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Smart PV Controller - 125kW
(MPPT DC/DC)

RI-PVS-125K
User Manual

E&OE. Please check critical parameters at time of order. ISSUE : 2026081

Rayleigh Instruments Limited
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E&OE. Please check critical parameters at time of order. ISSUE : 20260071

Content

Notice

This manual contains important safety instructions, installation, electrical connections, commissioning, maintenance, and troubleshooting of the equipment.

Save the manual!

This manual must be stored carefully and be available at all times.

Copyright Declaration

Rayleigh Instruments Limited
Raytel House, Cutlers Road, South Woodham Ferrers, Chelmsford, Essex CM3 5WA. UK

1. About this manual

1.1 Applicability

Please read the product manual carefully before installation, operation, or maintenance. This manual contains important safety instructions and installation instructions that must be followed during the installation and maintenance of the equipment.

1.2 Target Group

The instructions in this document can only be performed by qualified persons who must have the following skills:

- Should have some electronic, electrical wiring, and mechanical expertise, and be familiar with electrical and mechanical schematics.
- Should be familiar with the composition and working principle of this product; familiar with the composition and working principle of the DC/DC module system and its front and rear equipment.
- Should have received specialized training related to the installation and commissioning of electrical equipment.
- Emergency response capability should be available for hazardous or unexpected situations that arise during installation or commissioning.
- Should be familiar with the relevant standards and norms of the country/region where the project is located.
- Should be familiar with the contents described in this manual.
- Only personnel who meet the above requirements may perform installation, operation, and maintenance of this product. Unauthorized personnel may not perform any operation on this product and should keep a sufficient safety distance from this product to avoid accidents.

1.3 Symbols Used

Symbols used have the following meaning:

DANGER 'Danger' indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
WARNING 'Warning' indicates a hazard with a medium level of risk that, if not avoided, will result in death or serious injury.
CAUTION 'Caution' indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.
NOTICE 'Notice' indicates a situation that, if not avoided, could result in equipment or property damage, or provides tips that are valuable for the optimal operation of your product.

1.4 Designation in the Document

BAT	Battery
BMS	Battery Management System
COM	Communication
EMS	Energy Management System
PV	Photovoltaic
EMS	Energy Management System
STS	Static Transfer Switch
PVS	Photovoltaic System

2. Safety

2.1 General Safety

The RI-PVS-125K should be used in an environment that meets the requirements of the design specifications. Failure to follow proper usage guidelines may result in equipment malfunction, component damage, personal injury, property damage, and other issues. Please note that the quality assurance of RI-PVS-125K does not cover any such problems. Installation, operation, and maintenance of equipment should comply with local laws, regulations, and norms. The safety precautions in the manual are intended only as a supplement to local laws, regulations, and norms. The company shall not be liable in the event of any of the following circumstances:-

- The installation and use environment exceeds the provisions of relevant international, national, and regional standards.
- Does not operate under the conditions of use described in this manual.
- Disassemble, alter the product, or modify the software code without authorization.
- Failure to follow the product's operating instructions, safety warnings, and documentation.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquakes, fires, storms, floods, mudslides, etc.).
- Damage caused by storage conditions not meeting the requirements of the product documentation.
- Damage to the hardware or data of the device due to customer negligence, incorrect operation, or intentional damage.
- System damage due to third-party or customer reasons, including relocation and installation systems that do not meet the requirements of this manual, and damage caused by adjustments, alterations, or removal of identifying marks that do not meet the needs of this manual.
- Defects, malfunctions, or damages resulting from acts, events, omissions, or accidents beyond the seller's reasonable control, including power or electrical failures, theft, war, riot, civil commotion, terrorism, intentional or malicious damage, etc.
- The battery cabinet is equipped with an automatic fire extinguishing system, and the fire switch should not be triggered unless it is an emergency.

2.2 Electricity safety

High voltage! Risk of electric shock! It is strictly prohibited to touch live parts!

Before installation, please make sure that the DC sides is de-energized.

Do not place the static transfer switch cabinet on a flammable surface.

There is a risk of electric shock if you touch the power grid or the contacts and terminals connected to it inside the equipment!

- Do not touch terminals or conductors connected to the grid circuit. Observe all instructions or safety documentation

regarding connection to the mains.

- Lethal high voltages exist inside the product!
- Note and abide by the warning signs on the product.
- Observe the safety precautions listed in this manual and other documents related to this equipment.

Damaged equipment or system failure may cause electric shock or fire!
Perform an initial visual inspection of the equipment for damage or other hazards before operation.
Check whether other external devices or circuit connections are secure.
Confirm that this equipment is in a safe state before operating it.

DANGER

When a ground fault occurs in the RI-PVS-125K, fatal high voltages may exist in the originally unenergized parts. It is extremely dangerous if touched accidentally! Before the operation, please ensure that there is no ground fault in the system and take relevant protective measures.
There is high voltage in the RI-PVS-125K. Accidental contact may cause fatal electric shock. Therefore, during live measurements, you should:

- Take protective measures (such as wearing insulating gloves, etc.).
- There must be an accompanying person to ensure personal safety.

WARNING

Before wiring, disconnect all equipment switches from the static transfer switch cabinet.

NOTICE

To prevent uninvolved persons from approaching the RI-PVS-125K for misoperation or accidents, please observe the following precautions:
On the perimeter of the RI-PVS-125K, prominent warning signs are placed to prevent accidents caused by disclosure.

2.3 Installation and wiring safety

WARNING

During the whole process of machinery installation, the relevant standards and requirements of the project site must be strictly adhered to.
Failure to install in accordance with the installation design requirements given in this manual, which causes a system failure in the RI-PVS-125K, will not be covered by the warranty.
During electrical connections, the bolts must be tightened in strict accordance with the torque described in this manual.
Only qualified electrical engineers or professionally qualified persons are allowed to work with electrical connections. Please observe the requirements given in the safety instructions in this manual. Rayleigh Instruments accepts no liability for injury, death, or property damage resulting from disregard of these safety instructions.
When laying cables, ensure electrical insulation and comply with EMC specifications. Power cables and power and communication cables should be laid in layers. And when necessary, provide protection and support for the cable to reduce the stress on the cable.
Perform wiring operations in strict accordance with the wiring markings inside the unit.
Only complete and undamaged static transfer cabinets may be installed and commissioned! Please make sure before starting the installation:

- The RI-PVS-125K itself is intact and undamaged.
- All parts in the RI-PVS-125K are intact and undamaged.

All electrical connections are to be made in strict accordance with the wiring schematic.

All electrical connections must be made with the equipment completely uncharged.

Only qualified electrical engineers may carry out work related to electrical connections. Please observe the requirements given in the "Safety Instructions" of this manual. We accept no liability for injury, death, or property damage resulting from disregard of these safety instructions.

The installation and operation environment of the RI-PVS-125K is outdoor, and its installation location and foundation must meet the requirements. In addition, during the entire process of electrical connection, the operation must be carried out in strict accordance with the regulations.

The system should only be put into operation after the installation has been confirmed by a professional and permission has been obtained from the local power authority. Close all distribution circuit breakers before operating the unit.

NOTICE

The RI-PVS-125K must be installed and designed in accordance with the relevant standards or codes of the country/region where the project is located.

Failure to follow the installation design requirements given in this manual, or failure to comply with the relevant electrical standards or codes in the location of the installation, which results in a failure of the RI-PVS-125K or the system, will not be covered by the warranty.

2.4 Operation and maintenance safety

DANGER

To avoid unnecessary injury or death and equipment damage, this product must be operated in strict accordance with the requirements of this manual. Improper operation may cause arc hazards or even other risks such as fire or explosion. We assume no responsibility for accidents such as electric arcs, fires, explosions, etc., caused by failure to follow the machine identification or the product manual.

- Select high-quality measuring equipment that meets the requirements of the site in terms of range and usable conditions.
- Ensure that the connection and use of the measuring equipment are correct and standardized to avoid hazards such as electric arcs.

If measuring with electricity, protection is required (e.g., wearing insulated gloves, etc.).

WARNING

If work is to be carried out on energized equipment, it must be well insulated, and at least two staff members should be present at the same time.

The RI-PVS-125K is outdoor equipment, usually located in field environments that are remote from urban areas, and should be prepared with appropriate field ambulance facilities for implementation as needed.

Before operating the equipment, the risk of electric arcs in the operating area must be assessed. If there is a risk of electric arcs, the operator must have received prior safety training. Before working in the area of possible electric shock, the required protective equipment must be worn, e.g., protective clothing, insulated gloves, insulated shoes, and anti-scald gloves.

Improper operation as described below may cause an electric arc, fire, explosion, and other hazards inside the machine:

- Electrically plug and unplug the DC-side high-voltage cables of each device.
- Loose power cable connections, screws, and other parts have accidentally fallen into the power module.
- Incorrect operation by untrained and unqualified operators, etc.

