



PVS-18RM
PV Reverse Combiner Box
User Manual

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1 About This Manual

1.1 Applicability

This manual is applicable to PVS-18RM PV reverse combiner box which are hereafter referred to as "combiner box" unless otherwise specified.

1.2 Brief introduction

This manual is intended for combiner boxes and covers the following:

- Safety instructions
describes the safety precautions for operating and maintaining the combiner box.
- Product description
describes the overall dimensions and external composition of the combiner box.
- Installation
describes the mechanical installation and electrical connection of the combiner box.
- Routine Maintenance
describes how to replace the fuse of the combiner box.
- Miscellaneous
describes the technical data, quality assurance clauses of the combiner box and contact information.

1.3 Intended audience

This manual is intended for personnel who operate, maintain and perform other work on the combiner box. The personnel who operate the combiner box electrically should have knowledge of electricity and be familiar with the electrical schematic diagram and the characteristics of the electronic components.

1.4 Using this manual

Please read this manual carefully before using this product. Please put this manual and other materials of the module together so that relevant personnel can easily access it.

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Descriptions in this manual are subject to changes and may differ from the physical product. Please refer to the actual product purchased.

1.5 Symbols

This manual contains notices which you should observe to ensure your own personal and property safety or to ensure efficient use and optimal product performance. These notices are highlighted with appropriate symbols.

The symbols that may be used in this document are listed below. Please read carefully to make better use of this manual.

DANGER

"Danger" indicates high-risk potential hazards that, if not avoided, will lead to death or serious injury.

WARNING

"Warning" indicates moderate-risk potential hazards that, if not avoided, may lead to death or serious injury.

CAUTION

"Caution" indicates a slightly hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

"Note" indicates potential risks that, if not avoided, can lead to device malfunction or financial losses.



"Information" indicates additional information in the manual, which is an emphasis or supplement to the manual and may provide tips for users to better use the product, solve problems or save time.

Always pay attention to the hazard warnings on the machine, including:

Symbol	Description
	indicates high voltage in the machine. touching it may cause electric shock.
	indicates the temperature exceeding the acceptable range for the human body. It is prohibited to touch it in order to avoid personal injury.
	indicates a protective ground terminal. This terminal should be firmly grounded in order to ensure the safety of the operator.

2 Safety instructions

You are advised to read this chapter carefully before installing and using the combiner box. SUNGROW assumes no responsibility or quality assurance for any personal injury or device damage due to failure to observe these safety precautions.

DANGER

There is a high voltage in the PV string. Accidental contact may cause fatal electric shock or severe burns. When wiring the combiner box, you need to:

- disconnect the end of the PV string before wiring.
- follow the string manufacturer's safety instructions.

DANGER

Damaged device or system failure may cause electric shock or fire!

- Before operation, visually check the device for damage or other hazards.
- Check that other external devices or circuit connections are safe.

Make sure the device is safe before operating.

DANGER

Touching the internal terminals of the device may result in electric shock or fire!

- Do not touch the terminals or conductors connected to the inverter or string.
- Pay attention to all instructions or safety documents regarding the connection of the combiner box.

 **DANGER**

There may be a high voltage electric shock hazard inside the product!

- Note and observe the warnings on the product.
- Observe the safety precautions listed in this manual and other related documents of this device.

 **DANGER**

The grounding cable must be well connected to ground, otherwise:

- It may cause fatal electric shock to the operator in case of failure!
- The device may be damaged when struck by lightning!

 **WARNING**

Incorrect cable connection can cause damage to PV modules, combiner boxes, and inverters. When wiring, observe the following precautions:

- Wire according to the wiring drawing.
- Before wiring, measure the open circuit voltage of the string to ensure that the DC input voltage range meets the requirements of the combiner box.
- Before wiring, check the positive and negative polarity of the string and ensure that there is no ground fault.

 **WARNING**

- Operation and wiring can only be done by professional electricians or qualified personnel.
- Operations and wiring must be done in accordance with relevant national and local standards.
- Warning signs must be legible and should be replaced immediately if damaged.

