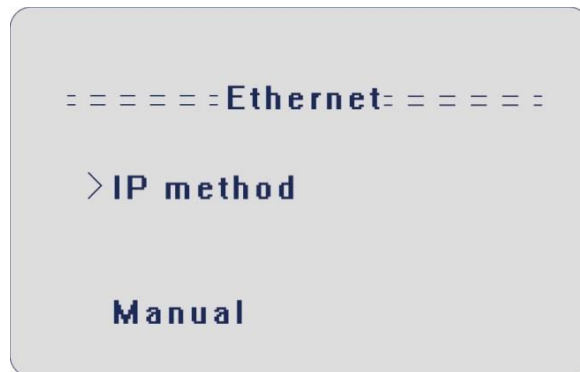


K) Charger

Here the user can set the parameters of charger; charge and discharge parameters.

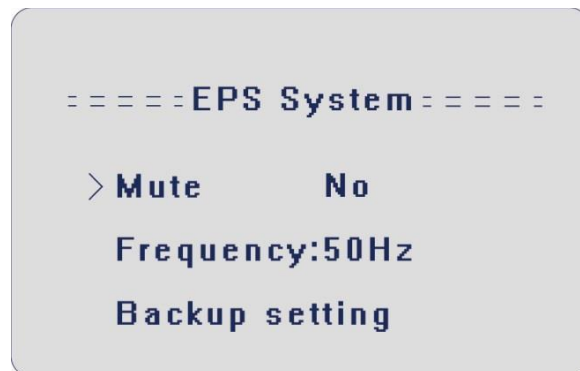
L) Ethernet

Users can set the information about Ethernet here, such as IP address, subnet mask number, and default gateway number. Press up or down button to select and press “OK” to confirm.



M) EPS system

The ESC-Hybrid inverter can work in the EPS mode. Installer can set the EPS parameters here. “Mute “means you can set the warning of system which has entered EPS mode. “No “means there will be a buzzing and it is the default value. “Yes “means you choose to shut down the warning function. Besides, if the buzzing is sharp, it means EPS output takes over loads. “Frequency “here can be set 50Hz or 60Hz please based on correlative loads. “Backup setting “here can be set “Battery backup discharge Volt”.End user can only set the “Mute” and “Frequency” here.



NOTICE

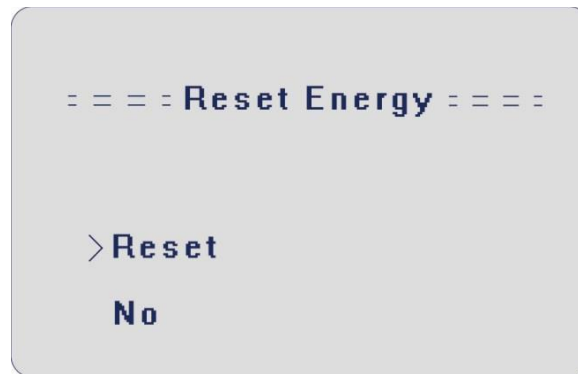
- When you want to use the EPS function, the setting of the discharge cut voltage need to be higher than the Battery backup discharge Volt.
 - The battery backup discharge Volt is the min Voltage of the battery.
-

1. In online mode, the discharge cut voltage is 47V. In EPS mode, the battery backup discharge voltage is 46V.

2. You can adjust the discharge cut voltage and the battery backup discharge Voltage or increase Min capacity to adjust the Capacity for EPS usage in case you have frequently power cut.

N) Reset energy

User can reset the energy record here. Press up or down button to select and press "OK" to confirm.



O) Reset error logs

User can reset the error log here. Press up or down button to select and press "OK" to confirm.

P) Language

User can choose the language "English" or "Deutsch" here. Press up or down button to select and press "OK" to confirm.

Q) Self-Test (applies to CEI 0-21 only)

User can test running status of inverter by choosing "Start Test". It will turn back to the Home page automatically and shows "Self-Testing..." 60 seconds later, it will display "success", which means self-test completed successfully. Then it will turn back to the "Test Report" page as below automatically and shows specific parameters.

Note: This section can be displayed and set only when choosing "CEI0-21" in safety setting.