- Maintenance operations can only be performed on the RI-PVS-125K if the equipment within it is completely unpowered.
- Ensure that the interior of the unit has been completely de-energized and will not be accidentally re-energized.
- Insulate and cover adjacent potentially live parts of the operating section with fabric made of insulating material.
- Keep escape routes clear throughout the operation.

During daily operation, ensure that the RI-PVS-125K cover is closed. This is to prevent unauthorized personnel from entering the cabinet and having accidents, or the internal equipment from being attacked by rain or animals.

CAUTION

Contact with or improper handling of printed circuit boards or other static-sensitive components can cause damage to the device.

- Avoid unnecessary board contact.
- Comply with electrostatic protection norms, e.g., wear anti-static bracelets.

NOTICE

Do not tear or damage the sign:

- Ensure that body warning signs are always legible.
- Always replace the body warning label as soon as it is damaged or obscured.
- Do not open the RI-PVS-125K cover in case of bad weather, such as sandstorm, thunderstorm, gale, or hail, during inspection, or when the relative humidity of the surrounding environment is greater than 95%.

2.5 Explanation of Symbols

Symbols on Label:

Symbol	Explanation
	Warning! Metal parts of the batteries are always under voltage. Do not short-circuit the batteries! In case of a short-circuit, very high currents may flow and cause burns. Touching conductive parts can cause cardiac arrhythmia and shock.
	All external power connections must be disconnected before performing maintenance operations on the unit!
	This symbol indicates that the temperature is higher than the acceptable human body temperature and should not be touched arbitrarily to avoid injury.
	Maintenance, repair, etc., should not be performed until the system has been powered off for 5 minutes.
	During equipment operation, noise may be generated. It is recommended to wear mute earplugs.
	CE mark. The machine complies with requirements of applicable CE guide-lines.

	Please read this manual before installation.
	This symbol indicates that this is the protective earth (PE) terminal, which needs to be firmly grounded to ensure the safety of operators.

3. Introduction

3.1 Block diagram

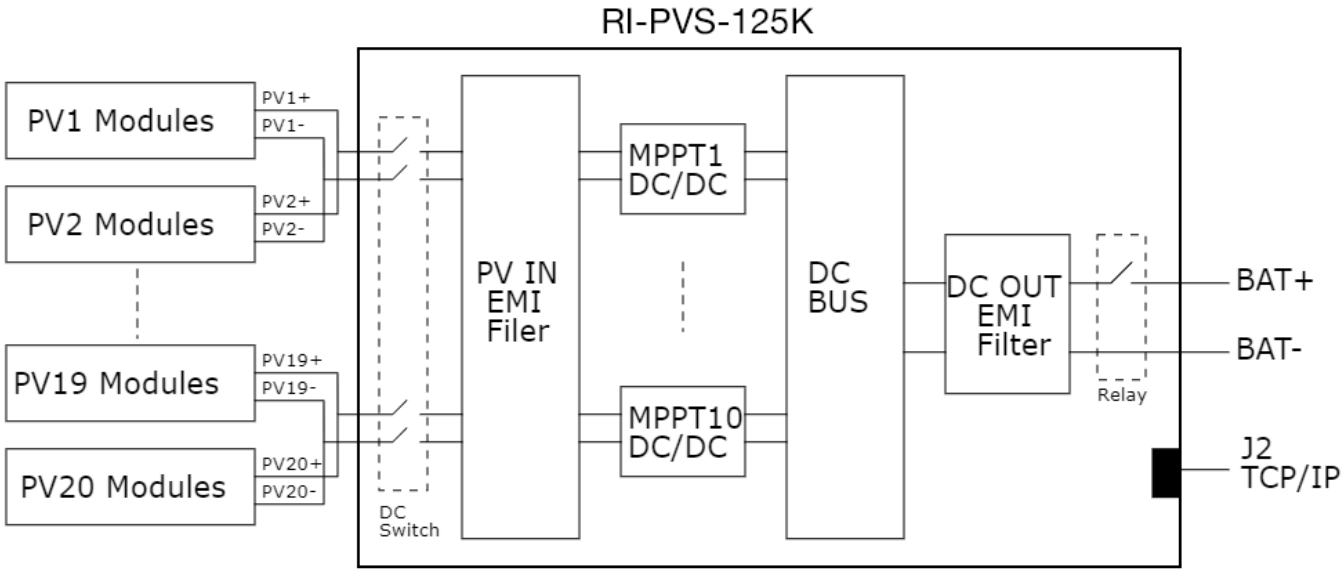


Figure 3-1 Block diagram of the RI-PVS-125K

3.2 Product Overview

The RI-PVS-125K is a DC/DC modular system, primarily used in commercial and industrial settings, designed to provide high-performance, high-stability bus voltages for maximum power point tracking.

Model name: RI-PVS-125K

- 125kW
- Photovoltaic System

3.3 Appearance Introduction

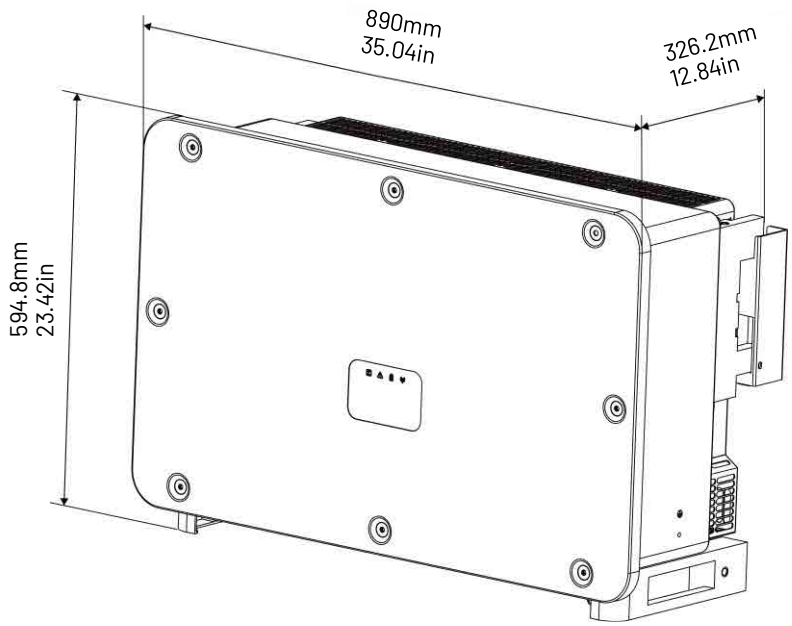


Figure 3-2 Dimensions of RI-PVS-125K

3.4 Technical Data

Input	
Max. Recommended PV Power [kWp]	187.5
Max. PV Input Voltage [V]	730
MPPT Voltage Range [V]	180~600
Rated PV Input Voltage [V]	550
Start-up Voltage [V]	200
No. of MPP Trackers	10
No. of Input Strings per Tracker	2
Max. PV Input Current [A]	40
Max. Short-circuit Current [A]	50
Output	
Rated DC Output Voltage [V]	832
Output Voltage Range [V]	650-949
Rated DC Output Power [kW]	125
Max. DC Output Power [kW]	125
Max. DC Output Current [A]	183
General Data	
Ingress Protection	IP65
Cooling	Fan
Other Functions	String current sensing, PID/AFCI(Optional)
Power Supply	Self-powered
Communication	RS485/LAN

Input	
Ambient Temperature Range [℃]	-30~60
Relative Humidity	≤95%
Operation Altitude [m]	4000（>2000 Derating）
Dimensions (W * H * D) [mm]	890*594.8*326.2
Weight [kg]	85
Environmental Category	Outdoor
Installation	Wall-Mounted
Cable Inlet and Outlet	Bottom

