USER MANUAL

TRC SERIES

Solar Charge Controller

TRC3106, TRC5106, TRC1206, TRC2206
TRC3210, TRC4210, TRC4215, TRC4415, TRC5215

EN

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Preface

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Disclaimers

Before using the product, please read this manual carefully to ensure you fully understand the product and can use it correctly. Please keep this manual properly for future reference after reading. Improper use of this product may cause serious injury to you or others, or result in product damage and property loss. By using this product, you are deemed to have understood, acknowledged, and accepted all terms and contents in this manual. BEIJING EPSOLAR TECHNOLOGY CO., LTD. shall not be liable for any losses caused by the user's failure to use the product in accordance with this manual.

The warranty does not apply to the following conditions:

- Damage caused by improper use or inappropriate environments (such as the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments).
- The actual current/voltage/power exceeds the limit value of the controller.
- Damage caused by operating temperature exceeding the rated temperature range.
- Electric arc, fire, explosion and other accidents caused by failure to follow controller labels or manual instructions.
- Unauthorized disassembly and maintenance of the controller.
- Damage caused by force majeure such as lightning strikes, rainstorms, mountain torrents and utility failures.
- Damage occurred during transportation or loading/unloading the controller.

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Scope of application

This user manual describes the installation, electrical connection, commissioning, maintenance and troubleshooting of the TRC series solar charge controller (hereinafter referred to as "controller"). The TRC series includes the following product models:

TRC3106, TRC5106, TRC1206, TRC2206, TRC3210, TRC4210, TRC4215, TRC4415, TRC5215

This manual is only intended for professionals who are familiar with local regulations, standards and electrical systems, have received professional training, and know the product well.

Symbol definition

To ensure the user's personal and property safety during operation, as well as the efficient use of this product, relevant safety instructions are provided in the manual and highlighted with the corresponding symbols. To prevent personal injury and property damage, please fully understand and strictly follow these highlighted information. The symbols used in this manual are as follows:

DANGER

Indicates a high-level hazard that, if not avoided, will result in serious injury or death.

WARNING

Indicates a medium-level hazard that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a low-level hazard that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates an important reminder during the operation which, if ignored, may result in an equipment error alarm.

Tip	Indicates recommendation for reference.
	Read through the user manual before any operations.

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Important Safety Instructions

Please keep this manual for future reference.

- Read all the instructions and warnings carefully in the manual before installation.
- No user-serviceable components inside the controller, do not attempt to disassemble or repair the controller.
- Install the controller indoors to avoid component exposure and water ingress.
- Install the controller in a well-ventilated place, the heat sink temperature will be very high during operation.
- Do not install the controller in the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments.
- It is recommended to install the proper fast-acting fuses/breakers externally.
- Disconnect PV array connections and the battery fast-acting fuse/breakers before controller installation and adjustment.
- Check whether the wiring is tight to avoid the danger caused by heat accumulation due to loose connection.
- The entire system should be installed and operated by professional personnel.

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1 General Information

1.1 Product overview

TRC series adapts the brand new generation of MPPT control algorithm to improve the tracking and response speed of maximum power point. Minimizing the loss rate and time of the maximum power point guarantees the maximum power point tracking efficiency, response speed and DC/DC conversion efficiency in high and low power bands. It can track the maximum power point of the PV arrays in various sunlight conditions and capture the energy from the solar panels.

It supports no-battery mode operation by allowing the load to be connected directly to the battery terminals on the controller, and is fully compatible with major lithium battery types.

Excellent low-power design that significantly reduces static power consumption and extends system standby time.

With the functions such as the charging current limit, charging power limit and automatic reduction of charging power at high temperature, it can ensure the system stability when it is connected to the excess PV modules and operating at high temperature.

There are five model types based on LCD configuration and communication methods. Type 1 has an LCD and two RS485 communication ports. Type 2 has an LCD, one RS485 communication port and one CAN communication port, and the CAN port adopts the RV-C communication protocol. Type 3 has an LCD, one RS485 communication port and one LIN communication port, and the LIN port adopts the CI-BUS communication protocol. Type 4 has no LCD, and has one RS485 communication port, one CAN communication port, and built-in Bluetooth, and the CAN port adopts the RV-C communication protocol. Type 5 has no LCD, and has one RS485 communication port and one CAN communication port, and the CAN port adopts the RV-C communication protocol.

The controller adopts a dust-proof and water-proof design, which enhances its reliability and adaptability, and extends its service life.

The controller has short-circuit protection and isolated RS485 communication interface that can be connected with optional 4G, WiFi and other modules to achieve remote monitoring. The communication port can be set to enable (with power output and communication) or disable (no power output, no communication) according to actual needs, and the static power consumption can be further reduced when communication is disabled.

Self-adaptive three-stage charging mode can effectively extend the service life of battery and significantly improve the system performance. It also has comprehensive electronic protections for overcharge and PV polarity etc, to ensure the safety, stability and long-lasting operation of the solar system. The controller can be widely used for RV, household systems, field monitoring and other fields.

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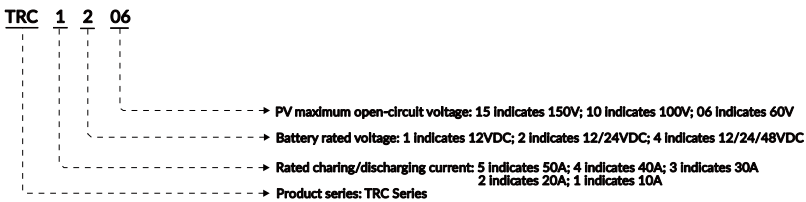
Features

- Low power consumption with static loss less than 10mA
- No-battery mode operation
- Advanced MPPT technology, with maximum tracking efficiency not less than 99.5%
- Conversion efficiency up to 98.5%
- Supporting multiple battery types, including lithium batteries
- Stable self-activation for lithium batteries
- Supporting local setting of main control parameters
- RS485 communication interface, connected with optional 4G, WiFi and other modules for remote monitoring
- Dual limits for rated charging power and charging current
- Automatic power reduction when charging at high temperature
- Comprehensive electronic protections
- Optional multiple communication methods
- Optional independent BMS communication interface, enabling charging and discharging management and display based on the lithium battery status
- Optional independent CAN communication interface supports the RV-C protocol and parallel operation
- Energy statistics and 30-day history records(1)
- Compliant with IEC62109, EMC and other relevant standards

(1) Only controllers without an LCD support history records, see Subsection 3.3 Parameter setting for the recorded information.

Naming rules



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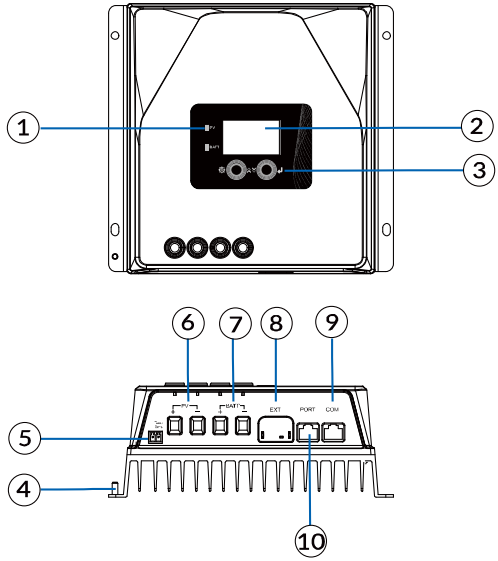
1.2 Product exterior

1.2.1 Appearance and ports



No.	Description	No.	Description
1	Indicator (see Subsection 1.2.2)	6	PV terminals
2	LCD (see Subsection 1.2.2)	7	Battery terminals
3	Buttons (see Subsection 1.2.2)	8	Bluetooth expansion hub
4	Grounding terminal	9	COM: RS485 COM port (RJ45, 5VDC/200mA)(1)
5	RTS port(3)	10	PORT COM port(2)

(1) RS485 communication interface:

- Select isolated RS485 communication or non-isolated RS485 communication as required. It utilizes the MODBUS protocol and can be connected to different communication objects by setting the COM port's MPMS mode. When the MPMS mode is OFF, it can be connected to computer cloud platforms, WiFi, Bluetooth, TCP, 4G, and other modules to enable remote monitoring. When the MPMS mode is ON, it can be connected to the BMS-Link module and lithium battery through the interface. With the setting of the BMS protocol number, the

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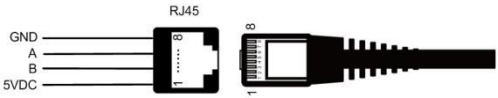
BMS-Link module can convert the BMS protocols of different lithium battery manufacturers into our standard protocols to realize the communication between the controller and lithium batteries BMS of different manufacturers.

