

PV Combiner Box

WENZHOU LONGQI NEW ENERGY TECHNOLOGY CO.LTD

Overview

This document primarily describes the installation, electrical connection commissioning, maintenance, and troubleshooting procedures for the LQX series PV combiner box. Before installation and use, please carefully read this manual to understand the safety information and familiarize yourself with the combiner box's functions and features.

Applicable Personnel

This manual applies to:

- Installation and maintenance personnel
- Users

Manual Usage

Please read this manual carefully before using this product. Keep this manual and other documentation included with the product components together and ensure that relevant personnel can easily access and use them.

Interpretation of symbols

The following symbols may appear in this document, and their meanings are as follows:

Symbol	Instruction
 Danger	Used to warn of an emergency hazard that, if not avoided, will result in death or serious injury.
 Warning	Used to warn of potentially hazardous situations that, if not avoided, could result in death or serious personal injury.
 Caution	Used to warn of potentially hazardous situations that, if not avoided, could result in moderate or minor personal injury.
 Notice	Warning indicates a situation that, if not avoided, will result in equipment failure or property damage.



Comments provide additional information, emphasize content, or offer hints to help you solve problems or save time.

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1 Safety Instructions

Please read this section carefully when installing and using the PV Combiner box, if the operation is not in accordance with the safety matters in this manual resulting in injury or damage to the equipment. In case of injury or damage to the equipment caused by failure to follow the safety instructions in this manual, we reserve the right to exclude responsibility and warranty.

Danger

- Only professional electricians or qualified personnel may operate and wire the product.
- All operation and wiring must comply with the requirements of the relevant national and local standards.
- Warning labels must be clearly visible and should be replaced immediately if damaged.

Danger

PV strings are subject to high voltages and accidental contact can result in a fatal shock hazard or severe burns. When wiring the PV Combiner box, the following safety precautions need to be observed. The following safety precautions should be observed when wiring the PV Combiner box:

- Disconnect the end of the PV string before wiring.
- Do not use an ordinary multimeter to measure the DC side voltage before wiring, it is recommended to use a multimeter with a voltage withstand level of not less than 1500V to measure the voltage on the DC side before wiring.
- Follow all safety instructions of the panel manufacturer.

Danger

There may be a risk of high voltage shock inside the product!

- Observe and comply with the warning labels on the product.
- Observe the safety precautions listed in this manual and other relevant documents for this equipment.

 **Danger**

Damaged equipment or system failure could cause electric shock or fire!

- Initially visually inspect the equipment for damage or other hazardous conditions before operation.
- Check that other external equipment or circuit connections are in a safe condition.

Make sure that the equipment is in a safe condition before operating.

 **Danger**

Touching the unit's internal terminals may result in death by electric shock or fire and combustion!

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

 **Warning**

Incorrect cable connections can lead to damage to the PV panels, converter box and inverter. Observe the following precautions when wiring:

- Follow the wiring drawings.
- Measure the open-circuit voltage of the string before wiring, and make sure that the DC input voltage range meets the requirements of the combiner box.
- Before wiring, identify the positive and negative polarity of the string and make sure there is no ground fault.

Warning

The grounding cable must be well earthed, otherwise:

- Risk of fatal electric shock to the operator in the event of a malfunction!
- In the event of a lightning strike, damage to the equipment may result!

Warning

Before checking and replacing the fuse, operation with load is prohibited! Installation and removal of fuses must be carried out without load to avoid arcing damage to the equipment and accidental injury to persons.

Arc damage to the equipment and personal injury can be avoided.

Warning

When wiring, make sure that the fastening screws of the busbar terminals are tightened in place. If the copper core of the cable is not sufficiently contacted with the terminals and pressed tightly, the terminals will burn out after a long period of time!

If the copper core of the cable is not sufficiently contacted with the terminals and pressed tightly, prolonged operation will cause the terminals to heat up and burn out! Use multi-stranded copper flame-retardant cables with a wire diameter of not less than the recommended value in the appendix.