⚠ WARNING

When wiring, make sure that the fastening screws of the combiner box terminal are tightened in place. If the copper core of the cable cannot be in full contact with the wiring terminal or pressed tightly, the terminal would be heated and burned after a prolonged period. Multi-strand copper core flame-retardant cables must be used, with the wire diameter not less than the recommended value in the appendix.

The screw cap of the waterproof terminal must be fastened in place, otherwise it may cause water leakage and damage the combiner box.

⚠ WARNING

Do not check or replace the fuse with load! Installation and removal of the fuse must be carried out with no load to avoid arc damage to the device personal injury.

NOTICE

After operation, be sure to lock the door.

Do not open the door cover of the combiner box frequently to avoid affecting its waterproof performance.

3 Product description

3.1 System introduction

The PV power generation system with combiner box is shown in Figure 3-1.

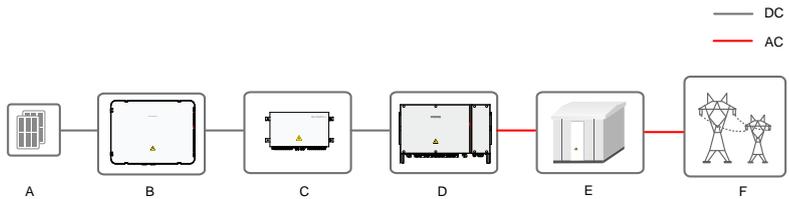


Figure 3-1 Composition of the PV grid-connected generation system

Table 3-1 Parts list

No.	Name
A	PV array
B	PV intelligent combiner box
C	PVS-18RM combiner box
D	Inverter
E	Transformer
F	Public power grid

3.2 Key features

Safety and reliability

- PV special fuse, makes the system safer
- C4 corrosion resistance level, high corrosion resistance level
- Up to IP65

Flexible solution

- Standard terminal design for ease of wiring
- 18-way terminal output, flexible design

Easy to operate and maintain

Light weight, easy to install and handle

3.3 Appearance and structure

The appearance of the DC combiner box is shown in the figure below.

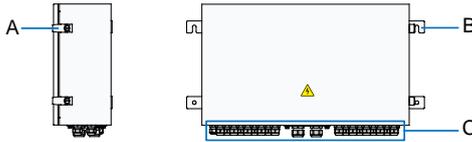
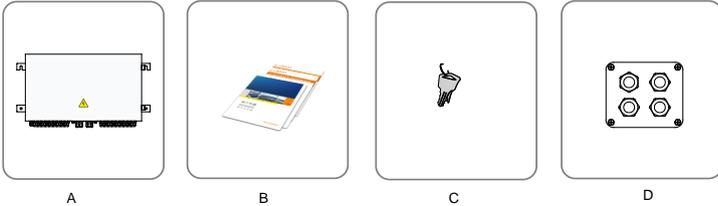


Figure 3-2 PVS-18RM appearance

No.	Name	Description
A	Door lock	-
B	Lug	Used to fix the combiner box
C	Waterproof terminal	-

4 Mechanical Installation

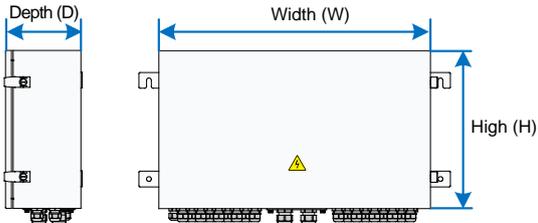
4.1 Scope of supply



No.	Name	Description	Quantity
A	Reverse combiner box	-	1
B	Related documents	Including certificate, warranty card, factory inspection report, etc.	1
C	Key	Used to open the combiner box door	1
D*	Waterproof terminal assembly	Including bottom cover and 4 waterproof terminals	1

* Optional

4.2 Dimensions



Width (W)	High (H)	Depth (D)
680 mm	400 mm	190 mm

4.3 Storage

The combiner box should be stored under specific environmental conditions when not in use:

- The combiner box with the outer package should be stored in a ventilated, dry, and clean indoor environment, with desiccant inside.
- The container should be able to withstand the weight of the combiner box with the package.
- The number of stacks of multiple combiner boxes must not exceed the "stack limit" marked on the outer box.
- The packing box must not be inclined or upside down.
- The storage environment should be well ventilated and free from moisture. Accumulated water is not allowed in the storage environment.
- Storage temperature range -40°C ~ $+70^{\circ}\text{C}$, relative humidity range 0~95%, no condensation.
- Pay attention to possible hazards in the surrounding environment, such as sudden temperature changes or collisions, to prevent any damage to the combiner box.
- The device which has been stored for more than half a year must be fully inspected and tested by professionals before it can be put into operation.
- Regular inspections, generally not less than once a week. Check that the packaging is not damaged and prevent any damage that may be caused by pests and animals. Replace the packaging immediately if it is damaged.

NOTICE

Storage without packaging is prohibited!

Storage outdoors or in direct sunlight is prohibited!

Tilt or stacking on the chassis is prohibited!

NOTICE

Before installing the combiner box which has been stored for a prolonged period, a thorough inspection is required to ensure the combiner box is in good condition. If necessary, it must be tested by professionals before installation.

4.4 Installation

4.4.1 Installation environment requirements

The combiner box features IP65 and is suitable for outdoor or indoor installation. The following requirements should be met:

- The installation location should fully consider its dimensions and weight (see the parameter chapter for details).
- The installation environment temperature should be between $-40^{\circ}\text{C}\sim+60^{\circ}\text{C}$, and the relative humidity should be between 0~99%. The combiner box should be installed in a dry, well-ventilated and dust-proof place.
- Never install the combiner box in a place exposed to direct sunlight, otherwise the high temperature will reduce the yield of the system and may also affect the service life of the combiner box.
- For large-scale power plant projects, the combiner box should be installed in a dark place on the PV module mounting bracket.
- For better heat dissipation and ease of routine maintenance, sufficient space should be reserved for installing the combiner box.

NOTICE

During the installation, moisture would cause damage to the combiner box. Do not install the combiner box in rainy day or high air humidity.

After installation, the waterproof terminal must be tightened to prevent water vapor from entering. After wiring, the unused terminals must be blocked.

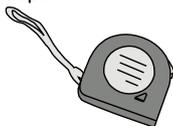
4.4.2 Installation tool preparation

General tools

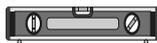
Marker pen



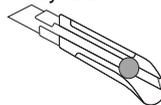
Tape



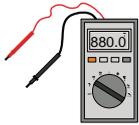
Level ruler



Utility knife



Multimeter
Range:
≥1000Vdc



Anti-static wrist strap

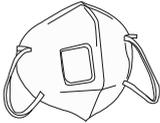


Protective gloves

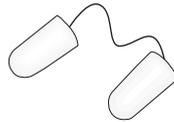


-

Dust mask



Sound insulation earplugs



Goggles



Insulated shoes



Vacuum cleaner



Heat-shrink tube



Hot air gun



-

Installation tool

φ11 impact drill



M10 electric screwdriver



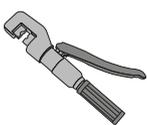
M10 screwdriver



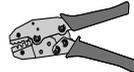
Wire stripper



Hydraulic clamp



Crimping tool



MC4 terminal wrench

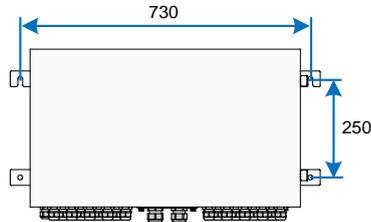


Wire cutter



4.4.3 Installation method

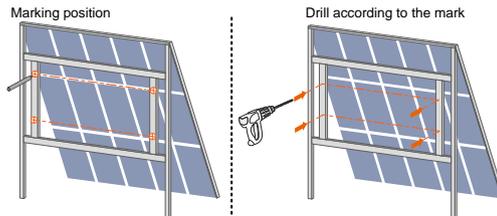
When installing the combiner box, fix it to the installation plane through the lugs on its both sides. The hole distance of the lugs on its both sides is shown in the figure below.