3.5 Components Introduction

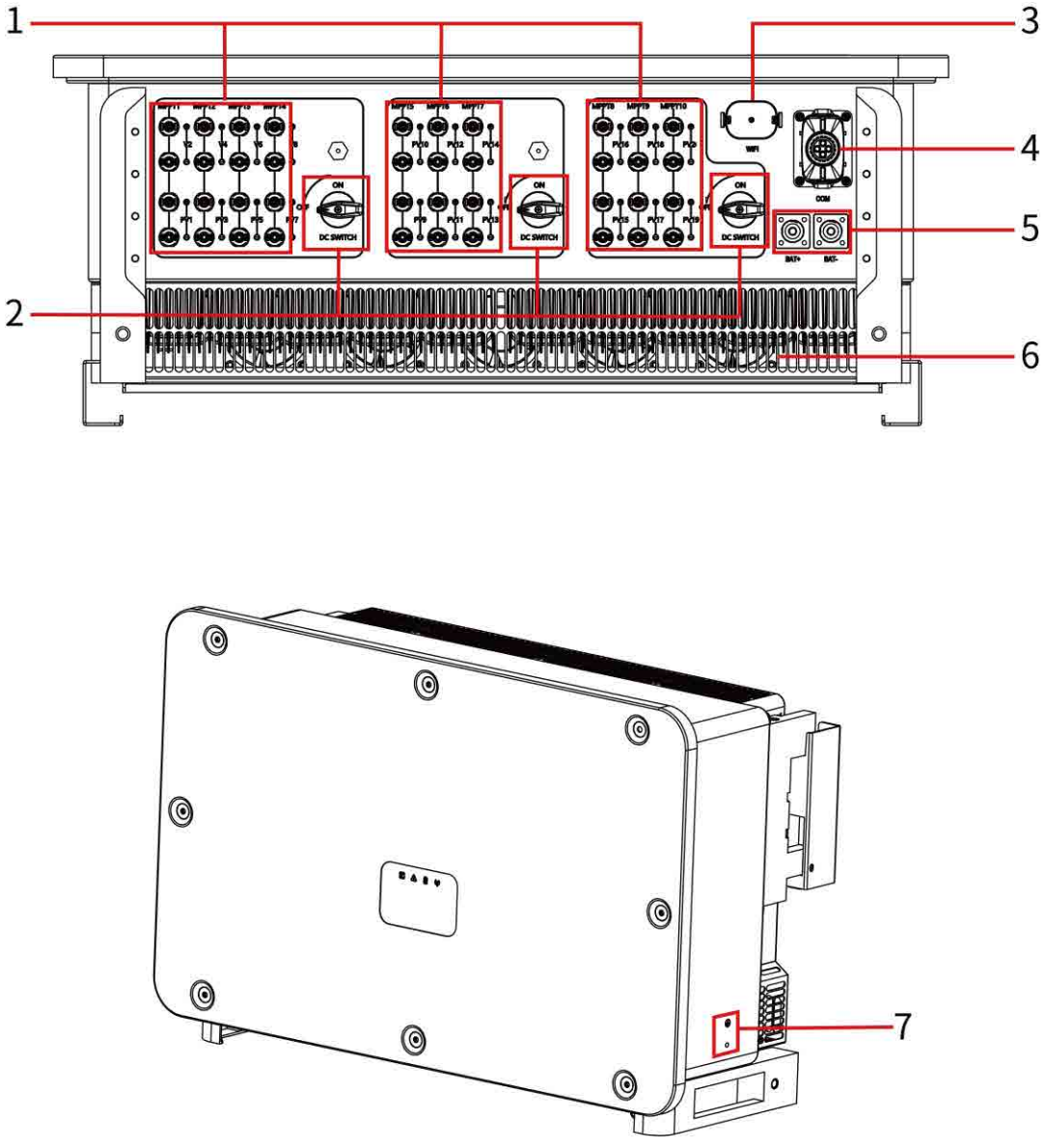


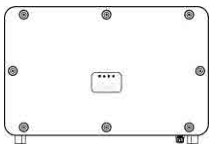
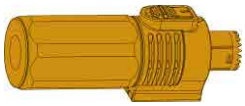
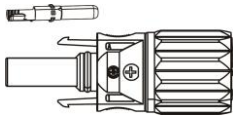
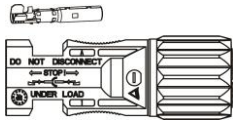
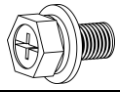
Figure 3-3 Components of the RI-PVS-125K

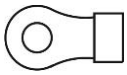
No.	Name	Function
1	PV input terminal	Connectors for the PV input.
2	DC switch	Used to disconnect the DC circuit when necessary.
3	Smart dongle port	Connector for WIFI / 4G / LAN dongle.
4	Communication port	Connectors for Meter/BMS CAN/DRM/Parallel/DI/DO.
5	Battery terminal	Connectors for the battery power cables.
6	Fan	For heat dissipation.
7	Grounding terminal	For reliable grounding.

4. Installation

4.1 Unpacking

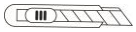
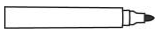
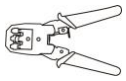
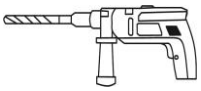
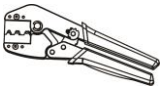
Before opening the package, please check whether the packing box is complete and whether there is any damage, soaked in water; if the package is incomplete or obviously damaged, please contact the supplier. If the package is complete, please open the box to check whether the contents are complete against the material list or as shown in the figure below; if there is any omission or damage, please contact the supplier.

No.	Shape	Model	Quantity
1		The RI-PVS-125K	1
2		Mounting bracket	1
3		Battery power cable terminal(+) with a corrugated pipe	1
4		Battery power cable terminal(-) with a corrugated pipe	1
5		PV cable terminal(+) with a corrugated pipe	20
6		PV cable terminal(-) with a corrugated pipe	20
12		Expansion tube M8 & screw M8*100 for mounting bracket	4
13		Fastening screw M5*16	3

No.	Shape	Model	Quantity
15		Ground OT terminal	1
16		Quality Certificate	1
17		User Manual	1

4.2 Preparation for installation

4.2.1 Installation tools

No.	Tool	Model	No.	Tool	Model
1		Spirit level	7		Knife
2		Wire stripper	8		Marker
3		Tube Terminal Crimping Pliers	9		Rubber hammer
4		Heat gun	10		RJ45 crimping tool
5		Hammer drill	11		Torque screwdriver
6		PV terminals crimping tool	12		Multimeter

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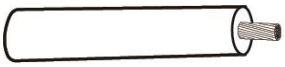
4.2.2 Protective tools

No.	Tool	Model	No.	Tool	Model
1		Dust mask	4		Insulated shoes
2		Goggles	5		Safety helmet
3		Insulated gloves			

4.2.3 Required cables

No.	Tool	Model	Cross-section
1		PV cable	6 mm^2
2		Grounding cable	25 mm^2
4		Network cable	Standard network cable
5		Signal cable	0.25 ~ 0.3 mm^2
6		Battery cable	50 ~ 70 mm^2

4.3 Installation precaution

WARNING

Loading capacity and hardness of the supporting surface, load rating of mounting bracket should be at least four times the weight of the devices according to IEC62109-1. And supporting characteristics will be impaired by wear, corrosion, and material fatigue or ageing, this should be calculated by inspection of the design data of supporting material and consulting construction engineer.

The RI-PVS-125K is designed for outdoor installation (IP65).

- Do not install the machine in direct sunlight.
- Do not mount the machine on flammable material.
- Do not install the machine in areas where flammable materials are stored.
- Do not install the machine in potentially explosive areas.
- Do not install the machine during rain or high humidity (>95%).
- Provide adequate ventilation when using batteries, and also read the warning label on the bottom of the the machine.

- Install the machine where air temperature would be below 40°C. Children should not have access to the machine.
- The machine emits a slight noise when operating, this is normal and will not affect performance.
- Mounting should not tilt more than 5 degrees.
- The machine is heavy, ensure the mounting is strong enough to hold the weight of the machine.
- If installed in a cabinet, closet or other small enclosed areas, sufficient air circulation must be ensured in order to dissipate heat generated by the unit.
- Please select a concrete wall with load-bearing capacity and non-flammable surface for installation.

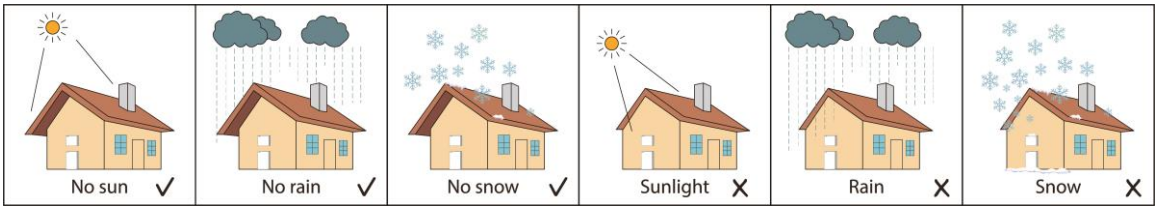


Figure 4-1 Installation environment

4.4 Space requirement

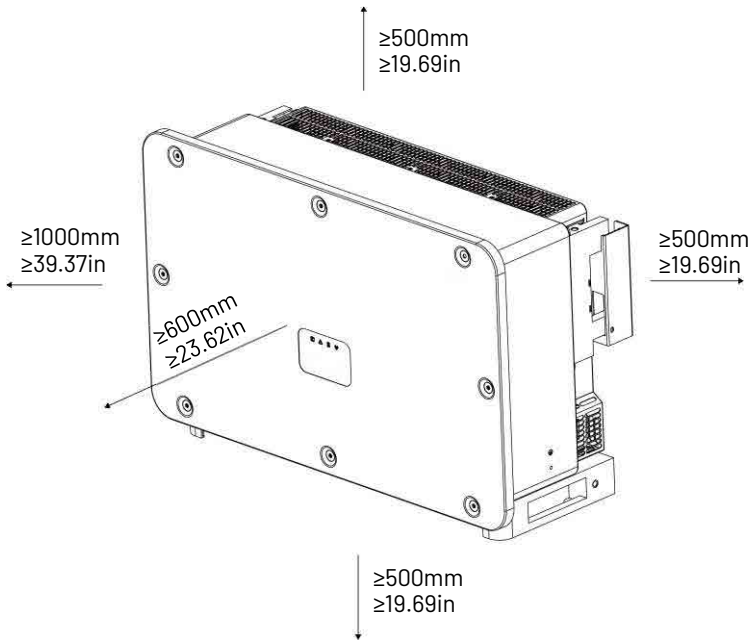


Figure 4-2 Installation space

4.5 Installation steps

CAUTION

- Due to the heavy weight of the machine, at least 2-3 people should work during manual handling and installation to avoid falling accidents or injuries.
- Do not walk or stand beneath or in the proximity of the load.