Use multi-stranded copper flame retardant cable with wire diameter not less than the recommended value in the catalogue.

The nuts of the waterproof terminals must be tightened in place, otherwise it may lead to water leakage and cause damage to the busbar.

2 Product Introduction

2.1 Product Overview

2.1.1 Overview

The LQX PV combiner box is a critical component in photovoltaic power generation systems, primarily designed to aggregate and output the DC power from multiple PV strings. It integrates components such as circuit breakers (MCB, or disconnect switches), surge protection devices, fuses. Its core functions include circuit convergence, overload and short-circuit protection, lightning strike prevention, and circuit switching. It effectively enhances system reliability and facilitates operation and maintenance management, making it widely applicable in various types of photovoltaic power plants.

2.1.2 Application scenario

Photovoltaic combiner boxes are frequently used between photovoltaic arrays and inverters (as shown in Figure 2-1) to serve as convergence circuit and protective devices. The entire photovoltaic system typically consists of photovoltaic arrays, photovoltaic combiner boxes, monitoring modules, inverters, batteries, battery protection boxes, AC distribution panels, the utility grid, and loads.

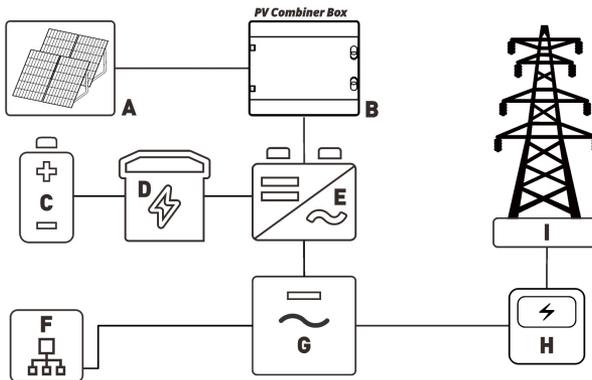


Figure 2-1

No.	Device	No.	Device
A	PV arrays	F	Load
B	PV combiner box	G	AC Distribution Box
C	Battery Pack	H	Bidirectional Meter
D	Battery Protection Box	I	Power grid
E	Inverter		

2.1.3 Product Detailed Parameters

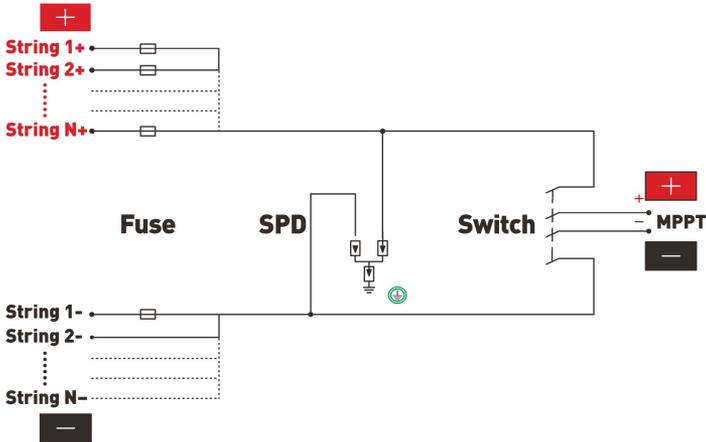
LQX - □/□ **DC** □ **V -** □□

①
②
③
④
⑤
⑥

Code name	Meaning
①	CNLonQcom Metal Busbar Box
②	Up to 6-string input
③	Up to 4-string output
④	Rated voltage
⑤	Input connector: M: MC4, P: PG
⑥	Output connector: M: MC4, P: PG