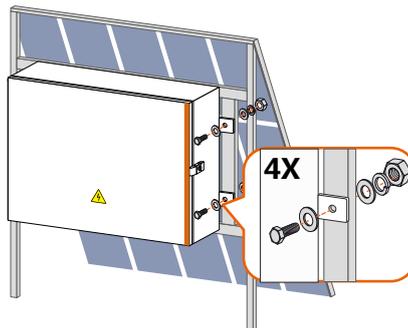
Wall mounting

Step 1 Measure the distance between the lugs on its both sides.

Step 2 On the plane on which the combiner box is to be installed, mark the position of the mounting hole and drill.



Step 3 Fix M10 bolts, flat washers, lugs, brackets, flat washers, spring washers, and nuts in order. The torque is 34~40N.m.



5 Electrical Installation

5.1 System diagram overview

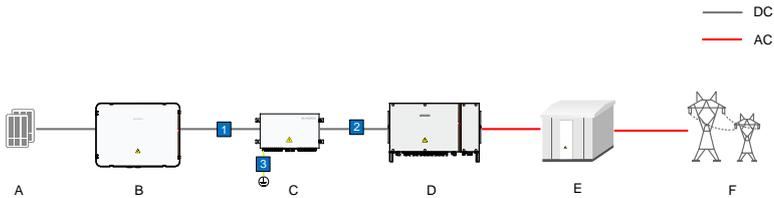


Table 5-1 Device list

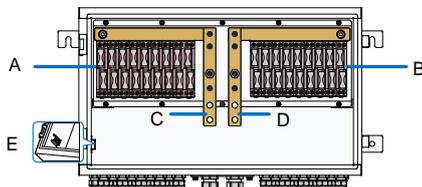
No.	Description
A	PV module
B	PV intelligent combiner box
C	Reverse combiner box
D	PV grid-connected inverter
E	Transformer
F	Power grid

Table 5-2 Cable designation

No.	Description	Wiring Method
1	Input cable, connect to PV intelligent combiner box	Refer to “5.5.1 Input wiring”
2	Output cable, connected to PV grid-connected inverter	Refer to “5.5.2 Output wiring”
3	Grounding Cable	Refer to “5.5.3 Grounding”

5.2 Internal structure

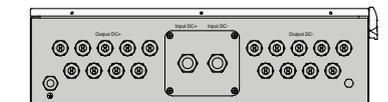
Taking PVS-18RM for example, the internal structure of the combiner box is shown in the figure below.



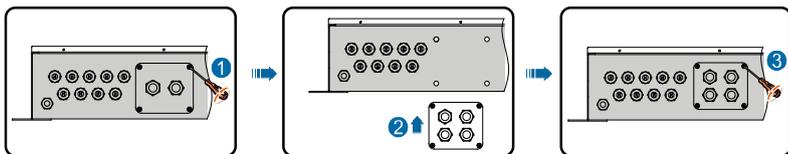
No.	Description
A	Positive output fuse box and fuse
B	Negative output fuse box and fuse
C	Positive input terminal
D	Negative input terminal
E	Grounding point

5.3 Waterproof terminal

Land pattern



There are two input waterproof terminals on the bottom of the standard combiner box. To connect four waterproof input terminals, it is necessary to install waterproof terminal assemblies. For details on installation, refer to the figure below.



Waterproof terminal model

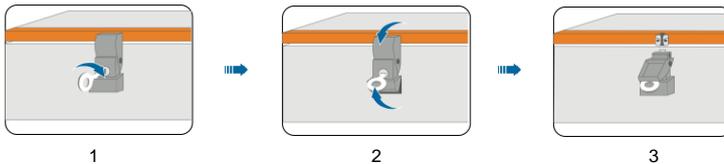
Tag	Description	Model	Cable OD (mm)
INPUT DC+	Positive input waterproof terminal	PGB25*	16~20
		PGB29**	18~25
INPUT DC-	Negative input waterproof terminal	PGB25*	16~20
		PGB29**	18~25
	Grounding waterproof terminal	PG-16	10~14
OUTPUT DC+	Positive output waterproof terminal	MGB24-H2	4.5~6
OUTPUT DC-	Negative output waterproof terminal		

*For the version with four input waterproof terminals.