Note: Controllers without an LCD and built-in Bluetooth do not support MPMS mode.

- When using the Pylon batteries with BMS protocol number of 21, and the Epever batteries with BMS protocol number of 10, 27 or 34, you can connect the batteries directly to COM port by removing the BMS-Link module, and set the BMS protocol number accordingly for BMS communication. Use a CC-RJ45-RJ45-120 cable or standard network cable with RJ45 pin converter (RJ45 Pin Converter FF-V1.0) for BMS communication.
- When the system has no BMS function, it is required to set the "BPRO (BMS protocol number)" as 32, connect a remote temperature sensor (model: RTS-D47K) through the port to detect the battery temperature, sampling distance ≤ 20 meters.

The pins of the RS485 interface (RJ45) are defined as follows:



Pin	Definition	Pin	Definition
1	+5VDC	/	/
/	/	6	RS485-A
3	RS485-B	/	/
/	/	8	GND

(2) Select the following communication methods for PORT COM port as required:

Note: Controllers without an LCD support CAN communication only; the PORT COM port is not available.

- RS485 communication, MODBUS protocol

When the system uses lithium batteries with BMS function, connect the BMS-Link module and lithium batteries through the port. With the setting of the BMS protocol number, the BMS-Link module can convert the BMS protocols of different lithium battery manufacturers into our standard protocols to realize the communication between the controller and lithium batteries BMS of different manufacturers.

When using the Pylon batteries with BMS protocol number of 21, and the Epever batteries with BMS protocol number of 10, 27 or 34, you can connect the batteries directly to the PORT port by removing the BMS-Link module, and set the BMS protocol number accordingly for BMS communication. Use a CC-RJ45-RJ45-120 cable or standard network cable with RJ45 pin

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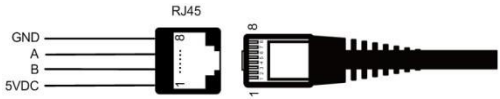
converter (RJ45 Pin Converter FF-V1.0) for BMS communication.

When the system has no BMS function, it is required to set the "BPRO (BMS protocol number)" as 32, connect a remote temperature sensor (model: RTS-D47K) through the port to detect the battery temperature, sampling distance ≤ 20 meters.

Note: Select isolated RS485 communication or non-isolated RS485 communication as required.

The pin definitions are as follows:



Pin	Definition	Pin	Definition
1	+5VDC	5	/
2	/	6	RS485-A
3	RS485-B	7	/
4	/	8	GND

Tip	Please go to EPEVER official website to check or download the currently supported BMS manufacturers and the BMS parameters.

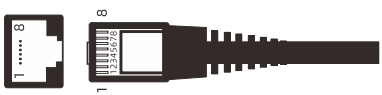
- CAN communication, RV-C protocol

Different communication protocols can be switched by setting the PAEN (Parallel Communication Enable). When PAEN is set to OFF, it can be connected to computer with the RV-C protocol. When PAEN is set to ON, the port switches to parallel communication, enabling parallel operation of multiple models. Refer to the Parallel manual for details.

Note: Controllers without an LCD do not support parallel operation.

Note: Select isolated CAN communication or non-isolated CAN communication as required.

The pin definitions are as follows:



1-+5VDC
4-CAN-H
5-CAN-L
8-GND

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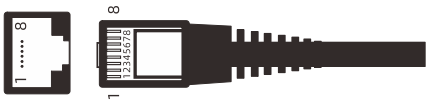
Pin	Definition	Pin	Definition
1	+5VDC	5	CAN-L
2	/	6	/
3	/	7	/
4	CAN-H	8	GND

- LIN communication, CI-BUS COM protocol

The communication methods can be customized.

Note: Select isolated LIN communication or non-isolated LIN communication as required.

The pin definitions are as follows:



1-+5VDC
7-LIN
8-GND

Pin	Definition	Pin	Definition
1	+5VDC	5	/
2	/	6	/
3	/	7	LIN
4	/	8	GND

(3) Connect an external temperature sensor (model: RT-MF58R47K3.81A) through **port 5** to detect the ambient temperature, or connect a remote temperature sensor (model: RTS300R47K3.81A) to detect the battery temperature. **Note:** If the remote temperature sensor is not connected to the controller, the default temperature for battery charging is 25℃ without temperature compensation.

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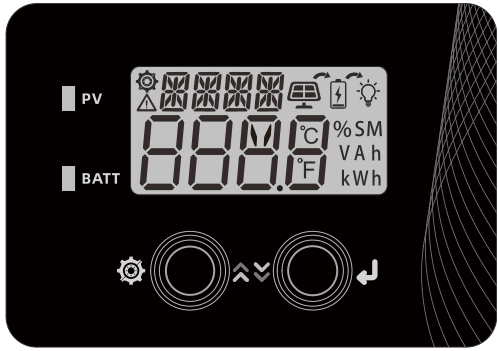
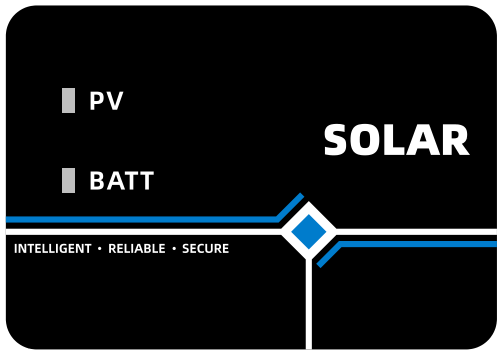
1.2.2 Indicators/Buttons/LCD

- **With LCD**



- **No LCD**



a) Indicator

Indicator	Color	Status	Description
PV	Green	Solid ON	Normal PV connection with low voltage, but no charging.
		Solid OFF	1. No sunlight; 2. Connection error
		Slowly flashing (1Hz)	Charging
		Fast flashing (4Hz)	PV input overvoltage

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BATT	Green	Solid ON	Battery is normal.
		Slowly flashing (1Hz)	Battery fully charged, SOC low battery alarm
		Fast flashing (4Hz)	Battery overvoltage, cell overvoltage
	Orange	Solid ON	Battery Undervoltage (including BMS battery pack under voltage), cell under voltage
	Red	Solid ON	Battery over discharging
		Slowly flashing (1Hz)	Battery over temperature, battery low temperature, cell over temperature, cell low temperature, BMS charging protection, BMS discharging protection
		Fast flashing (4Hz)	BMS other faults, BMS sensor fault, lithium battery rated voltage identification error
Charging (green) and battery (orange) flash simultaneously			Equipment over temperature

b) Buttons

Buttons	Operation	Description
	Press the button	Scroll up
	Press and hold the button (2s)	• Enter the setting interface (in the real-time interface). • Enter the parameters setting interface (in the setting interface). • Confirm the setting parameters.
	Press the button	Scroll down
	Press and hold the button (2s)	Confirm the setting parameters.

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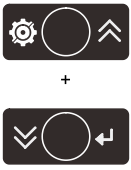
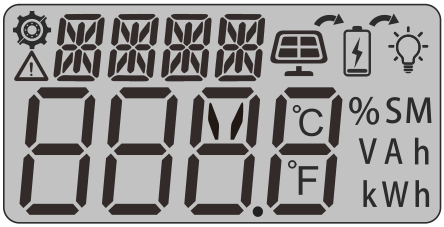
	Press the button	Exit the parameters setting interface (in the setting interface).

Note: Only controllers with an LCD are equipped with buttons.

c) LCD



Name	Icon	Status
PV array		Not charging
		Charging
	PV	Displays the input voltage, input current, input power and input energy of PV, see Subsection 3.3.1 PV real-time data.
Battery	BAT	Displays battery voltage, battery charging current, battery type, battery SOC, battery temperature, and BMS connection status, see Subsection 3.3.2 Battery real-time data.

Note: The LCD operating temperature range is -25℃ to +70℃.