2.1.4 Circuit Diagram

● General Wiring Diagram

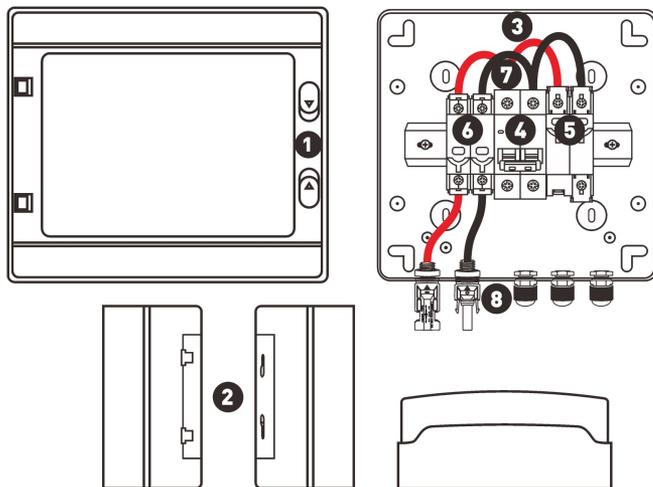


2.1.5 Technical data

Product Name	PV DC Combiner Box
Model	LQX-□/□DC□V-□□
Standard Composition	MCB or isolator and SPD and fuse
Function	circuit isolation, overload protection, short circuit protection, surge protection. lightning protection.
Number of input strings	1~6 strings optional
Number of output strings	1~4 strings optional
Rated Voltage (Ue)	DC500V, 1000V optional
Maximum input current per string	10A, 15A, 20A, 25A, 30A optional
Maximum output current per string	32A~125A optional
In (8/20)us	20kA
I_{max} (8/20)us	40kA
Protection Level (Up)	2.2kV, 3.6kV optional
Impulse Withstand Voltage (U_{imp})	MCB:4kV, Isolator:8kV
Breaking Capacity (I_{cu})	MCB:6kA, Isolator:8kA
Quality Certificate	CE, TUV, CB, AZ, UKCA, ISO, IP65, RoHS, IEC
Standard	IEC60947-3, IEC60947-2, IEC61643-31, IEC60269-6
Protection Level	IP65
Impact Level	IK10
Material	PC+ABS(box)
Operating Temperature	-25°C~+60°C
Humidity	≤95%, no condensation
Installation	Wall Mounting
Altitude	2000m

2.2 Product Composition

2.2.1 Product Portfolio

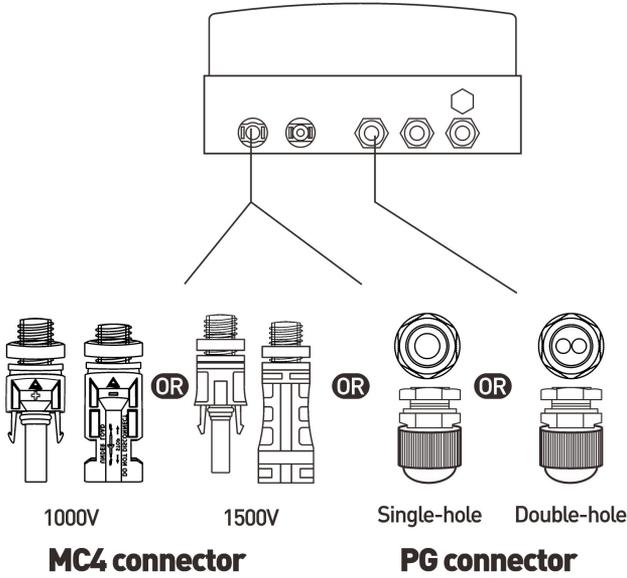


● Picture Example Model LQX-1/1DC500V-MP

Serial	Part Description	Model Number
1	Spring clip	Cannot be customized by default
2	Transparent front cover	Cannot be customized by default
3	Housings	A. PC+ABS
4	Miniature Circuit Breaker	A. LQB1-63Z B. LQB1-125Z C. LQL7-PV
	Isolator Switch	D. LQS3-63 E. LONQ-40.X F. LONQ-40.I
5	Surge Protective Device	A. LD3 B. LD1
6	Fuse	A. LQR3-32 B. LQR3-32X C. LQPV-32 D. LQPV-32X
7	Pre-terminated cable	A. PV-F B. BVR C. RV
8	Connector	A. PG B. PVCNT-BD

Note Module areas are all customizable, please contact us for other requirements.