1. Use the mounting bracket as a template to mark the position of the 4 holes, and use a level to make sure it is parallel to the ground.

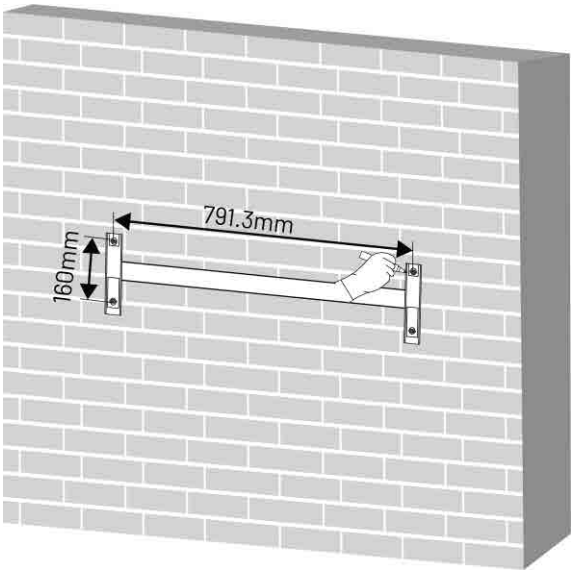


Figure 4-3

2. Drill 4 holes ⩾100mm deep in the wall with a Φ10mm drill. Remove the nut from the expansion bolt and drive the expansion tube into the wall.

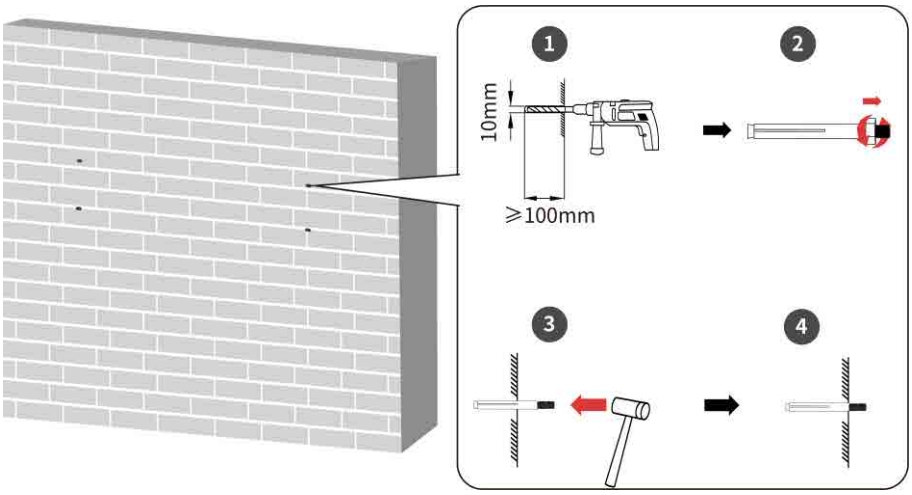


Figure 4-4

3. The mounting bracket is then secured to the wall with expansion screws. Tighten the nut.

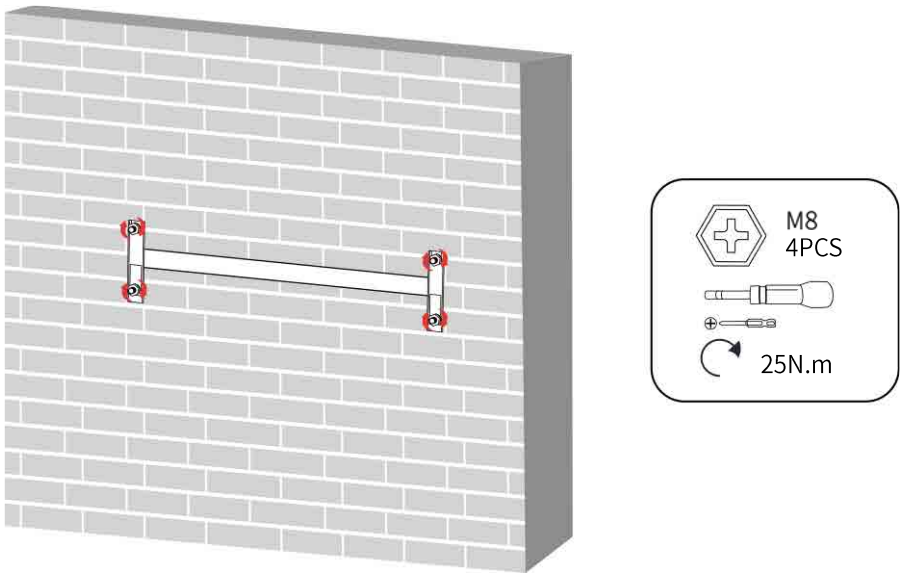


Figure 4-5

4. Hang the RI-PVS-125K on the mounting bracket, and make sure the unit hangs on the hanging bracket.

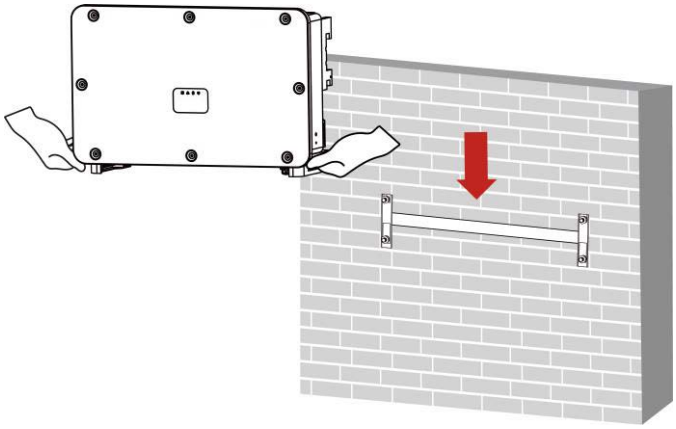


Figure 4-6

5. Secure the mounting bracket to the machine with fastening screw M5 * 2.

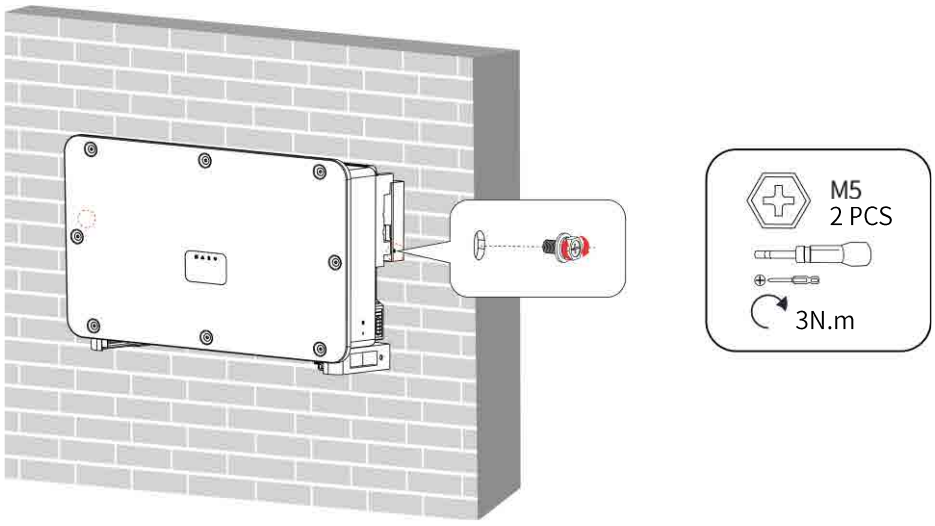


Figure 4-7

5. Electrical wiring connection

5.1 Grounding connection

1. Connect the grounding cable before connecting other cables. Users need to prepare their own grounding cable with a recommended cross-sectional area of 25mm^2. Slide the heat shrink tubing over the connector and shrink it with a heat gun.