Parameter	Comment
OvpValue	The value of over voltage protection.
OvpTime	The time of over voltage protection.
UvpValue	The value of under voltage protection.
UvpTime	The time of under voltage protection.
OfpValue	The value of over frequency protection.
OfpTime	The time of over frequency protection.
UfpValue	The value of under frequency protection.
UfpTime	The time of under frequency protection.
Ovp_AVG	The average value of over voltage protection in 10 min.
Tovp_AVG	The average time of over voltage protection in 10 min.
OfpVal2	The value of over frequency protection in restrictive mode.
OfpTime2	The time of over frequency protection in restrictive mode.
UfpVal2	The value of under frequency protection in restrictive mode.
UfpTime2	The time of under frequency protection in restrictive mode.

R) Relay Control

S) Relay Control is an optional function which can control designated load intelligently by consuming the surplus energy when feed in power reaches certain value.

For specific operation, please refer to “Load remote control installation guide”

- About

This interface shows the information of the inverter, such as series numbers and software version.



6.5 Remote monitoring



NOTICE

- Tesseract 5K14 can realize remote monitoring through 4G / Wi-Fi / Ethernet
 - Tesseract 5K14 can access the Renac Wi-Fi module and Renac remote monitoring platform by Renac Power Technology Co., Ltd. Please see the attachment "Renac Wi-Fi User Manual V2.0" for how to connect.
 - Tesseract 5K14 can also access the third part VPP platform.
-

7 Handling the Tesseract 5K14

7.1 Removing the Tesseract 5K14

Procedure

- Step 1** Power off the system by following the instructions in Section 6.3 Powering Off the System.
- Step 2** Disconnect all cables from the Tesseract 5K14, including signal cables, DC input power cables, battery cables, AC output power cables and PE cables.
- Step 3** Remove all battery packs in the battery box.
- Step 4** Remove the wiring of the battery box and the main control box.
- Step 5** Remove the main control box from the mounting bracket.
- Step 6** Remove the battery box from the mounting bracket.
- Step 7** Remove the mounting bracket.

7.2 Packing the Tesseract 5K14

If the original packaging is available, put the Tesseract 5K14 inside it and then seal it using adhesive tape.

If the original packaging is not available, put the Tesseract 5K14 inside a suitable cardboard box and seal it properly.

7.3 Disposing of the Tesseract 5K14

If the Tesseract 5K14 service life expires, dispose of it according to your local disposal rules for electrical equipment and electronic component waste.

8 Technical Specifications

8.1 DC Input

Model	Tesseract 5K14
Maximum DC Input Power	5000W
Maximum DC Input Voltage	580V
MPPT Voltage Range	100-550V
MPPT Range for Full Load	210-500V
Start-up Voltage / Initial Feeding Voltage	75V/110V
Maximum Input Current	12A/12A
Maximum Short Current	15A/15A
Number of MPPT	2
Number of DC Connection Sets per MPPT	1

8.2 AC Output

Model	Tesseract 5K14
AC Output Data (On-Grid)	
Nominal Power Output	5000W
Maximum Apparent Power Output	4600VA
Maximum AC Current Output	21.7A
Maximum Output Fault Current	43.4A
Maximum Output Overcurrent Protection	27.1A
Nominal Output Voltage/Range	230V/180-270V
Nominal Output Frequency/Range	50HZ/60HZ
Output Power Factor	0.8 leading ~0.8 lagging
Output THDi (at Nominal Output)	<3%
AC Output Data (Off Grid)	
Maximum Output Apparent Power	2300VA
Nominal Output Voltage	230V
Nominal Output Frequency	50/60HZ
Maximum Output Current	10A
Output THDi (at Linear Load)	<3%
Automatic Switch Time	<5 S
Peak Output Apparent Power	3500W

8.3 Internal Charger

Model	Tesseract 5K14
Battery Type	CATL
Nominal Battery Voltage	51.2V
Battery Voltage Range	40-60V
Maximum Charging Current	50A
Maximum Discharging Current	50A
Discharge Depth	90%
Communication Port	Can
Charging Curve	3-stage adaptive with maintenance

8.4 Efficiency

Model	Tesseract 5K14
Maximum Efficiency	97.60%
MPPT Efficiency	99.90%

8.5 General Data

Model	Tesseract 5K14
Size (Width x Height x Depth)	620 x 1750 x 210 mm
Weight	150kg
Mounting	Wall Hangings
Operating Temperature Range	-25°C ~ 45°C
Operation Altitude	4000m (>2000m derating operation)
Protection Degree	IP54
Cooling	Natural Convection
Noise	<35dB(A)
User Interface	LED
Communication Port	Ethernet (standard); RS485/4G (optional)
Warranty	10 years

8.6 Dimensions