2.2.2 Connector Components



- Different PV combiner boxes use different interfaces. The image is for reference only. Custom interface types are also available. Actual product specifications prevail.

3 Installation Instructions

3.1 Pre-installation Inspection

1. Visual Inspection:

Inspect the combiner box enclosure for any deformation, damage, cracks, or severe scratches caused during transportation. Check whether the box door operates smoothly and whether the sealing gasket is intact and free from detachment.

2. Internal Component Inspection:

Open the enclosure door and inspect the main components inside, such as circuit breakers, surge arresters, and fuses, for signs of loosening or damage. Check the busbars and terminal blocks for oxidation or corrosion.

3. Accessories and Documentation Verification:

Verify all accessories (Installation screws, spare fuses, MC4 tools, etc.) are complete by checking against the packing list.

Confirm that all technical documentation included in the box (such as electrical schematics, manuals, and certificates of conformity) is present.



Notice

Do not install the LQX during rainy or humidity days.

Screw the water-proof terminals tightly to prevent moisture penetration no matter vertical installation or horizontal installation. Seal the unused terminals after cable connection.

3.2 Select installation location

3.2.1 Environmental Conditions

Prioritize dry locations: Avoid installation in low-lying areas prone to water accumulation or potential flooding from rainwater (IP65 cannot maintain long-term waterproofing when submerged).

Avoid drip paths: Do not install beneath eaves drainage outlets or in locations susceptible to direct exposure to rooftop runoff.

3.2.2 Ventilation and Heat Dissipation

Avoid enclosed spaces: Junction boxes generate heat during operation, especially under high current conditions. Install them in well-ventilated areas to facilitate natural heat dissipation.

Keep away from heat sources: Position them away from other heat-generating equipment (such as inverter exhaust vents, water heaters, etc.) and avoid placing them adjacent to inverters.

3.2.3 Near the component array and inverter

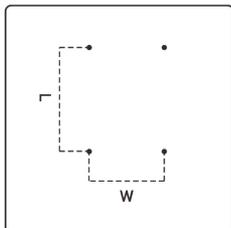
PV combiner boxes should be positioned as close as practicable to the photovoltaic strings to minimise the length of DC-side cables, thereby reducing line losses and costs. At the same time, the distance to the inverter must be considered to ensure a reasonable output cable routing.

3.2.4 Easy to operate and maintain

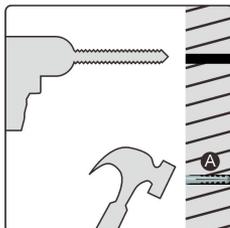
Allow sufficient space: The Box door should open fully (typically over 90 degrees), with adequate clearance in front (recommended minimum of 0.5 meters) for wiring, measurements, and replacing surge protection modules and circuit breakers.

Moderate height: Installation height should be between 1.2 and 1.8 meters to facilitate viewing display data (if applicable) and manual operation, while preventing easy access by children. Avoid installing too high or too low to minimize maintenance difficulty.

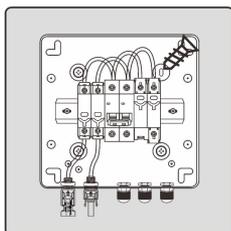
3.3 Installation



measure the installation dimensions.



Mark the wall according to the measured installation dimensions, drill holes, and insert the expansion anchors.



First remove the lid, then drill holes inside the box, use the matching screws to mount the box to the wall through these four holes

Item	Name	Description
A	Expansion tube	Included by default
B	Installation screw	Included by default

Note Wiring first or mounting on the wall first can be chosen according to individual needs.

4 Electrical Connection

4.1 Pre-wiring Inspection

Danger

Lethal electric shock or serious burn from high voltage present on PV string! Observe the following safety instructions related to the wiring operations:

Before starting wiring, disconnect the cable connection on the end of the PV string.

Do not use a conventional multimeter to measure the DC voltage. A multimeter with voltage withstanding of at least 1,500V is recommended. Otherwise, serious damage may follow. Respect all safety instructions of the PV module manufacture.