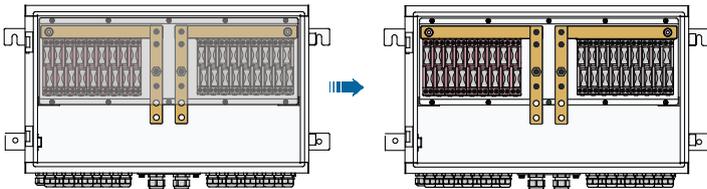
**For the version with two waterproof terminals.

5.4 Preparation before wiring

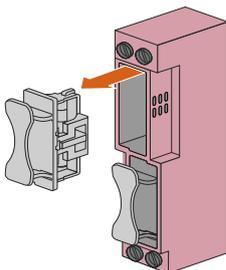
Step 1 Open the combiner box.



Step 2 Remove the protective cover.



Step 3 Remove the fuse cover.

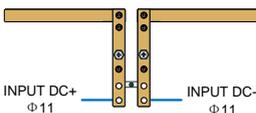


5.5 Wiring

5.5.1 Input wiring

Wiring Area Overview

Input wiring hole, as shown in the figure below.



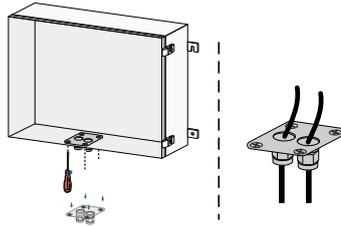
Input the rated current of the copper bar 300A. When selecting the cable specifications, this parameter must be taken into consideration.

For the cable size less than 0AWG or greater than 50mm², refer to “**Wiring scheme 1**” for wiring.

For the cable size greater than 0AWG or less than 50mm², refer to “**Wiring scheme 2**” for wiring.

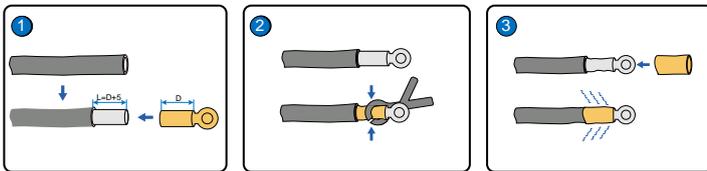
Wiring scheme 1

Step 1 Use a screwdriver to remove the waterproof terminal assembly from the bottom of the combiner box (take the version with two waterproof terminals for example, follow the same the wiring method for the version with four waterproof terminals).



Step 2 Pass the cable with the wire designation "DC+" through the waterproof terminal "INPUT DC+", and reserve an appropriate length margin.

Step 3 Strip the protective layer and insulation layer of the cable to expose the copper core of the wire $L \approx 25\text{mm}$, crimp the cable to an appropriate DT terminal, and insert it into a heat shrink tube.



Step 4 Fix the crimped DT terminal to the input terminal.

For copper wire, the fixing method is as shown in the figure below, and the tightening torque is 34~40N.m.

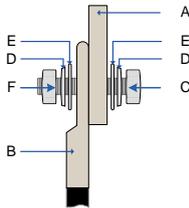


Figure 5-1 Copper wire connection diagram

A	B	C	D	E	F
Copper bar	Copper connecting terminal	M10 bolt	Spring cushion	Flat washer	Nut

For aluminum wire, the fixing method is as shown in the figure below, and the tightening torque is 34~40N.m.