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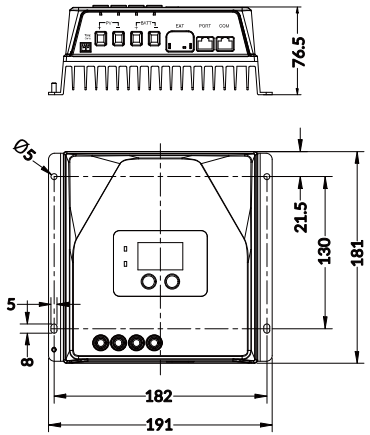
1.2.3 Dimensions

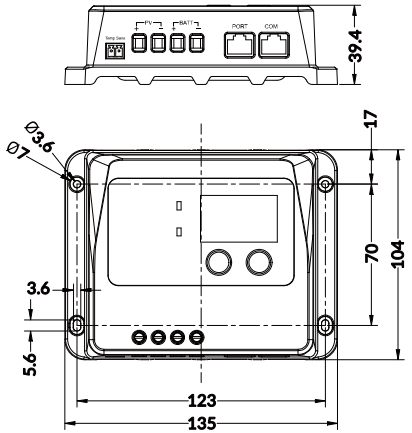
Unit: mm

- **With LCD**

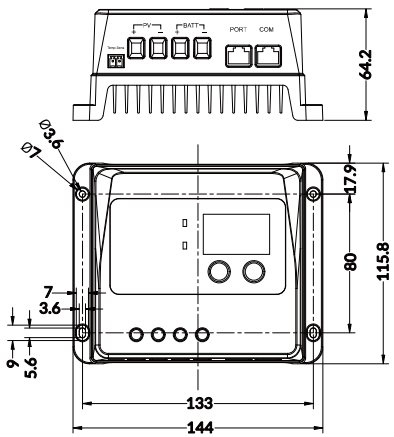
TRC4210, TRC5106



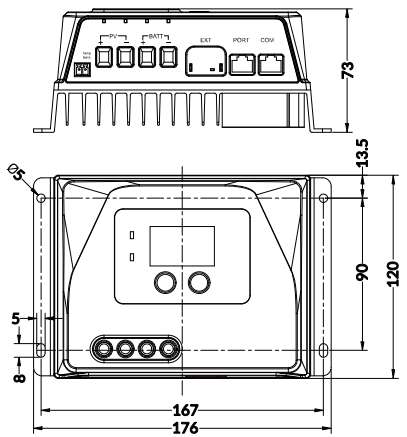
TRC1206



TRC2206



TRC3106



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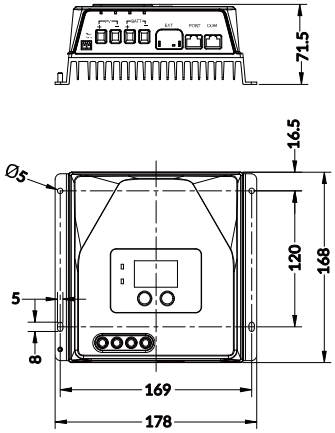
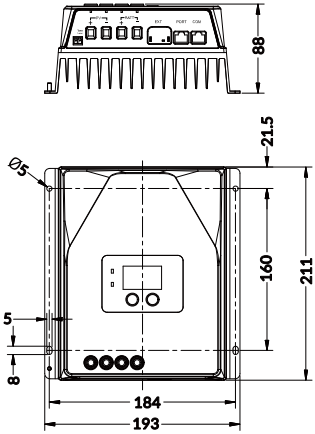
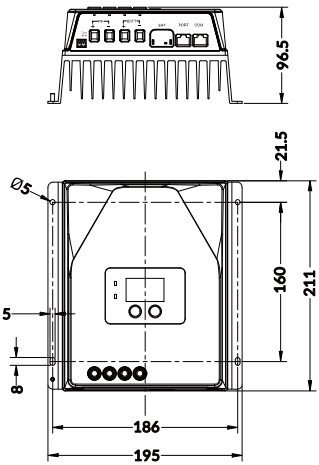
TRC3210	TRC4415, TRC4215
	

TRC5215


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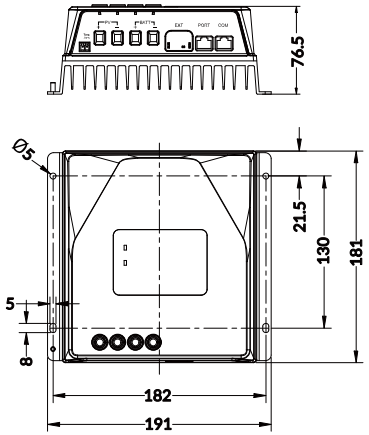
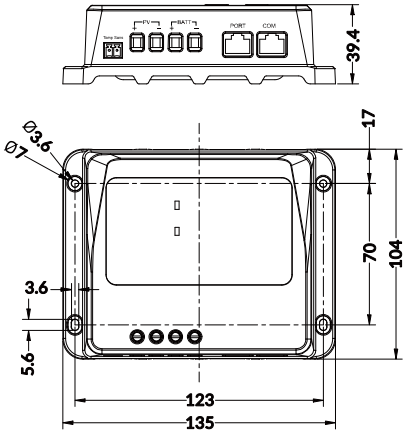
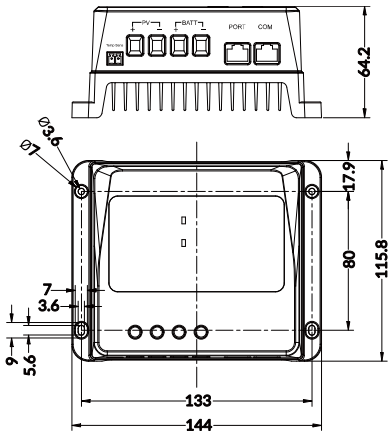
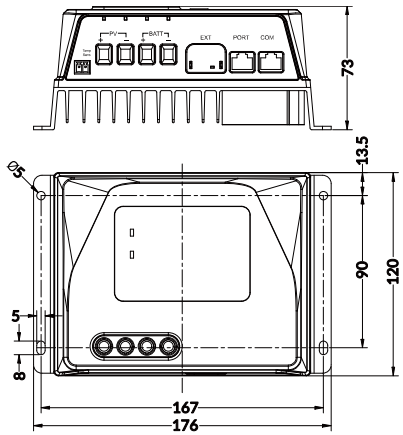
- **No LCD**

TRC4210, TRC5106	TRC1206
	
TRC2206	**TRC3106**
	

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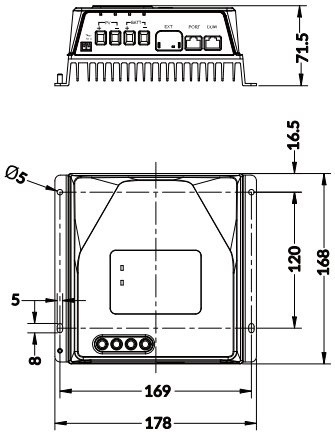
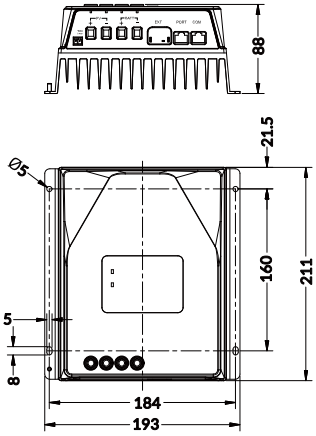
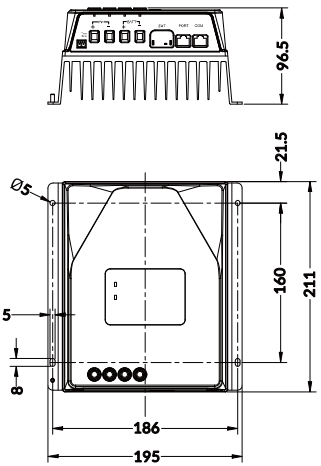
TRC3210	TRC4415, TRC4215
	

TRC5215


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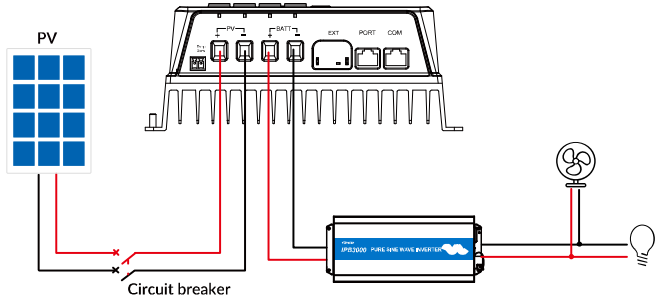
1.3 System schematic diagram

- **No battery mode**

When there is no battery, TRC series controller can be connected to the inverter directly. The inverter must be connected to the battery terminals of the controller and meet the following conditions at the same time:

1) When connecting a high-frequency inverter: PV input power > (load output power divided by the inverter conversion efficiency divided by the controller conversion efficiency).

2) When connecting an industrial frequency inverter: PV input power > (load output power divided by the inverter conversion efficiency divided by the controller conversion efficiency) × 2.



NOTICE

When operating in No-battery mode, ensure the connected load's input voltage range exceeds the system's rated voltage at the BATT terminals.