Warning

Incorrect cable connection may cause damages to the PV cells, the LQX and inverter. Respect the following instructions during cable connection:

Connect by strictly following the circuit diagram;

Measure the positive and negative polarity of each string by ammeter with withstanding voltage no less than 1500V and make sure there is no reversed connection before cable connection;

Identify the positive pole and negative pole before connection.

Notice

Check whether the circuit breaker on the combiner box is in the "OFF" position.

Disconnect the fuse. Prior to shipment, the fuse is pre-installed in the fuse box. However, before making electrical connections, you must open the fuse cover to disconnect the fuse connection.

**Notice**

To prevent moisture from entering the combiner box, do not open the combiner box door during rain or snow. If unavoidable, take protective measures.

4.2 Prepare the cables

Select cables with appropriate specifications:

Safe current-carrying capacity > Maximum system current. Rated voltage > Maximum system voltage

a. Input cables (from component strings to combiner boxes)

Current: Each input cable must carry the short-circuit current (Isc) of one string.

Calculation: Based on the string's Isc value, consult the cable ampacity table and select a cable with an ampacity slightly greater than 1.56 times Isc (a safety factor of 1.56 must be applied per NEC standards).

Length: If the distance from the string to the combiner box is significant (e.g., exceeding 50 meters), calculate the voltage drop and appropriately increase the cable diameter to ensure power loss remains below 2%.

b. Output cables (from the combiner box to the inverter)

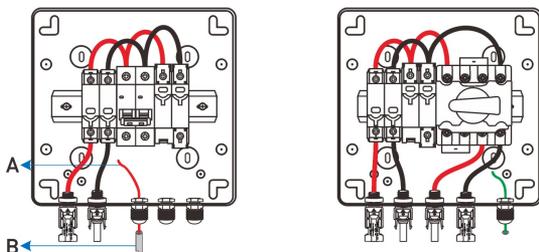
Current: The output cable must carry the total sum of currents from all input strings. Calculation: This is the most critical part. Output current = String short-circuit current (Isc) × Number of input strings / Number of output strings × Safety factor (typically 1.25).

4.3 Connecting cable

4.3.1 PG Terminal

Step 1 Loosen the "INPUT DC+" union nut of gland terminals

Step 2 Insert the "PV1+" cable through terminals of "INPUT DC+", and connect the cable to the "PV1+" terminal inside the device. Enough wire bending space should be ensured.

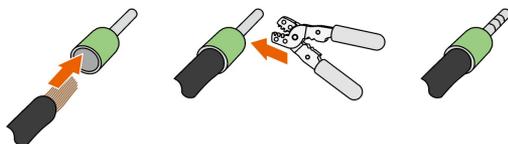


No.	Description
A	Cable (e.g. "PV1+" "PV2+" "PV1" "PV2" etc.)
B	Conduit

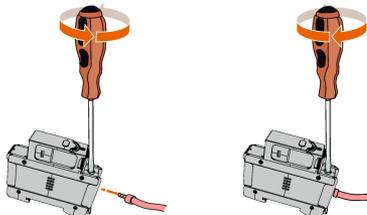
Step 3 Stripped off the cable insulation layer, using wire stripper, to reveal the copper core, Select proper terminal to the corresponding cable.

⚠ Notice

Do not break the copper wire during stripping.



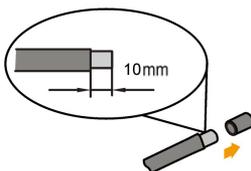
Step 4 connect the terminal to the corresponding terminal of the LQX.



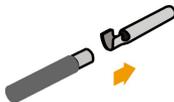
Step 5 Follow the same procedure to connect the rest of cables. Appropriate cable bending space shall be ensured.

4.3.2 MC4 Terminal

Step 1 Strip off 10mm insulation layer from the positive and negative DC cable.