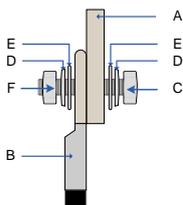
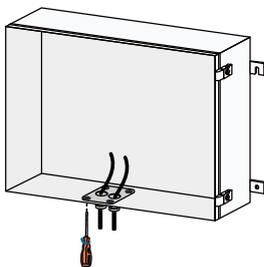


Figure 5-2 Aluminum wire connection diagram

A	B	C	D	E	F
Copper bar	Copper aluminum transition terminal	M10 bolt	Spring cushion	Flat washer	Nut

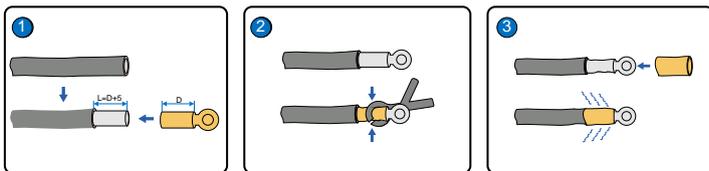
Step 5 Install the waterproof terminal assembly to the bottom of the combiner box.



Wiring scheme 2

Step 1 Pass the cable with the wire designation "DC+" through the "INPUT DC+" waterproof terminal, and reserve an appropriate length margin.

Step 2 Strip the protective layer and insulation layer of the cable to expose the copper core part of the wire $L \approx 25\text{mm}$, crimp the cable to an appropriate DT terminal, and put it into a heat shrink tube.



Step 3 Fix the crimped DT terminal to the input terminal.

For copper wire, the fixing method is as shown in the figure below, and the tightening torque is 34~40N.m.

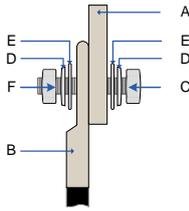


Figure 5-3 Copper wire connection indication

A	B	C	D	E	F
Copper bar	Copper connecting terminal	M10 bolt	Spring cushion	Flat washer	Nut

For aluminum wire, the fixing method is as shown in the figure below, and the tightening torque is 34~40N.m.

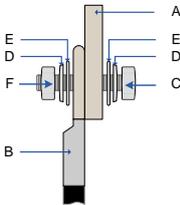


Figure 5-4 Aluminum wire connection indication

A	B	C	D	E	F
Copper bar	Copper aluminum transition terminal	M10 bolt	Spring cushion	Flat washer	Nut

Step 4 Tighten the nut of the waterproof terminal clockwise.

5.5.2 Output wiring

Safety precautions

⚠ DANGER

There is a high voltage in the PV string. Accidental contact may cause fatal electric shock or severe burns. When wiring, you need to observe the following safety precautions:

- disconnect the end of the PV string before wiring.
- follow the string manufacturer's safety instructions.

⚠ WARNING

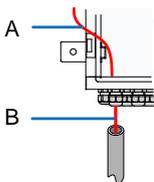
Improper cable connection may cause damage to the PV module, combiner box, and inverter. When wiring, observe the following precautions:

- Wire according to the wiring drawing.
- Before wiring, use a multimeter to measure the positive and negative polarity of each channel to ensure that there is no reverse connection.
- Before wiring, check the positive and negative polarity of the string and ensure that there is no ground fault.

Wiring steps

Step 1 Unscrew the waterproof terminals "OUTPUT DC+" and "OUTPUT DC-".

Step 2 Pass the cable with the wire designation "PV1+" through the galvanized conduit, to the waterproof terminal in the "OUTPUT DC+" area, and connect to the "PV1+" terminal in the combiner box. The cable should be reserved with an appropriate length margin so that it can be bent or fixed easily inside the combiner box.



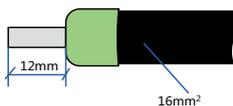
No.	Description
A	Cable ("PV1+", "PV2+"... "PV1-", "PV2-", etc.)
B	Threading tube

Step 3 Stripping. Use wire strippers to strip the insulation layer of the wire to expose the copper core.

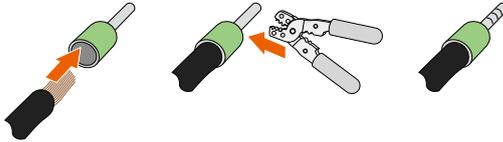
NOTICE

When stripping, do not strip the copper wire to avoid affecting the electrical performance of the wire.