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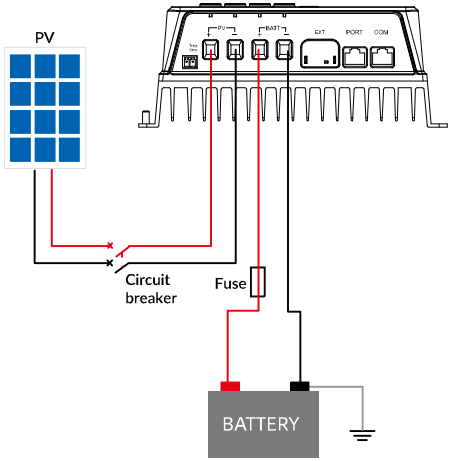
- **Battery mode**

In a system with battery connected, if you need to connect an inverter, please connect the inverter directly to the battery pack.



NOTICE

- Ensure that the length of battery connection cable is less than 3 meters.
- It is recommended that the length of the PV connection cable is less than 3 meters. If the length of the PV connection cable is less than 3 meters, it meets the requirements of EN/IEC61000-6-4 standard; If the length of the PV connection cable exceeds 3 meters, it may not meet the requirements of the EN/IEC61000-6-4 standard.

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2 Installation and Connection

2.1 Precautions

- Be careful when installing the batteries. Wear protective goggles when installing flooded lead-acid batteries, and rinse with clean water in time once in contact with battery acid.
- The battery and PV connections must be guarded against with inadvertent contact. Install the solar charge controller in an enclosure.
- Keep the battery away from any metal objects to prevent battery short circuit.
- Acidic gases may be generated when charging the battery, ensure that the environment is well ventilated.
- Avoid direct sunlight and rain infiltration for outdoor installation.
- Do not install the controller in the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments.
- Loose power connections and corroded cables may result in high heat, melting cables insulation, burning surrounding materials, or even causing a fire. Ensure tight connections and secure cables with cable ties to prevent them from swaying while moving the controller.
- Charge the lead-acid and lithium-ion batteries that are within the control range of this controller only.
- The battery terminals on the controller can be connected to either the same battery or a group of batteries. The following instructions in the manual are for use with a single battery, but they are also applicable to a system with a group of batteries.
- Select the system connection cables according to the current density of no greater than 5A/mm^2.
- The stripped length for wiring should not be too long, and the exposed metal part of the wire should not protrude from the metal part of the terminal block.
- Please refer to IEC62109 for the cross-sectional area of the grounding wire, which should not be less than 4mm^2.
- The torque for tightening the wiring screws should be not less than 1.2 N·m.

2.2 Installation requirements

Determine the installation position and heat-dissipation space

When installing the controller, ensure that there is enough air flow through the controller's heat sink, and leave at least 150mm of clearance above and below the controller to guarantee natural convection for heat dissipation.

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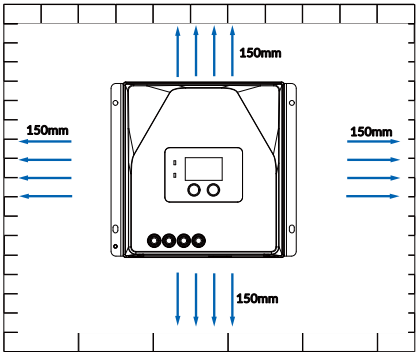
Note: If the controller is mounted in a closed cabinet, ensure that heat can be dissipated through the cabinet.



Serial connection (string) of PV modules

Due to the different types of PV modules on the market, and as an important part of the PV system, it is essential for the controller to suit various types of PV modules and to maximize the conversion of solar energy into electricity. According to the open-circuit voltage (V_{OC}) and the maximum power point voltage (V_{MPP}) of the MPPT controller, the suitable serial connection for different PV modules can be calculated. The following PV module series connection table is for reference only.

TRC1206/2206/3106/5106:

Battery Voltage/ PV Specifications	36-cell Voc < 23V		48-cell Voc < 31V		54-cell Voc < 34V		60-cell Voc < 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	2	2	1	1	1	1	1	1
24V	2	2	-	-	-	-	-	-

Battery Voltage/ PV Specifications	72-cell Voc < 46V		96-cell Voc < 62V		Thin-film module Voc > 80V
	Max.	Best	Max.	Best	
12V	1	1	-	-	-
24V	1	1	-	-	-

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TRC3210/4210:

Battery Voltage/ PV Specifications	36-cell Voc < 23V		48-cell Voc < 31V		54-cell Voc < 34V		60-cell Voc < 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	4	2	2	1	2	1	2	1
24V	4	3	2	2	2	2	2	2
48V	4	3	2	2	2	2	2	2

Battery Voltage/ PV Specifications	72-cell Voc < 46V		96-cell Voc < 62V		Thin-film module Voc > 80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	2	1	1	1	1
48V	2	1	1	1	1

TRC4215/4415/5215:

Battery Voltage/ PV Specifications	36-cell Voc < 23V		48-cell Voc < 31V		54-cell Voc < 34V		60-cell Voc < 38V	
	Max.	Best	Max.	Best	Max.	Best	Max.	Best
12V	4	2	2	1	2	1	2	1
24V	6	3	4	2	4	2	3	2
48V	6	5	4	3	4	3	3	3

Battery Voltage/ PV Specifications	72-cell Voc < 46V		96-cell Voc < 62V		Thin-film module Voc > 80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	3	2	2	1	1
48V	3	2	2	2	1

Note: The above parameters are calculated under the STC (Standard Test Condition)—temperature at 25℃, air mass 1.5, irradiance 1,000W/m^2.

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2.3 Wire size

The wiring and installation methods must conform to the national and local electrical code requirements.

- **Recommended PV array wire size**

Since the PV array output current varies according to the PV module's type, connection method and sunlight angle, the minimum PV cable specifications can be calculated by the PV Isc (short circuit current). For details, please refer to the short-circuit current value in the PV module specifications sheet (the short-circuit current remains unchanged when PV modules are connected in series; when connected in parallel, the short-circuit current is the sum of the short-circuit currents of the parallel modules). The PV array's ISC must not exceed the controller's maximum PV input current. For controller's maximum PV input current and maximum PV cable specifications, please refer to the table below.

Model	Maximum Input Current	Maximum Wire Size
TRC1206	10A	4mm²/12AWG
TRC2206	20A	6mm²/10AWG
TRC3106/TRC3210	30A	10mm²/8AWG
TRC4210/TRC4215/TRC4415	40A	16mm²/6AWG
TRC5106/TRC5215	50A	16mm²/6AWG

NOTICE

- When the PV modules connect in series at the lowest temperature, the total voltage must not exceed the controller's maximum PV open circuit voltage 60V (TRC3106, TRC1206, TRC2206, RV5106).
- When the PV modules connect in series at 25℃, the total voltage must not exceed the controller's maximum PV open circuit voltage 46V (TRC3106, TRC1206, TRC2206, RV5106).
- When the PV modules connect in series at the lowest temperature, the total voltage must not exceed the controller's maximum PV open circuit voltage 100V (TRC3210, TRC4210).
- When the PV modules connect in series at 25℃, the total voltage must not exceed the controller's maximum PV open circuit voltage 92V (TRC3210, TRC4210).
- When the PV modules connect in series at the lowest temperature, the total voltage must not exceed the controller's maximum PV open circuit voltage 150V (TRC4215, TRC4415, TRC5215).
- When the PV modules connect in series at 25℃, the total voltage must not exceed the

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controller's maximum PV open circuit voltage 138V (TRC4215, TRC4415, TRC5215).

- **Recommended battery wire size**

Battery wire size should be selected according rated current, please refer to the table below for wiring specifications.

Model	Rated Charging Current	Maximum Wire Size
TRC1206	10A	4mm^2/12AWG
TRC2206	20A	6mm^2/10AWG
TRC3106/TRC3210	30A	10mm^2/8AWG
TRC4210/TRC4215/TRC4415	40A	16mm^2/6AWG
TRC5106/TRC5215	50A	16mm^2/6AWG

NOTICE

- The wire size is only for reference. If there is a long distance between the PV array and the controller or between the controller and the battery, thicker cables can be used to reduce the voltage drop and improve system performance.
- For the battery, the recommended wire size is selected according to the conditions that its terminals are not connected to any additional inverter.

2.4 Device connection

⚠ DANGER

- Risk of explosion! Never install the controller in the enclosed space with flooded batteries! Do not install it in a confined area where battery gas can accumulate either.
- Electric shock hazard! The PV array may generate a very high open circuit voltage. Disconnect the circuit breaker or fast-acting fuse first and be careful when wiring.