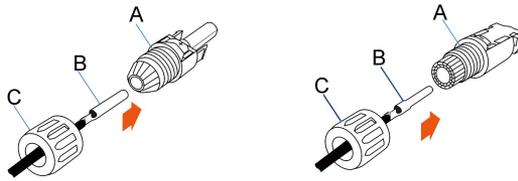


Step 2 Assemble the cable ends with crimp contacts by crimping pliers



Step 3 Connect the cables according to the method illustrated below. Pull the cable gently to make sure it is secured.

-Connect the positive input cable according to the figure below.



A	B	C
Input terminal	input cable	Sealing cover

Connect the negative input cable according to the figure below.

5 System Maintenance

5.1 Pre-Maintenance Inspection

Due to ambient temperature, relative humidity, windblown dust and vibrations components of LQX will get aging. It is necessary to do the routine maintenance work periodically on the device.

Inspection Items	Inspection Method	Maintenance Cycle
Electrical Connection	Inspect wiring connections at fuse boxes, connectors, and components for any loose or disconnected wires. Check cables for damage.	Every 3 months
Seal Inspection	Regularly inspect the sealing strips for bubbles, cracks, peeling, missing adhesive, or indentations.	Initially every 1-2 months, Generally once a year

 **Warning**

Only qualified electricians can do the maintenance work described in this chapter.

Note Before performing maintenance, troubleshooting, and other operations on the LQX, stop it and ensure that the operating area is voltage free.

5.2 Routine maintenance

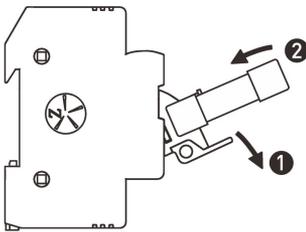
5.2.1 Replace the Fuse

 **Warning**

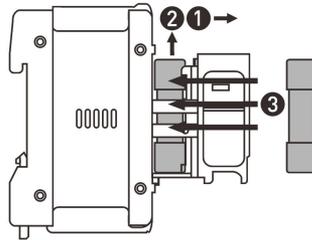
Once the fuse is blown, the damage is irrecoverable. Replace the fuse by qualified operators in time.
Replace the fuse with new one with the same model and the same grade.

Steps for Replacing the Fuse Element

- Step 1:** Disconnect the load switch/circuit breaker.
- Step 2:** Use a clamp meter to measure the current on each circuit, ensuring it reads zero.
- Step 3:** Open the fuse box and remove the fuse.
- Step 4:** Install a fuse of equivalent rating.
- Step 5:** Close the fuse box.
- Step 6:** Close the load switch/circuit breaker.



LQPV-32/LQPV-32X



LQR3-32/LQR3-32X

Warning

Tighten the fuse cover after replacing the fuse.

Warning

Disconnect the load-break switch before checking and replacing fuse. Please notice that high voltage still exist in all terminals of the load-break switch. Make sure the current of each input is zero by pliers and then replace the fuse.

5.3 Common Faults and Troubleshooting Methods

Important Safety Notice: Before performing any inspection or troubleshooting, ensure the inverter is disconnected. Isolate the combiner box from the array by disconnecting the DC circuit breaker or using a disconnect switch. Allow sufficient time for capacitive charge to dissipate. Only proceed once complete de-energization is confirmed. Wear appropriate personal protective equipment (PPE), such as insulated gloves and safety glasses, during all operations.

5.3.1 No output voltage or abnormally low voltage

Possible causes

1. DC circuit breaker not closed or damaged.
2. Input fuse blown.
3. Surge arrester failure causing short circuit (voltage drop).
4. Loose terminal connections or damaged cables.
5. Reverse connection in a string group.

Troubleshooting and Solutions

1. Inspect and close the circuit breaker; replace if damaged.
2. Check input voltage per circuit to identify abnormal circuits, then replace the corresponding fuse.
3. Disconnect all inputs and check the combiner box no-load voltage. If still low, remove surge protection modules one by one for inspection.
4. Tighten all terminal connections and inspect cables for damage or burn marks.
5. Measure input voltage per circuit using a multimeter. Reverse polarity in a string will display a negative voltage [-Voc].