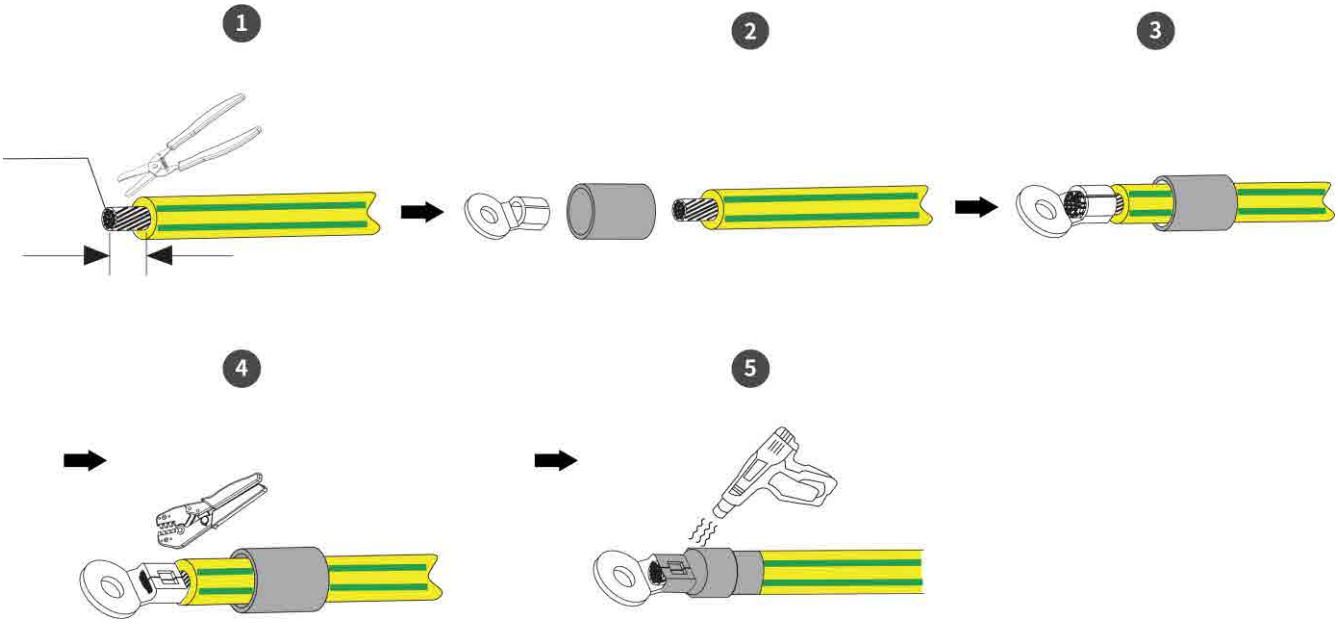


Figure 5-1

2. Connect the grounding cable at the RI-PVS-125K end.

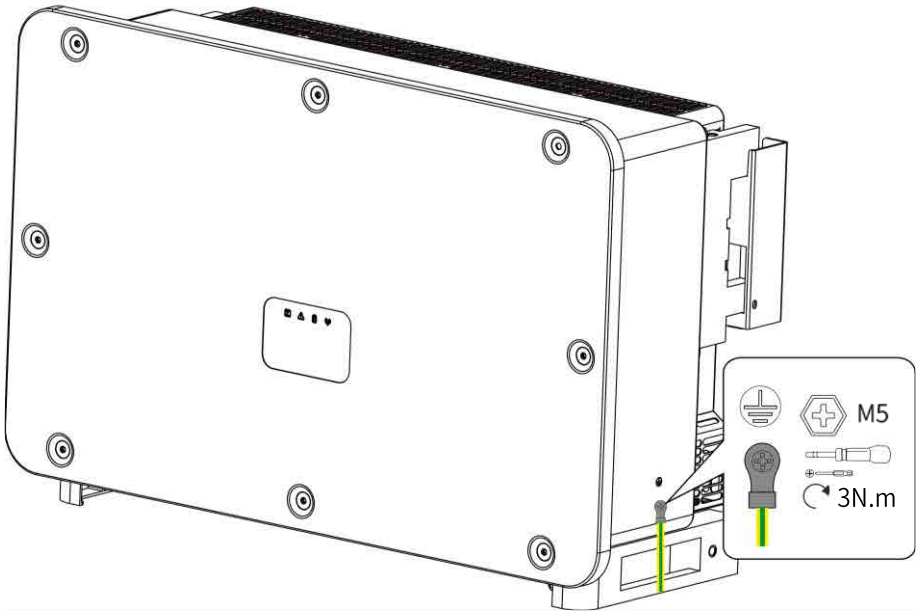


Figure 5-2

5.2 PV connection

1. Strip about 7mm of the cable insulation with a wire stripper.

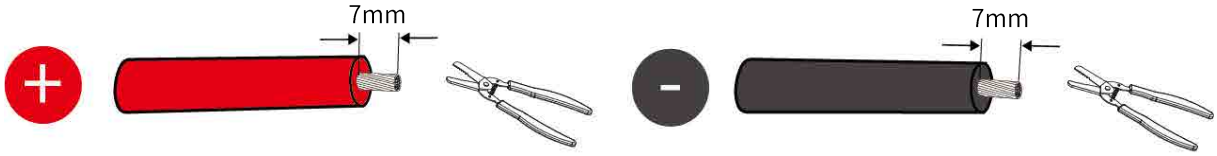


Figure 5-3

2. Unscrew the swivel nut and thread the PV cable through the swivel nut.

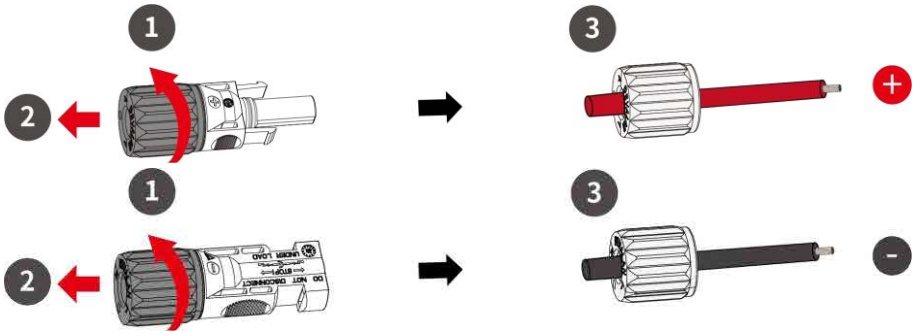


Figure 5-4

3. Insert the cable into the PV cable terminal until a "Click" is heard. Tighten the swivel nut clockwise.

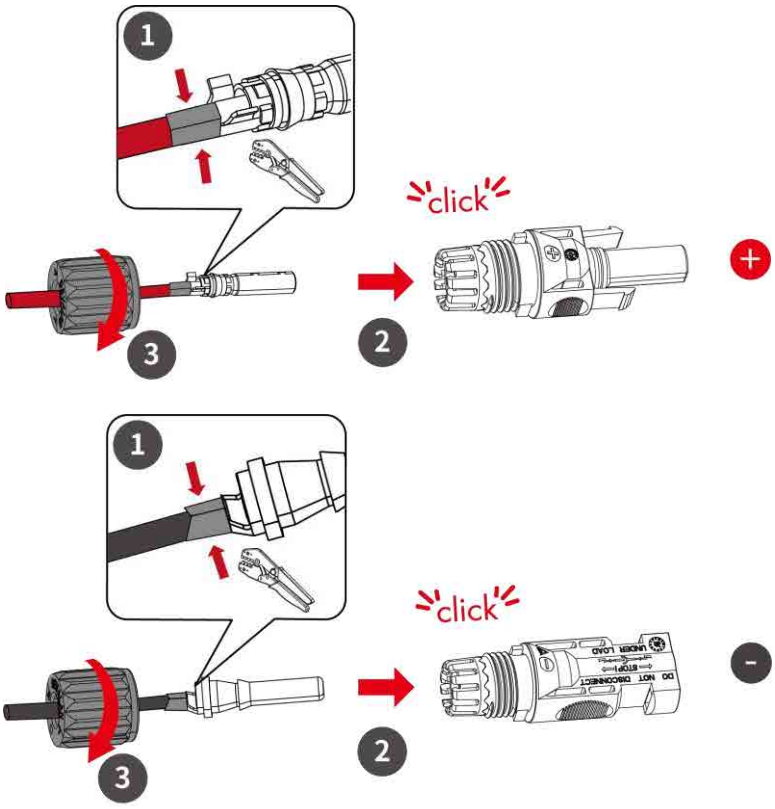


Figure 5-5

4. Use a multimeter to measure the positive and negative voltages at the PV cable terminal. Ensure that the open circuit voltage does not exceed the 730V input limit.

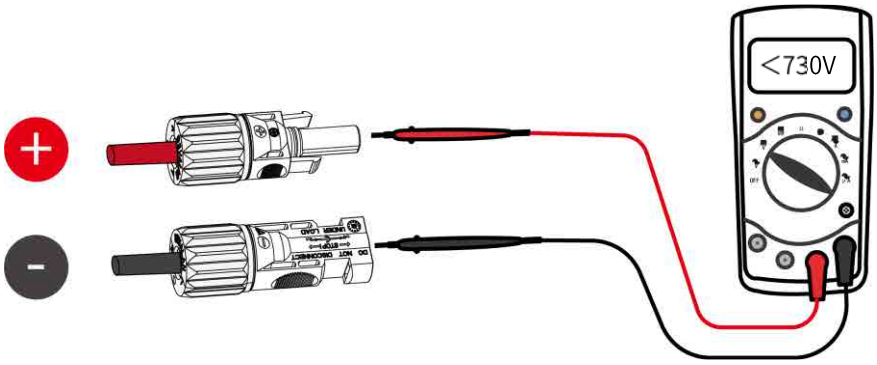


Figure 5-6

5. Remove the PV terminal caps of the RI-PVS-125K and connect the PV cable terminal to the corresponding terminals until there is a "Click". The other end is connected to the PV panels.