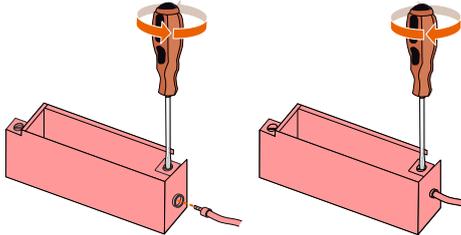
Choose the European tubular terminal according to the cable. For example: LT160012, where 16 denotes the crimping wire diameter 16mm², and 12 denotes the crimping tube length of the terminal is 12mm.



Step 4 Crimping. Insert the cable without the insulation layer into the European tubular terminal, and use a special crimping tool to crimp.



Step 5 Connect the cable and tighten it according to as shown in the figure below. The tightening torque is 1.4-1.6N.m.



Repeat the same steps to connect the remaining terminals.

5.5.3 Grounding

Safety Instructions

⚠ WARNING

The grounding cable must be well grounded, otherwise:

- It may cause fatal electric shock to the operator in case of failure!
- The device may be damaged by lightning!

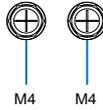
NOTICE

The grounding must comply with relevant grounding standards and regulations.

- The grounding cable must be firmly and reliably connected to the device and the grounding electrode.
- The ground resistance measured after the grounding is complete shall not be greater than 1Ω.

Grounding holes

A riveted screw should be installed on the grounding hole inside the combiner box. The riveted screw is M4. The location is as shown in the figure below.



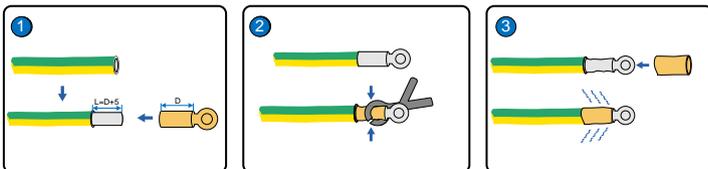
It can be installed in the corresponding riveted screw hole according to the actual needs.

Table 5-3 Comparison table of grounding hole and wiring requirements

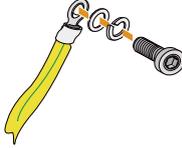
Pressure riveting screw specifications	M4
Recommended cable specifications	16mm ²
Stripping length L	15mm
Tightening torque	3N.m

Wiring steps

- Step 1** Loosen the lock nut of the grounding waterproof terminal “” of the combiner box.
- Step 2** Pass yellow and green wires through the waterproof terminal “” to the wiring terminal inside the combiner box, reserve an appropriate length margin.
- Step 3** Use a wire stripper to strip the protective layer and insulation layer of the cable to expose the copper core of the wire. For the specific stripping length, refer to the “Table 5-3 Comparison table of grounding hole and wiring requirements”.
- Step 4** Crimp the OT terminal.



Step 5 Fix screw, spring washer, flat washer, OT terminal and ground hole to the ground point in order. For tightening torques, refer to “Table 5-3 Comparison table of grounding hole and wiring requirements”.



Step 6 Tighten the nut of the waterproof terminal clockwise.

6 Power Up/Down

6.1 Power up

Step 1 Close the output pre-switch of the combiner box.

Step 2 Use a multimeter to measure the positive and negative polarity of each input in the combiner box to ensure that the voltage is basically the same, and there is no reverse polarity.

Step 3 Close the post-switch on DC side of the inverter.

Step 4 Lock the door and pull out the key.

6.2 Power down

Step 1 Disconnect the p-switch on DC side of the inverter.

Step 2 Disconnect the output post-switch of the combiner box.

Step 3 Lock the door and pull out the key.

7 Routine Maintenance

The internal devices of the combiner box would be aging and wearing due to the ambient temperature, humidity, dust and vibration, which may cause potential failures to the combiner box.

WARNING

Only qualified electricians are allowed to perform the maintenance as described in this chapter.