NOTICE

- TRC series controllers have no battery reverse protection. Do not reverse the battery during the wiring. Otherwise, the controller may be damaged.
- When installing the controller, ensure that there is enough air flow through the controller's heat sink, and leave at least 150mm of clearance above and below the controller to guarantee natural convection for heat dissipation. If the controller is mounted in a closed cabinet, ensure that heat can be dissipated through the cabinet.

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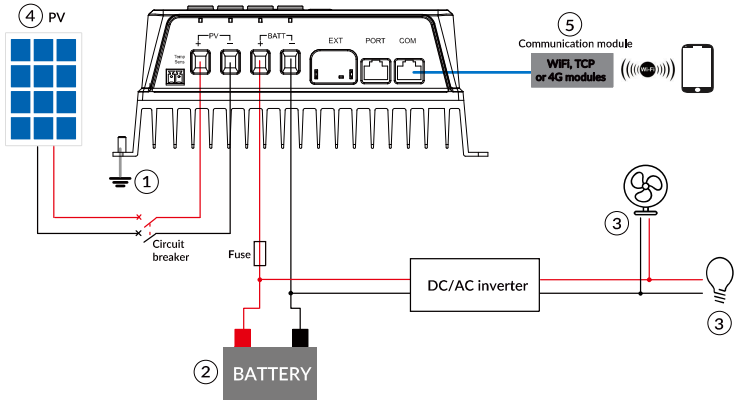
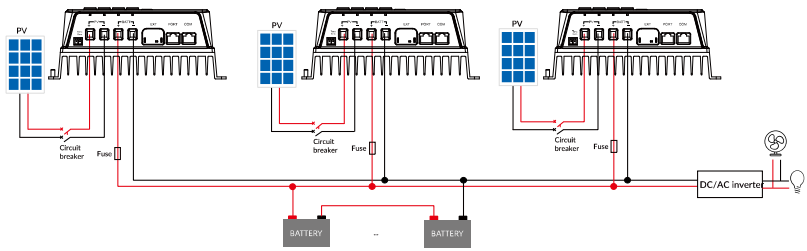
Connect the controller in the sequence of "①Ground > ②Battery > ③Load > ④PV array > ⑤Communication modules", and disconnect the controller wiring in the reverse order of the following diagram.

The following wiring diagram is illustrated with the appearance of "TRC4210 with LCD". Please refer to the actual terminals position for correct wiring of other models.



Only the model with an isolated CAN communication PORT supports stand-alone applications, also supports the parallel operation of multiple controllers of the same model (up to 3 units). **Note:** Other models do not support parallel operation, and parallel connection will damage the controllers. The wiring diagram of multiple controllers is as follows. For instructions on parallel wiring of multiple controllers, please refer to the controller parallel operation manual.

Note: Controllers without an LCD do not support parallel operation.



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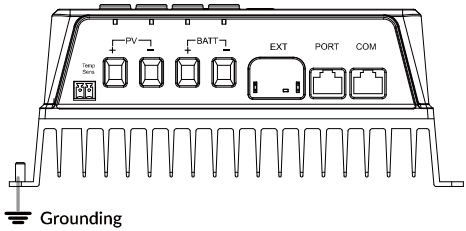
2.4.1 Connecting the ground cable (PE)



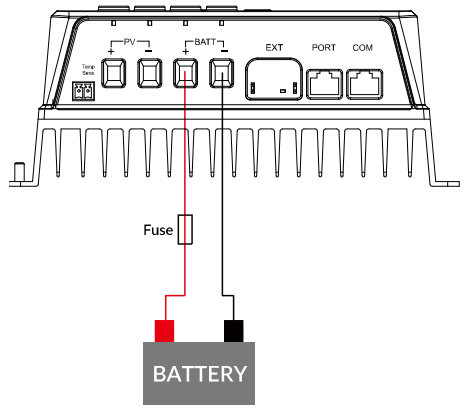
NOTICE

- Install the battery in a positive or negative grounded system. Use a single-point grounding connection, the grounding connection point shall be as close as possible to the battery, to avoid system fault or ground loops.
- Do not connect the PV modules to ground. The base of the PV modules shall be grounded to reduce the impact of the lightning. Do not connect the grounding of controller to the PV array. Only one grounding connection point is allowed, and it should be close to the battery.

2.4.2 Connecting the battery

NOTICE

- Do not connect the circuit breaker or fast-acting fuse when wiring and ensure that the leads of "+" and "-" poles are connected correctly.
- A fast-acting fuse whose current is 1.25 to 2 times the controller's rated current must be installed on the battery side with a distance from the battery no longer than 150mm.
- Please connect the inverter directly to the battery when connecting inverter in the system.



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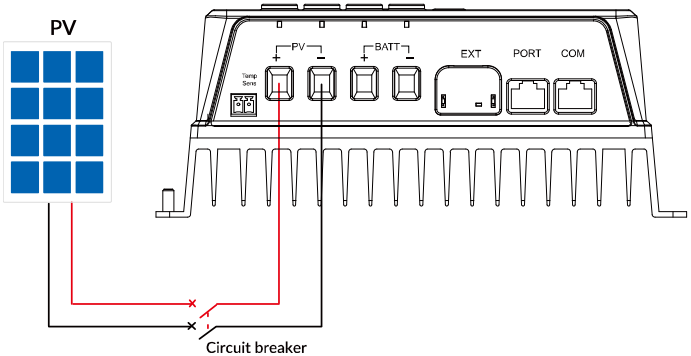
2.4.3 Connecting the PV modules

DANGER

Electric shock hazard! The PV array can generate very high voltage, disconnect the circuit breaker before wiring, and ensure that the leads of "+" and "-" poles are connected correctly.

NOTICE

If controller is used in an area with frequent lightning strikes, an external surge arrester must be installed at the PV input terminals.



2.4.4 Connecting the accessories

a) Connect the BMS-Link module

The controller can be connected to the BMS-Link module via the following two methods (choose one), to realize communication with compatible lithium battery BMS.

Note: Controllers without an LCD and built-in Bluetooth cannot be connected to the BMS-Link. Controllers without LCD but with built-in Bluetooth can be connected to the BMS-Link after setting the COM port's MPMS mode.

① PORT port: When the controller uses lithium batteries with BMS function, if the PORT adopts RS485 communication, connect the BMS-Link module and lithium batteries through the PORT; with the setting of the BMS protocol number, the BMS-Link module can convert the BMS protocols of different lithium battery manufacturers into our standard protocols to realize the communication between the controller and lithium batteries BMS of different manufacturers.

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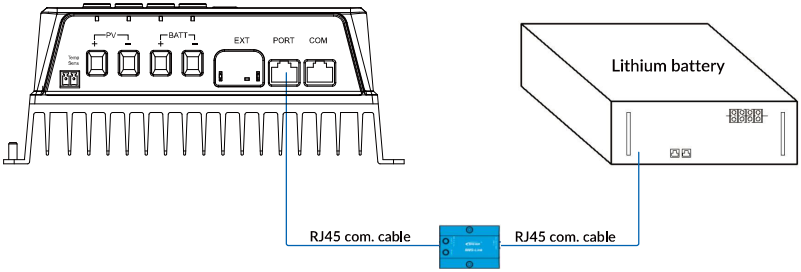
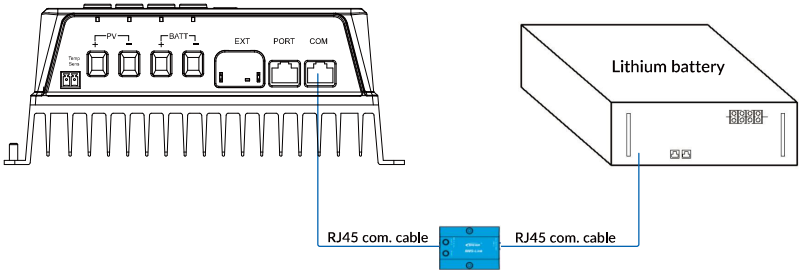


② COM port: If the PORT adopts other communication methods, set the MPMS mode as ON, and connect the BMS through the PORT.

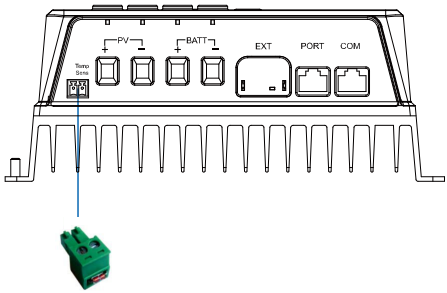


b) Connect the temperature sensor

The controller can be connected to the temperature sensor via the following three methods (choose one), to realize accurate temperature sampling of the battery.

Note: If the remote temperature sensor is not connected to the controller, the default temperature for battery charging is 25℃ without temperature compensation.

① RTS port: Connect an external temperature sensor (model: RT-MF58R47K3.81A) through the RTS port to detect the battery temperature.