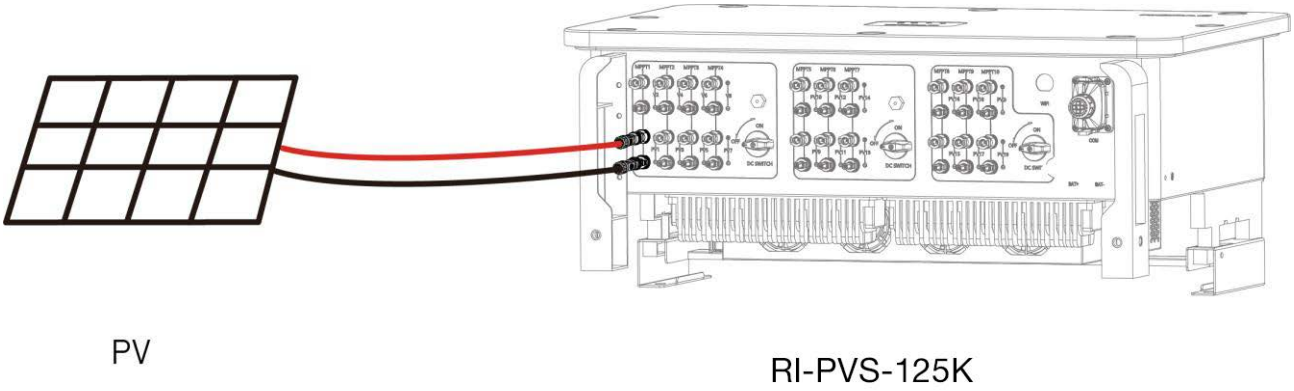


Figure 5-7

5.3 Battery power connection

1. Strip about 15mm of the cable insulation with a wire stripper.

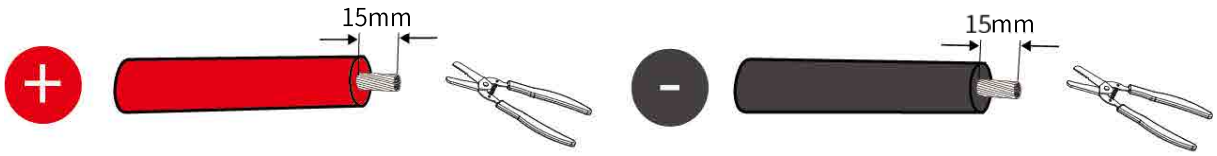


Figure 5-8

2. Press the unlock button in the direction of the arrow and unscrew the swivel nut.

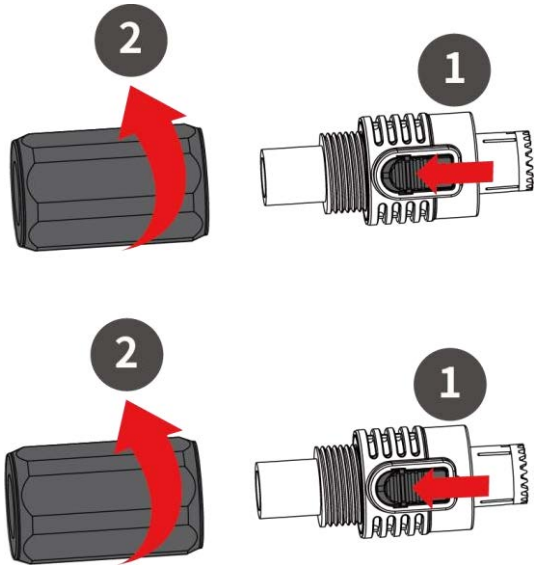


Figure 5-9

3. Pass the cables through the swivel nut and terminals in turn and crimp them.

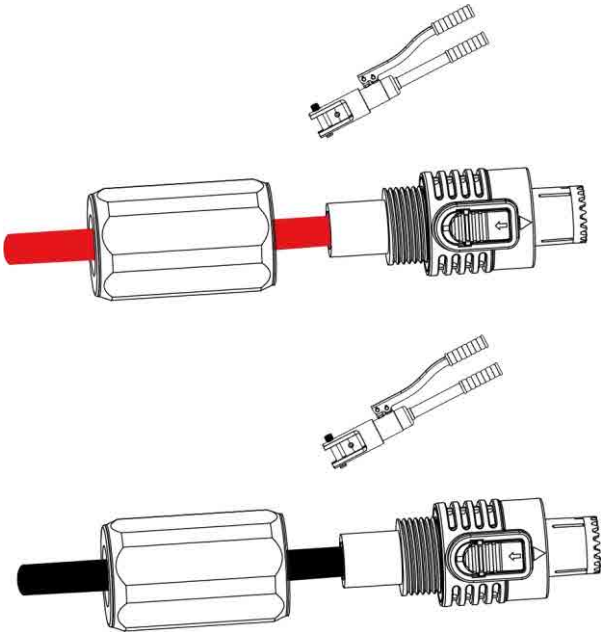


Figure5-10

4. Tighten the swivel nut.

Figure 5-11

5. Use a multimeter to measure the positive and negative voltages at the BAT cable terminal. Ensure that the open circuit voltage does not exceed the 949V input limit.

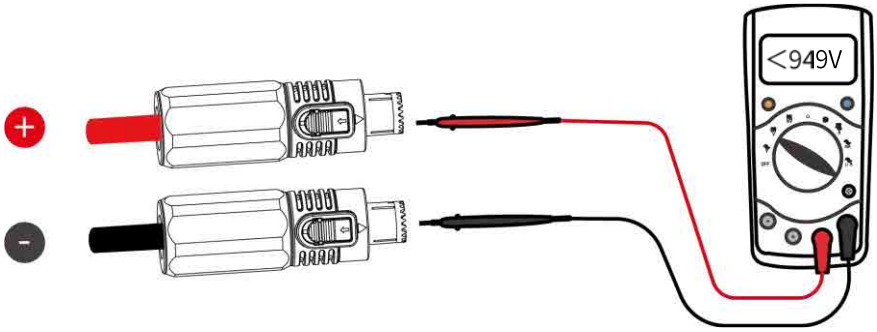


Figure 5-12

5. Remove the battery terminal caps of the hybrid the RI-PVS-125K and connect the battery power cable terminal to the corresponding terminals until there is a "Click".