5.3.2 Frequent fuse blowouts

Possible causes

1. Excessive string current (e.g., module short circuit, hot spot effect, shading)
2. Incorrect fuse rating selection (undersized)
3. Poor contact or oxidation in fuse holder causing overheating and blowout.
4. Short circuit on the load side (inverter).

Troubleshooting and Solutions

1. Measure whether the short-circuit current (I_{sc}) of this string is significantly exceeding the standard. Inspect the corresponding string for shading, damage, or soiling.
2. Verify that the fuse's rated current is $> 1.5 \times I_{sc}$.
3. Check the fuse holder for signs of burning or blackening; clean or replace as needed.
4. Inspect the insulation integrity of the cables feeding into the inverter.

5.3.3 Surge protector failure (indicator/alarm)**Possible causes**

1. Normal operation: Experienced lightning strike or surge voltage, energy has been discharged.
2. Surge caused by grid-side or environmental lightning strikes.
3. Quality issues with the surge arrester itself or end of service life.

Troubleshooting and Solutions

1. Immediately replace with a new lightning protection module of the same model. Do not continue using the faulty unit!
2. Verify the reliability of the grounding system (grounding resistance ≤ 4 ohms).
3. Record the time of failure and analyze surrounding lightning activity.

5.3.4 Severe combiner box overheating**Possible causes**

1. Loose terminal connections causing excessive contact resistance.
2. Undersized cable specifications resulting in insufficient current-carrying capacity.
3. Aged circuit breaker or switch contacts leading to increased resistance.
4. Inadequate environmental ventilation and heat dissipation.

Troubleshooting and Solutions

1. After powering down, inspect hot spots using a handheld thermal imager or contact thermometer, then tighten all screws.
2. Verify that wire gauge meets maximum current requirements.
3. Replace aged circuit breakers.
4. Improve installation environment to ensure adequate ventilation and avoid direct sunlight.

5.3.5 Ground insulation resistance too low/alarm

Possible causes

1. Damage to the insulation layer of input or output cables, resulting in contact with grounded metal.
2. Deterioration of the module's inherent insulation properties (e.g., PID effect).
3. Moisture, condensation, or foreign objects inside the combiner box.

Troubleshooting and Solutions

1. Disconnect each input string individually and measure its insulation resistance to ground using a megohmmeter to locate the fault point.
2. Inspect the insulation condition of the output cables.
3. Ensure the combiner box door is securely closed with intact sealing strips; place desiccant inside if necessary.

5.4 Quality Assurance

The warranty period for this product shall be as specified in the contract. For any product that malfunctions during the warranty period, Wenzhou Longqi New Energy Technology Co., Ltd. (hereinafter referred to as "the Company") will provide free repair or replacement with a new product.

5.4.1 Evidence

During the warranty period, the company requires customers to present the purchase invoice and date for the product. Additionally, the trademark on the product must be clearly visible; otherwise, the company reserves the right to deny warranty coverage.

5.4.2 Conditions

- Replaced non-compliant products shall be handled by our company.
- The customer shall allow our company a reasonable period to repair the malfunctioning equipment.

5.4.3 Disclaimer of Liability

The Company reserves the right to decline quality assurance under the following circumstances:

- The entire machine or components have exceeded the free warranty period
- Damage caused during transportation
- Incorrect installation, modification, or usage
- Operation in extremely harsh environments beyond those specified in this manual
- Machine malfunctions or damage resulting from installation, repair, alteration, or disassembly by non-authorized service personnel
- Machine malfunctions or damage caused by the use of non-standard or non-Sunshine parts or software
- Any usage exceeding the installation and operating parameters defined in relevant international standards
- Damage caused by abnormal natural environmental conditions

Product malfunctions arising from the above circumstances may prompt customer requests for repair services. Following assessment by our service center, paid repair services may be provided.

5.4.4 Contact Information

If you have any questions about this product, please contact us.

Email: sales@cnlonq.com

6 PV Combiner Box Disposal

6.1 Dismantling the combiner box

6.1.1 System power failure:

Step 1: Disconnect the inverter. First, shut down the inverter via its control interface, then disconnect its AC-side circuit breaker.