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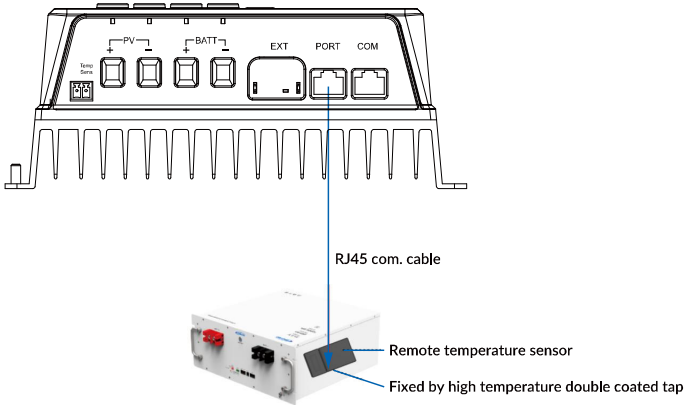
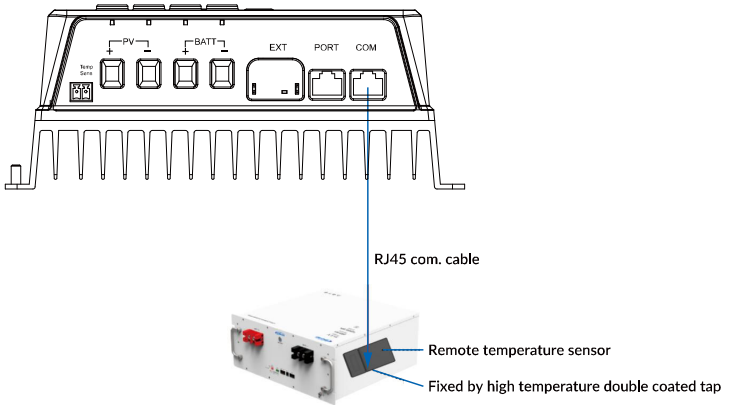
② PORT port: When the PORT adopts RS485 communication, connect a remote temperature sensor (model: RTS-D47K) through the PORT port to detect the battery temperature.

Note: It is required to set the "BPRO (BMS protocol number)" as 32. Controllers without an LCD do not support this connection method.



③ COM port: When the PORT adopts other communication methods, connect a remote temperature sensor (model: RTS-D47K) through the COM port to detect the battery temperature.

Note: It is required to set the MPMS mode as ON, and set the "BPRO (BMS protocol number)" as 32. Controllers without an LCD and built-in Bluetooth do not support this connection method.



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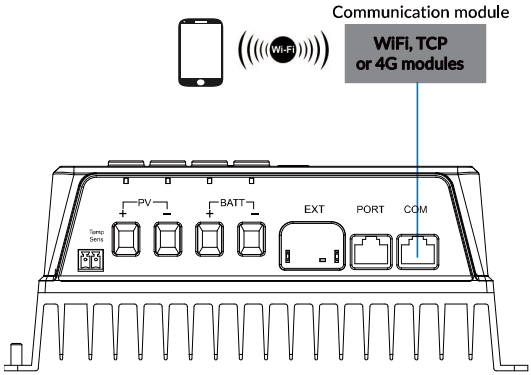
c) Connect the communication module

Connect the communication modules such as WiFi, Bluetooth, TCP or 4G modules to the RS485 COM port. You can remotely monitor the controller or modify its related parameters on the APP by phone. For specific setting methods, please refer to the user manuals of communication modules such as Cloud APP, WiFi, Bluetooth, TCP and 4G (4G module needs to be powered separately).



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3 Operation

3.1 Checking before powering on

- Whether the controller is installed correctly and securely.
- Whether the terminal wirings are connected correctly.
- Whether the terminal polarities are connected correctly.
- Whether the communication module is connected correctly and securely.

3.2 Operating the device

Connect the battery's fast-acting fuse to power on the controller. After the LCD normally displays and ensure the charge enable terminals are connected to the controller, connect the PV array's circuit breaker. The charging indicator is flashing slowly during PV charging.

Tip	If the controller does not work properly or the fault indicator indicates after the controller is powered on, refer to Chapter 6 Troubleshooting.

3.3 Parameter setting

- **No LCD**

Parameters can be set via the cloud platform or APP.

1. EPEVER cloud-PC website: https://hncloud.epsolarpv.com/.
2. EPEVER cloud-APP download:

iOS		Android	

Note: For specific setting methods, please refer to the cloud PC and cloud APP manuals.

- **With LCD**

Parameters can be set via the cloud platform, APP, or LCD. Real-time data can be viewed via the LCD.

- Controllers without an LCD can read device history records via the cloud platform and PC computer. You can view power data, PV voltage power, PV input status, battery voltage, battery charging status, battery alarm information, device status, BMS data and other information.

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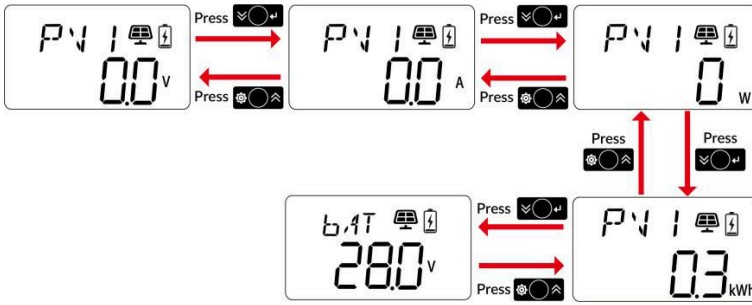
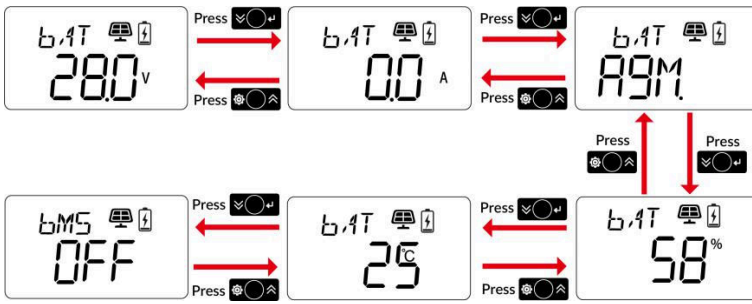
3.3.1 PV real-time data

After the controller is powered on and works normally, click on the LCD initial interface to display the following PV real-time data interfaces in sequence, you can view PV input voltage, PV input current, PV input power, and PV input energy.



3.3.2 Battery real-time data

Click on the real-time data interface of "PV input energy" to display the following battery real-time data interfaces in sequence, you can view the battery voltage, battery charging current, battery type, battery SOC, battery temperature, and BMS connection status.



3.3.3 Setting steps

Step 1: In PV/battery real-time data browsing interface, press and hold the button to enter the setting interface. Then, press the buttons to select the parameter to be set. Next, press and hold the button to enter the setting interface of the parameter (the parameter value is blinking). Modify the parameter value by pressing the buttons. And press and hold the or

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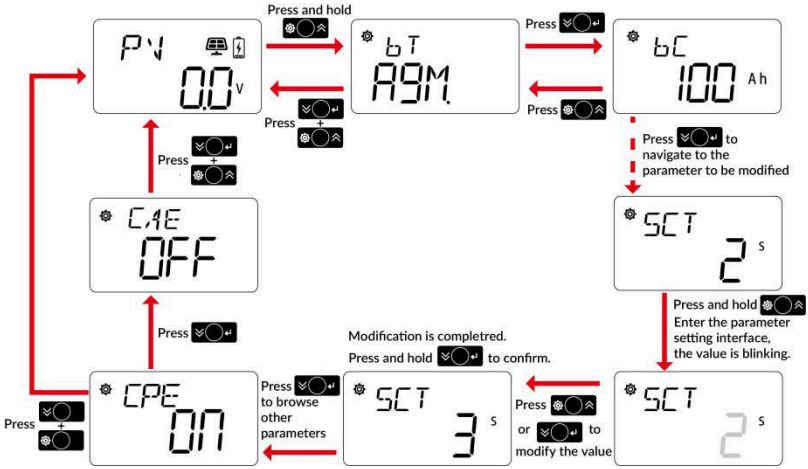
button to confirm the parameter value.

Step 2: Press the and buttons to exit the parameters setting interface and switch to the real-time data browsing interface.