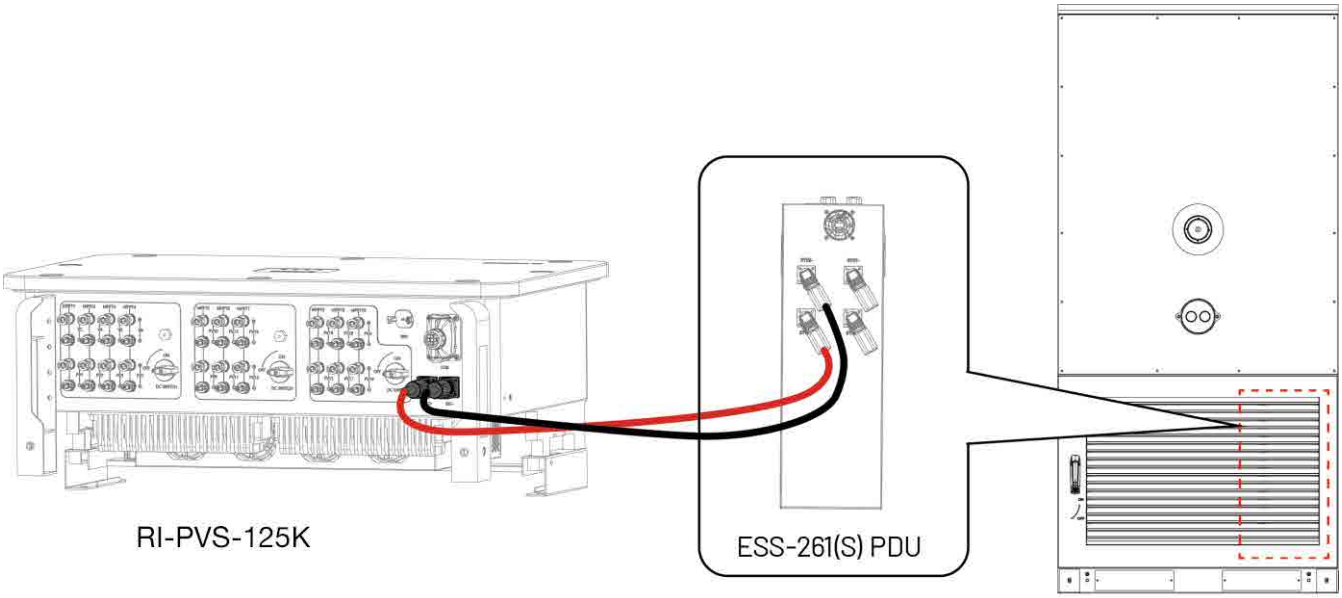


Figure 5-13

5.4 Communication connection

5.4.1 COM interface

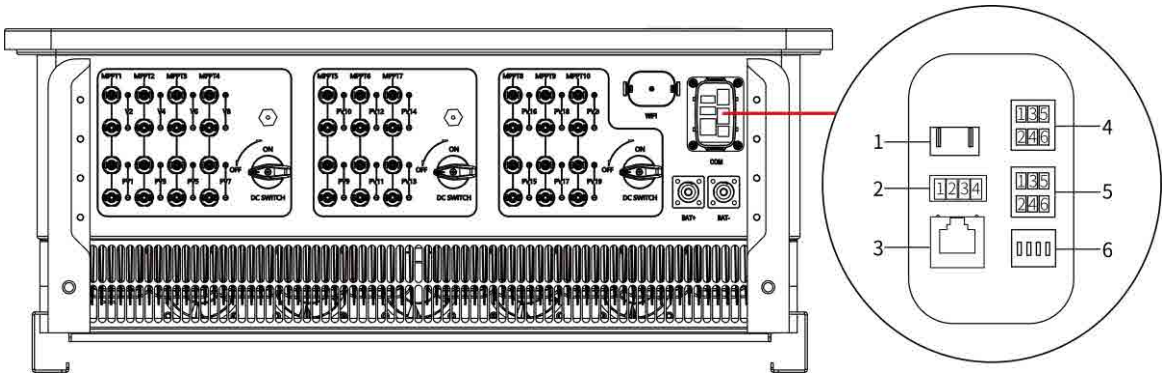


Figure 5-14

No.	Port definition	Description
1	USB port	For upgrading the software.
2	STOP port	Reserved
3	Ethernet interface	For communication with EMS via the network cable.
4	RS485 port	Reserved
5	CAN port	Reserved
6	Terminating resistor	RS485/CAN communication and terminal matching resistors

(2) STOP port

Pin	1	2	3	4
Function	/	GND	E-stop	/

(4) RS485 port

Pin	1	2	3	4	5	6
Function	RS 485_A1	RS 485_B1	RS 485_A2	RS 485_B2	RS 485_A3	RS 485_B3

(5) CAN port

Pin	1	2	3	4	5	6
Function	CAN_H1	CAN_L1	CAN_H2	CAN_L2	CAN_H3	CAN_L3

Note: Ports 1~5 are all standard network ports and the network cables used are all standard network cables, as shown in the figure below.

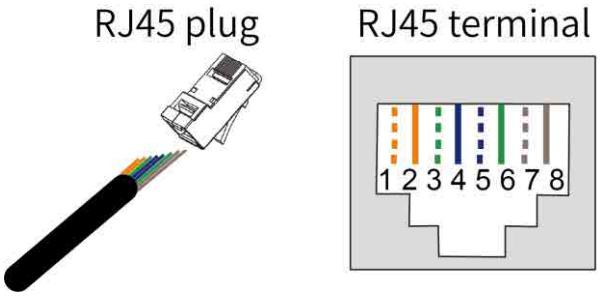


Figure 5-15

No.	Color	No.	Color
1	White- Orange	5	White- Blue
2	Orange	6	Green
3	White-Green	7	White-Brown
4	Blue	8	Brown

5.4.2 Connection steps:

1. Loosen the swivel nut on the communication waterproof cover and remove the waterproof plugs. Remove as many communication wires as are connected.

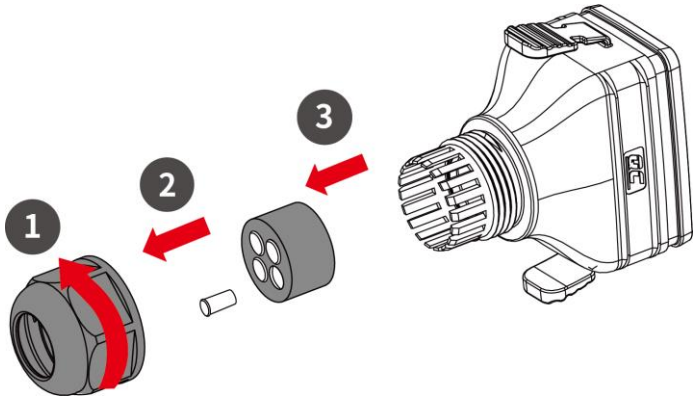


Figure 5-16

2. Crimp the crystal head with an RJ45 crimping tool. Or use an off-the-shelf standard network cable. Thread the network cable through the swivel nut, waterproof plug, and housing in sequence.

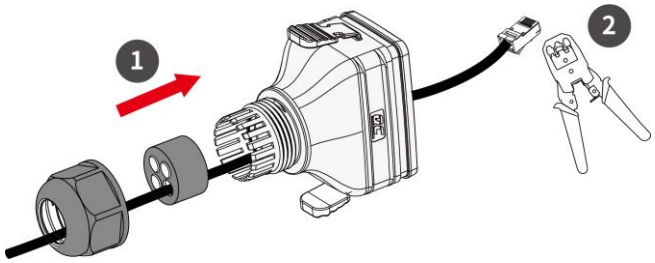


Figure 5-17

3. Insert the network cable into the corresponding network port, then put the communication waterproof cover and tighten the swivel nut. Ensure the cable fixture tongue is well inserted into the terminal slot until a "Click" is heard.