Step 2: Disconnect the combiner box output circuit breaker. Disconnect the DC side connecting the combiner box to the inverter.

Step 3: Disconnect the combiner box input circuit breaker. Switch all DC circuit breakers inside the box to the “OFF” position.

6.1.2 Waiting and Testing for Electricity:

Wait at least 15 minutes to allow the internal capacitors to fully discharge.

Using a multimeter (set to DC voltage range), carefully measure the voltage at each input terminal and output terminal to confirm the voltage is zero ($V \approx 0$). Verify each channel individually!

6.1.3 Disconnect:

First, disconnect the output cables: Using insulated tools, carefully loosen or unplug the cables connected to the inverter (typically MC4 connectors or bolt terminals). Immediately wrap exposed terminal heads with insulating tape to prevent accidental contact or short circuits.

Next, disconnect the input cables: Remove the input cables from the PV strings one by one. After disconnecting each cable, immediately label it with a tag indicating its origin (e.g., “Array 1 - String 3”) and wrap it with insulating tape for future reinstallation or troubleshooting.

Finally, disconnect the ground wire: Remove the grounding wire last.

6.1.4 Disassemble the enclosure:

Secure all cables properly to prevent sagging or pulling.

Use tools to remove the junction box from the mounting bracket or wall surface.

Documentation: Take photographs of the wiring configuration before and after disassembly for reference during subsequent installation or disposal.

6.2 Packaging combienr Box

6.2.1 Cleaning and Inspection:

Wipe the exterior of the enclosure with a dry cloth to remove dust. Check that the enclosure door is securely locked or fastened.

6.2.2 Cushioning Packaging:

Wrap the combiner box tightly with at least two layers of cushioning materials such as bubble wrap or foam padding, focusing on protecting protruding parts like the viewing window, gauges, and terminal blocks.

Place the wrapped combiner box into a appropriately sized corrugated cardboard box. Pack foam boards or filling material around the sides to prevent movement inside the box.

6.2.3 Outer Box Markings:

Clearly label the exterior packaging with:

Item Name: Photovoltaic Combiner Box

Fragile, Keep Dry, Moisture-Proof, etc.

Operating Direction (↑ Upward)

6.2.4 Packaging Storage Environment

Ensure storage areas are well-ventilated and moisture-free. Strictly avoid standing water.

Storage temperature range: -40°C to +70°C. Relative humidity range: 0% to 95%, no condensation.

6.3 Scrapping of Busbars

6.3.1 Hand over to qualified electronic waste recyclers:

Seek reputable recycling companies holding hazardous waste permits or electronic waste processing certifications.

They will employ professional methods for sorting, dismantling, and processing:

Metal components (copper busbars, aluminum casings): Recycled for reuse.

Plastic components: Shredded for recycling or used for energy recovery.

6.3.2 Dismantle for spare parts:

If merely upgrading equipment, the old combiner box may not be completely damaged. It can be incorporated into a spare parts inventory. Remove still-functional components like circuit breakers, fuse holders, terminals, etc., for future maintenance of other units of the same model.

Warning

- Strictly prohibited from being discarded at municipal landfills.
- Strictly prohibited from open-air incineration, which produces toxic gases.
- Strictly prohibited from unauthorized disassembly, especially dismantling electronic components without protective equipment, as this may expose individuals to hazardous substances and prevent effective resource recovery.

Certificate Qualification

PV Combiner Box

Model _____

This product has passed the tests in accordance with IEC60947-3 & IEC60947-2 & IEC61643-31 & IEC60269-6 standards and has been approved for delivery.



Inspector _____

Date of inspection _____



WENZHOU LONGQI NEW ENERGY TECHNOLOGY CO.LTD

Mobile:+86 13353319123 / +86 19032517836

Contact information:sales@cnlongq.com

<https://www.cnlongq.com>

Add:Shangyou Village,Liu Shi Town,Yueqing City,Wenzhou City,China