3.3.4 Parameters list

The default values and setting range of the controller parameters are shown in the following table, except for some read-only parameters, other parameters can be directly modified by LCD or APP:

No.	Parameters	Default	User Define
1	bT (Battery Type)	AgM	**48V system:** AgM, GEL, FLD, LFP15S, LFP16S, LNCM13S, LNCM14S, USER
			24V system: AgM, GEL, FLD, LFP8S, LNCM6S, LNCM7S, USER
			12V system: AgM, GEL, FLD, LFP4S, LNCM3S, USER
2	bC (Battery Capacity)	100Ah	User define: 1–200Ah, step size: 1Ah **Note:** To accurately display the battery capacity, you need to set this parameter according to the actual battery capacity.

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3	RVL (Rated Voltage Level)		User define: (auto-recognition), 12V, 24V, 48V **Note:** The default value for TRC3106 and TRC5106 is 12V (read-only, and cannot be configured). For non-lithium batteries, after modifying the voltage level, restart the controller for the modification to take effect. For lithium batteries, select the battery type to "USER", modify the voltage level, and select the correct lithium battery type, restart the controller for the modification to take effect.
4★	oVD (Overvoltage Disconnect Voltage)	16.0V (12V system)	User define: 9.0–17.0V, step size: 0.1V
		32.0V (24V system)	User define: 18.0–34.0V, step size: 0.1V
		64.0V (48V system)	User define: 36.0–68.0V, step size: 0.1V
5★	oVR (Overvoltage Recovery Voltage)	15.0V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		30.0V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		60.0V (48V system)	User define: 36.0–62.0V, step size: 0.1V
6★	ECV (Equalization Charging Voltage)	14.6V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		29.2V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		58.4V (48V system)	User define: 36.0–62.0V, step size: 0.1V
7★	bCV	14.4V	User define: 9.0–15.5V, step size: 0.1V

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	(Bulk Charging Voltage)	(12V system)	
		28.8V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		57.6V (48V system)	User define: 36.0–62.0V, step size: 0.1V
8★	FCV (Float Charging Voltage)	13.8V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		27.6V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		55.2V (48V system)	User define: 36.0–62.0V, step size: 0.1V
9★	bVR (Bulk Voltage Recovery Voltage)	13.2V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		26.4V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		52.8V (48V system)	User define: 36.0–62.0V, step size: 0.1V
10★	LVR (Low Voltage Recovery Voltage)	12.6V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		25.2V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		50.4V (48V system)	User define: 36.0–62.0V, step size: 0.1V
11★	UVAR (Undervoltage Alarm Recovery Voltage)	12.2V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		24.4V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		48.8V (48V system)	User define: 36.0–62.0V, step size: 0.1V

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12★	UVA (Undervoltage Alarm Voltage)	12.0V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		24.0V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		48.0V (48V system)	User define: 36.0–62.0V, step size: 0.1V
13★	LVd (Low Voltage Disconnect Voltage)	11.1V (12V system)	User define: 9.0–15.5V, step size: 0.1V
		22.2V (24V system)	User define: 18.0–31.0V, step size: 0.1V
		44.4V (48V system)	User define: 36.0–62.0V, step size: 0.1V
14★	ECT (Equalize Charging Time)	120M	User define: 0–180 minutes, step size: 1 minute
15★	bCT (Bulk Charging Time)	120M	User define: 0–180 minutes, step size: 1 minute
16	LbP (Lithium Battery Protection)	OFF	User define: OFF, ON OFF: Disable lithium battery protection ON: Enable lithium battery protection
17	LTCL (Low Temperature Charging Limit)	-5℃	User define: -40℃ to 10℃, step size: 1℃ **Note:** This parameter goes into effect when “LBP (Lithium Battery Protection)” is set as “ON”.
18	MCC (Battery Max Charging Current) **Note:** This parameter cannot be modified when BMS is connected, the charging is controlled by BMS.	10A	TRC1206: User define: 1–10A, step size: 1A
		20A	TRC2206: User define: 1–20A, step size: 1A
		30A	TRC3106/TRC3210: User define: 1–30A, step size: 1A
		40A	TRC4210/TRC4215/TRC4415:

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			User define: 1–40A, step size: 1A
		50A	TRC5106/TRC5215: User define: 1–50A, step size: 1A
19	bPRo (BMS Protocol)	32	User define: 1–100, step size: 1
20	AddR (Address)	1	User define: 1–200, step size: 1
21	bAUd (Baudrate)	1152	User define: 1152, 96, 24 **Note:** After setting the parameter, restart the controller for the setting to take effect.
22	TU (Temperature Unit)	C	User define: C, F
23	SCT (Screen Cycle Time)	2S	The switching time of the real-time interface is 0S by default, that is, the real-time interface is not automatically switched. User define: 0–100S, step size: 1S
24	CPE (Com Port Enable)	ON	User define: OFF, ON When set to “ON”, the communication port is enabled and communication is normal. When set to “OFF”, the external communication is turned off when there is no PV input or charging, otherwise the communication is turned on. **Note:** Controllers without an LCD and built-in Bluetooth cannot be configured.
25	CAE (Clear Accumulated Energy)	OFF	User define: OFF, ON When set to “ON”, the accumulated energy is cleared once.
26	PAEN (Parallel Enable)	OFF	OFF: Stand-alone mode. CAN is the RV-C protocol. ON: Parallel mode. CAN can be used for parallel communication (goes into effect

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			only when the PORT adopts isolated CAN communication). **Note:** This parameter goes into effect only when the PORT adopts CAN communication.
27	PMCC (Parallel Battery Max Charging Current)	200A	Limit the total current for parallel charging. If the setting value of this parameter exceeds the maximum charging current of an individual controller times the quantity of parallel controllers, the parameter is invalid and the system will limit the charging according to the maximum charging current of the individual controller. User define: 100–200A, step size: 10A
28	MPMS (COM Port Primary and Secondary Mode)	OFF	OFF: Secondary mode. The COM port is only used for communication with the computer and communication modules. ON: Primary mode. The COM port is only used for BMS communication connection (this function is not required if the PORT adopts RS485 communication, and enabling the BMS communication through the PORT). **Note:** Controllers without an LCD and built-in Bluetooth cannot be configured.
29	FV (Firmware Version)	/	Read-only. **Note:** Please refer to the actual display for the specific version.

★ Indicates that this setting is only available and visible when the battery type is set to "USER".

3.3.5 Battery voltage control parameters

a) Lead-acid battery parameters

The following table shows the voltage control parameters of 12V system (12V battery), voltage control parameters and user-define range of 24V system (24V battery) and 48V system (48V battery) are equal to the parameter values of 12V system times 2 and 4 respectively.

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Battery Type / Voltage Control Parameters	AGM	GEL	FLD	User Define
Overvoltage Disconnect Voltage	16.0V	16.0V	16.0V	9–17V
Charging Limit Voltage	15.0V	15.0V	15.0V	9–15.5V
Overvoltage Recovery Voltage	15.0V	15.0V	15.0V	9–15.5V
Equalization Charging Voltage	14.6V	--	14.8V	9–15.5V
Bulk Charging Voltage	14.4V	14.2V	14.6V	9–15.5V
Float Charging Voltage	13.8V	13.8V	13.8V	9–15.5V
Bulk Recovery Voltage	13.2V	13.2V	13.2V	9–15.5V
Low Voltage Recovery Voltage	12.6V	12.6V	12.6V	9–15.5V
Undervoltage Alarm Recovery Voltage	12.2V	12.2V	12.2V	9–15.5V
Undervoltage Alarm Voltage	12.0V	12.0V	12.0V	9–15.5V
Low Voltage Disconnect Voltage	11.1V	11.1V	11.1V	9–15.5V
Discharging Limit Voltage	10.6V	10.6V	10.6V	9–15.5V
Equalization Charging Time★	120 minutes	--	120 minutes	0–180 minutes
Bulk Charging Time★	120 minutes	120 minutes	120 minutes	10–180 minutes

★ When the battery type is changed to lithium battery, the lithium battery protection is automatically enabled, and the default values of “ECT” and “BCT” are changed to 10 minutes.

★ When the battery type is changed to “AGM, GEL or FLD”, the lithium battery protection is disabled, and the default values of “ECT” and “BCT” are changed to 120 minutes.

★When the battery type is changed to “USER”, the values of lithium battery protection, “ECT” and “BCT” remain the same as the previous battery type.