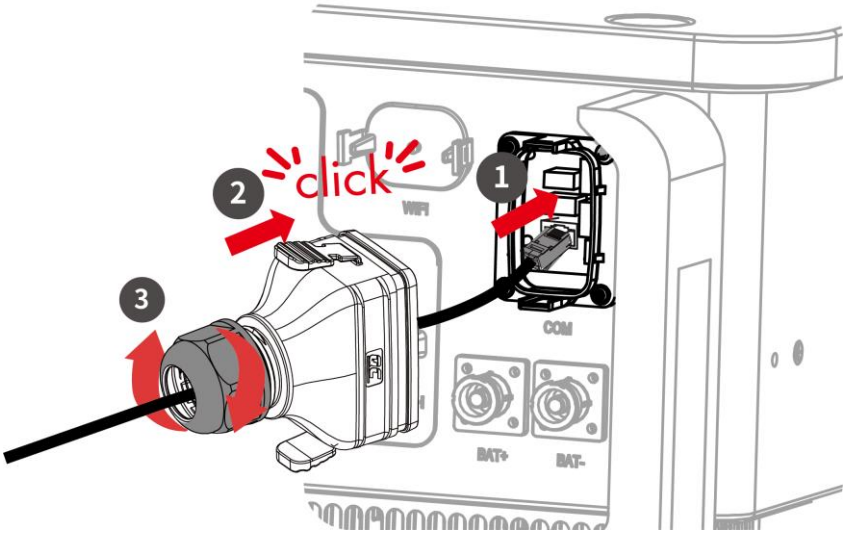


Figure 5-18

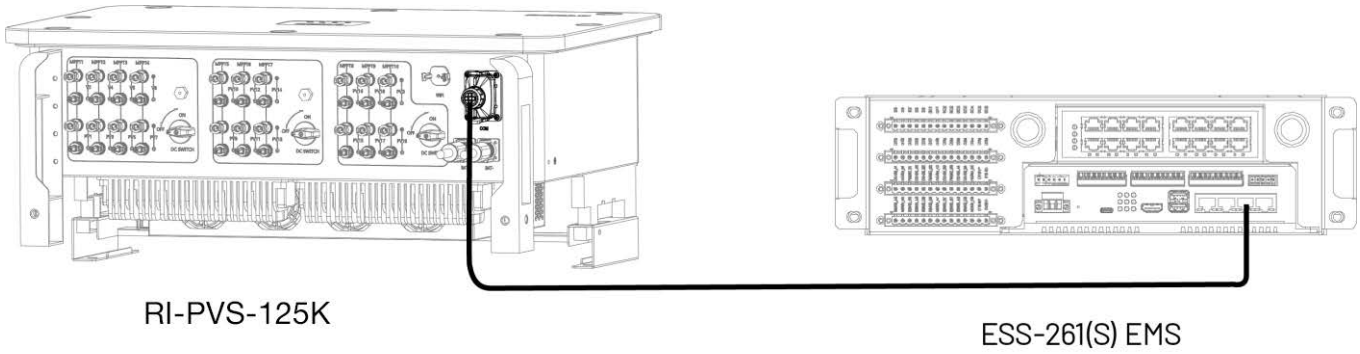


Figure 5-19

5.5 Overall Wiring Diagram

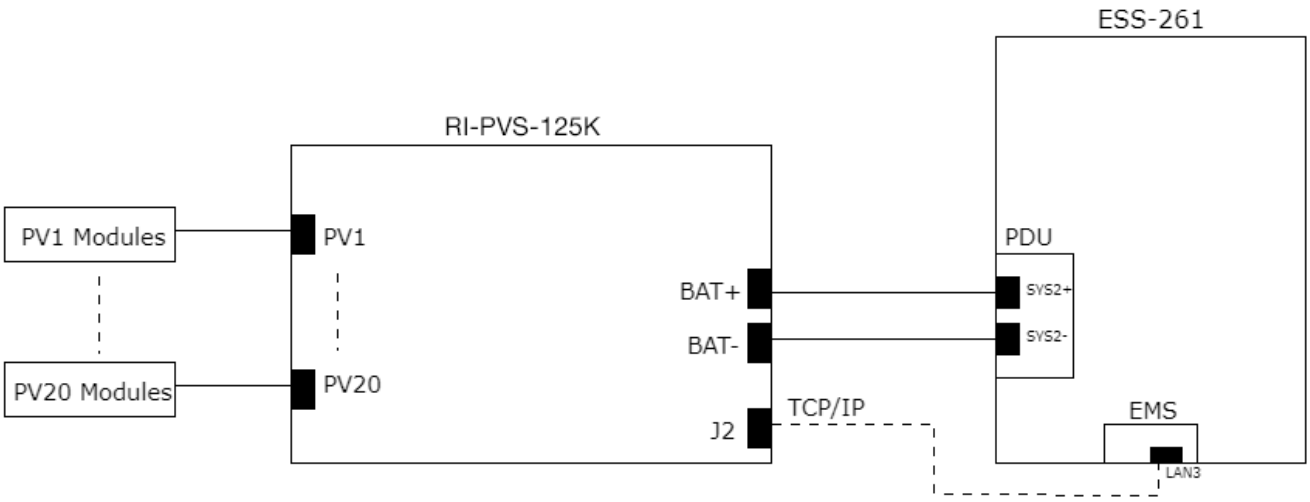


Figure 5-20

6. Power on

Simultaneously rotate the three DC switches to power on the unit.

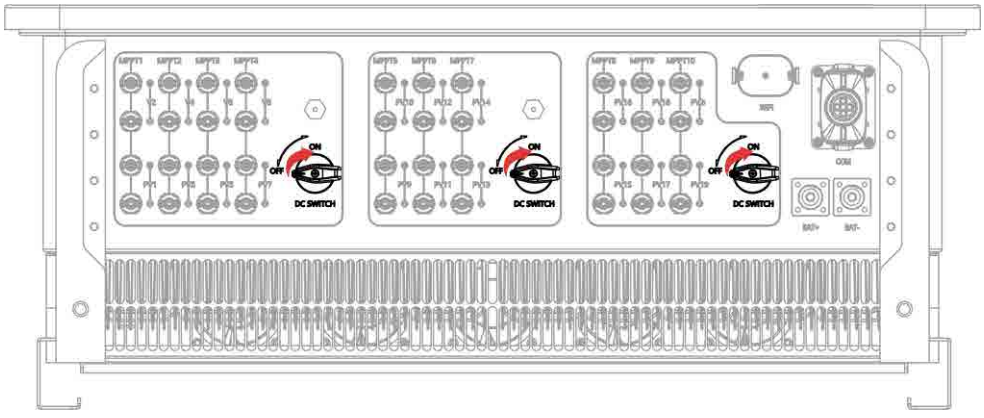


Figure 6-1

7. LED indicator status

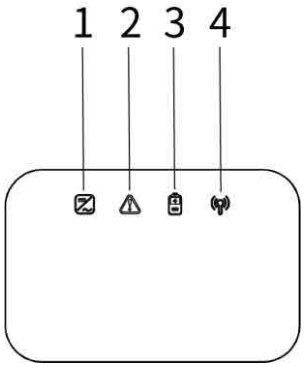


Figure 7-1

No.	Name	Description	
1	DC indicator (Green)	On	The RI-PVS-125K is in normal operation."
		Flashing	The RI-PVS-125K is in the process of self-check startup.
		Off	The RI-PVS-125K is in an abnormal state and not in the check state.
2	Fault indicator (Red)	On	The RI-PVS-125K is operating abnormally.
		Flashing	The RI-PVS-125K has no faults and ARM has a fan fault/faults.
		Off	The RI-PVS-125K has a fault/faults.
3	BAT indicator (Blue)	On	The BMS communication is normal.
		Off	The BMS communication is abnormal.
4	COM indicator (Yellow)	On	The EMS communication is normal.
		Off	The EMS communication is abnormal.

8. Maintenance Instruction

Cleaning Air Inlet and Outlet

A huge amount of heat is generated in the process of running the RI-PVS-125K. The the machine adapts a controlled forced-air cooling method. In order to maintain good ventilation, please check to make sure the air inlet and outlet are not blocked. Clean the air inlet and outlet with soft brush or vacuum cleaner if necessary.

The fans inside the RI-PVS-125K are used to cool the RI-PVS125K during operation. If the fans do not operate properly, the RI-PVS-125K may not be able to cool, and the efficiency of the RI-PVS-125K may be reduced. Therefore, it is necessary to clean the dirty fans in time and replace the bad fans.

Rayleigh Instruments Limited
Raytel House, Cutlers Road, South Woodham Ferrers, Chelmsford, Essex CM3 5WA. UK

Remove the fan board:

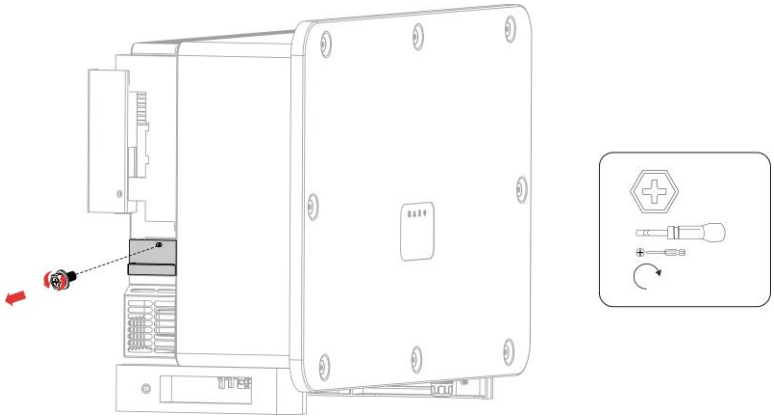


Figure 8-1

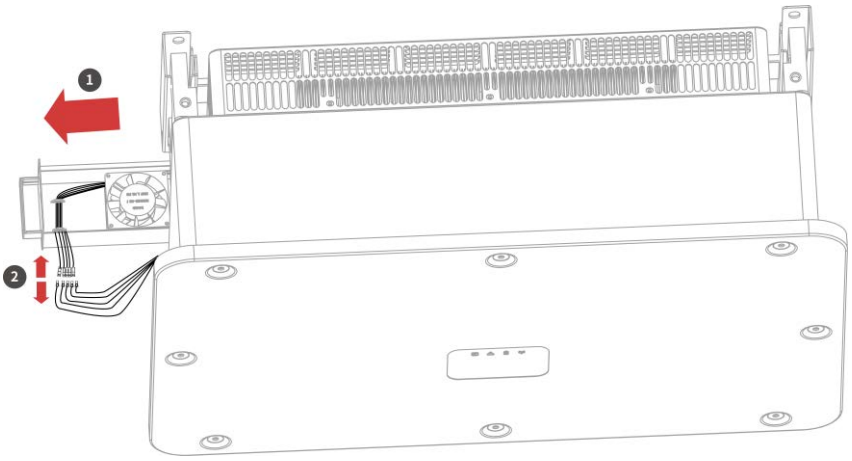


Figure 8-2

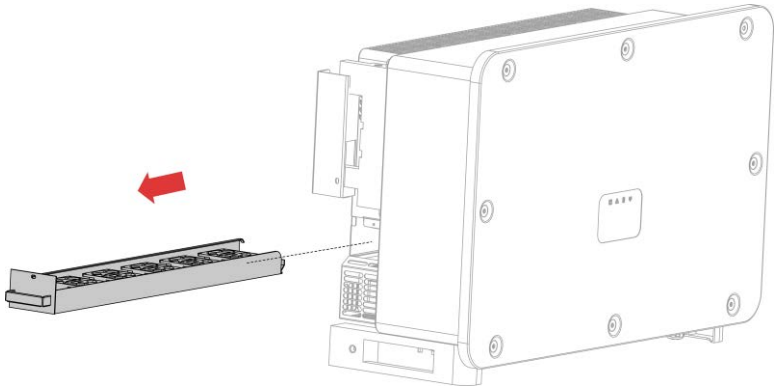


Figure 8-3