NOTICE

Do not leave screws, washers or other metal parts in the combiner box after maintenance, or they may damage the device!

Before maintaining the hardware of the combiner box, the combiner box must be powered off to ensure that the parts to touch are not live.

7.1 Replacing the fuse

Safety Instructions

WARNING

After the fuse is blown, it cannot be restored, and must be replaced by a qualified operator immediately.

The fuse replacement must be of the same grade as the original one!

Power down

Power down the combiner box by referring to "6.2 Power down",.

Replacement

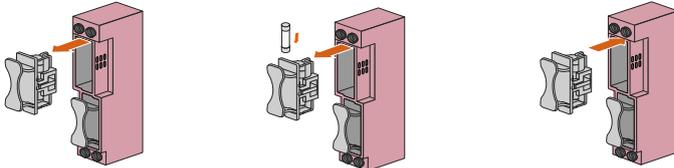


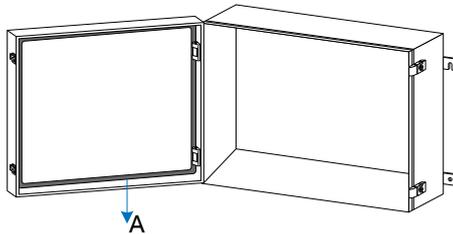
Figure 7-1 Fuse replacement diagram

⚠ WARNING

After replacing the fuse, be sure to close the fuse cover tightly!

7.2 Replacing the sealing strip

It is recommended to regularly inspect the internal sealing strip of the combiner box, which is located in the door cover of the combiner box, see "A" shown in the figure. If there is any non-man-made damage, contact SUNGROW immediately to replace the door cover and sealing strip.



8 Appendix

8.1 Basic parameters

Item	Parameter
Maximum input voltage	1000 Vdc
Maximum number of input channels	2
Maximum number of output channels	18
Maximum output current per string	13A
Fuse rated current	15 A
Maximum input current	234A
Input terminal type	PG waterproof terminal (maximum 240 mm ²)
Output terminal	PG waterproof terminal (maximum 240 mm ²)
IP	The rest: IP65 Case part: Type 4X
Ambient temperature	-40 ~+ 60 °C
Ambient humidity	0~95% (no condensation)
Dimensions (width x height x depth)	680 x 400 x 190 mm
Weight	20kg
Shell material	Metal
Anti-corrosion grade	C4
Altitude	Up to 4000m (derating greater than 3000m)

8.2 Warranty

The warranty period of this product shall be subject to the contract. For products that malfunction during the warranty period, Sungrow Power Supply Co., Ltd. (hereinafter referred to as "SUNGROW") shall repair or replace it with new products free of charge.

Evidence

If the product is within the warranty period, the customer shall provide the product purchase invoice and date. In addition, the trademark on the product should be legible. Otherwise, SUNGROW has the right to refuse to honor the warranty.

Conditions

- The unqualified products shall be disposed of by SUNGROW after replacement.
- The customer shall allow reasonable time for SUNGROW to repair the malfunctioning device.

Exemption from liability

Under the following circumstances, SUNGROW has the right to refuse to honor the warranty:

- Where the warranty period for the entire machine/module has expired.
- Where the device is damaged during transportation.
- Where the device was improperly installed, refitted, or used.
- Where the device is operated in extremely harsh environment as described in this manual.
- Where the fault or damage is caused by installation, repairs, modification, or disassembly performed by a service provider other than SUNGROW.
- Where the fault or damage IS caused due to the use of non-standard or non-SUNGROW components or software.
- Where the product is installed and used outside the range stipulated in relevant international standards.
- Where the damage is caused by an abnormal natural environment.

If the product failure is caused by any of above circumstances and the customer requests repair, SUNGROW may provide paid maintenance service after judgment by SUNGROW's service department.

8.3 Contact information

If you have any questions about this product, do not hesitate to reach out to us. In order to be more responsive and provide you with better after-sales service, please specify the following information:

- Device model
- Device SN
- Fault code/name
- Brief description of the fault

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