When the default battery type is selected, the battery voltage control parameters cannot be modified. To change these parameters, select the battery type as "USER". Follow the logic below to set the battery type as “USER”

A. Overvoltage Disconnect Voltage > Charging Limit Voltage ≥ Equalization Charging Voltage ≥ Bulk Charging Voltage ≥ Float Charging Voltage > Bulk Recovery Voltage;

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B. Overvoltage Disconnect Voltage > Overvoltage Recovery Voltage;

C. Low Voltage Recovery Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage;

D. Undervoltage Alarm Recovery Voltage > Undervoltage Alarm Voltage ≥ Discharging Limit Voltage;

E. Bulk Recovery Voltage > Low Voltage Recovery Voltage.

b) Lithium battery parameters

Battery Type / Voltage Control Parameters	LFP			
	LFP4S	User Define	LFP8S	User Define
Overvoltage Disconnect Voltage	14.5V	9–17V	29.0V	18–34V
Charging Limit Voltage	14.3V	9–15.5V	28.6V	18–31V
Overvoltage Recovery Voltage	14.3V	9–15.5V	28.6V	18–31V
Equalization Charging Voltage	14.2V	9–15.5V	28.4V	18–31V
Bulk Charging Voltage	14.2V	9–15.5V	28.4V	18–31V
Float Charging Voltage	13.3V	9–15.5V	26.6V	18–31V
Bulk Recovery Voltage	13.0V	9–15.5V	26.0V	18–31V
Low Voltage Recovery Voltage	12.8V	9–15.5V	25.6V	18–31V
Undervoltage Alarm Recovery Voltage	12.2V	9–15.5V	24.4V	18–31V
Undervoltage Alarm Voltage	12.0V	9–15.5V	24.0V	18–31V
Low Voltage Disconnect Voltage	11.3V	9–15.5V	22.6V	18–31V
Discharging Limit Voltage	11.0V	9–15.5V	22.0V	18–31V

Note: The LFP4S voltage is 12V, the LFP8S voltage is 24V.

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Battery Type / Voltage Control Parameters	LFP		
	LFP15S	LFP16S	User Define
Overvoltage Disconnect Voltage	54.7V	59.2V	36–68V
Charging Limit Voltage	53.6V	58.4V	36–62V
Overvoltage Recovery Voltage	53.6V	58.4V	36–62V
Equalization Charging Voltage	53.3V	57.12V	36–62V
Bulk Charging Voltage	53.3V	57.12V	36–62V
Float Charging Voltage	50.0V	54.4V	36–62V
Bulk Recovery Voltage	49.7V	53.28V	36–62V
Low Voltage Recovery Voltage	48.0V	52.0V	36–62V
Undervoltage Alarm Recovery Voltage	45.7V	51.2V	36–62V
Undervoltage Alarm Voltage	45.0V	49.6V	36–62V
Low Voltage Disconnect Voltage	42.5V	46.4V	36–62V
Discharging Limit Voltage	41.5V	44.0V	36–62V

Note: The voltage of LFP15S and LFP16S is 48V.

Battery Type / Voltage Control Parameters	LNCM				
	LNCM3S	User Define	LNCM6S	LNCM7S	User Define
Overvoltage Disconnect Voltage	12.8V	9–17V	25.6V	29.8V	18–34V
Charging Limit Voltage	12.6V	9–15.5V	25.2V	29.4V	18–31V
Overvoltage Recovery Voltage	12.5V	9–15.5V	25.0V	29.1V	18–31V
Equalization Charging Voltage	12.5V	9–15.5V	25.0V	29.1V	18–31V
Bulk Charging Voltage	12.5V	9–15.5V	25.0V	29.1V	18–31V
Float Charging Voltage	12.2V	9–15.5V	24.4V	28.4V	18–31V
Bulk Recovery Voltage	12.1V	9–15.5V	24.2V	28.2V	18–31V

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Low Voltage Recovery Voltage	10.5V	9–15.5V	21.0V	24.5V	18–31V
Undervoltage Alarm Recovery Voltage	12.2V	9–15.5V	24.4V	28.4V	18–31V
Undervoltage Alarm Voltage	10.5V	9–15.5V	21.0V	24.5V	18–31V
Low Voltage Disconnect Voltage	9.3V	9–15.5V	18.6V	21.7V	18–31V
Discharging Limit Voltage	9.3V	9–15.5V	18.6V	21.7V	18–31V

Note: The LNCM3S voltage is 12V, the voltage of LNCM6S and LNCM7S is 24V.

Battery Type / Voltage Control Parameters	LNCM		
	LNCM13S	LNCM14S	User Define
Overvoltage Disconnect Voltage	55.4V	59.7V	36–68V
Charging Limit Voltage	54.6V	58.8V	36–62V
Overvoltage Recovery Voltage	54.1V	58.3V	36–62V
Equalization Charging Voltage	54.1V	58.3V	36–62V
Bulk Charging Voltage	54.1V	58.3V	36–62V
Float Charging Voltage	52.8V	56.9V	36–62V
Bulk Recovery Voltage	52.4V	56.4V	36–62V
Low Voltage Recovery Voltage	45.5V	49.0V	36–62V
Undervoltage Alarm Recovery Voltage	52.8V	56.9V	36–62V
Undervoltage Alarm Voltage	45.5V	49.0V	36–62V
Low Voltage Disconnect Voltage	40.3V	43.4V	36–62V
Discharging Limit Voltage	40.3V	43.4V	36–62V

Note: The voltage of LNCM13S and LNCM14S is 48V.

When the battery type is set as “USER”, follow the logic below to set the voltage parameters of the lithium battery.

A. Overvoltage Disconnect Voltage < Over Charging Protection Voltage (Protection Circuit Modules(BMS)) minus 0.2V;

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B. Overvoltage Disconnect Voltage > Overvoltage Recovery Voltage = Charging Limit Voltage ≥ Equalization Charging Voltage = Bulk Charging Voltage ≥ Float Charging Voltage > Bulk Recovery Voltage;

C. Low Voltage Recovery Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage;

D. Undervoltage Alarm Recovery Voltage > Undervoltage Alarm Voltage ≥ Discharging Limit Voltage;

E. Bulk Recovery Voltage > Low Voltage Recovery Voltage;

F. Low Voltage Disconnect Voltage ≥ Over Discharging Protection Voltage (BMS) plus 0.2V.

NOTICE

- The lithium battery parameters must be set according to its BMS voltage parameters.
- It is required that the BMS accuracy of the lithium battery installed in the system is less than or equal to 0.2V, if it is higher than 0.2V, we shall not be liable for any system error.

3.3.6 Control strategy under lithium battery protocol

When the BMS is connected correctly, and the BPRO (BMS protocol) is set correctly, the system follows the following control strategies:

No.	Status/Condition	Control strategy
1	Battery forced charge request appears.	Forced charge the battery with the charging current value provided by the BMS.
2	The BMS sends an exit forced charge command.	Exit the battery forced charge mode and resumes normal operating mode.
3	Read the charging voltage upper limit and the discharging voltage lower limit from the BMS*	Each control voltage is converted according to the table "Conversion Relationship of Each Control Voltage", and the system is charged according to the converted voltage value, and the LCD meter displays the converted voltage value. **Note:** If the BMS communication is normal but charging voltage upper limit and the discharging voltage lower limit cannot be read, the system will be charged according to the value set by the customer.
4	Read the charging limit current from the BMS.	Limit the charging current as the read charging current limit value.
5	Turn off charging meter and display BCF.	BMS uploads the battery full charge status (Battery is fully charged).

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6	BMS voltage and current limiting parameters are taking effect.	The controller limits charging according to the maximum charging current value uploaded by BMS and the meter displays BLC.

★ For the maximum charging voltage and the minimum discharging voltage of the lithium battery, please refer to its specification sheet.

- **Conversion Relationship of Each Control Voltage**

No.	LCD	Control Voltage	Converted Voltage
1	OVD	Overvoltage Disconnect Voltage	Charging Voltage Upper Limit + 0.3 × Level
2	CLV	Charging Limit Voltage	Charging Voltage Upper Limit (namely, the Battery Pack Overvoltage Alarm Voltage)
3	OVR	Overvoltage Recovery Voltage	Charging Voltage Upper Limit
4	ECV	Equalization Charging Voltage	Charging Voltage Upper Limit - 0.1 × Level
5	BCV	Bulk Charging Voltage	Charging limit voltage - 0.1 × Level
6	FCV	Float Charging Voltage	Charging limit voltage - 0.1 × Level
7	BRV	Bulk Recovery Voltage	Charging Voltage Upper Limit - 0.8 × Level
8	LVR	Low Voltage Recovery Voltage	Discharging Voltage Lower Limit + 0.7 × Level
9	UAR	Undervoltage Alarm Recovery Voltage	Discharging Voltage Lower Limit + 0.7 × Level
10	UAV	Undervoltage Alarm Voltage	Discharging Voltage Lower Limit + 0.4 × Level
11	LVD	Low Voltage Disconnect Voltage	Discharging limit voltage (namely, the battery pack Undervoltage Alarm Voltage)
12	DLV	Discharging Limit Voltage	Discharging limit voltage - 0.7 × Level

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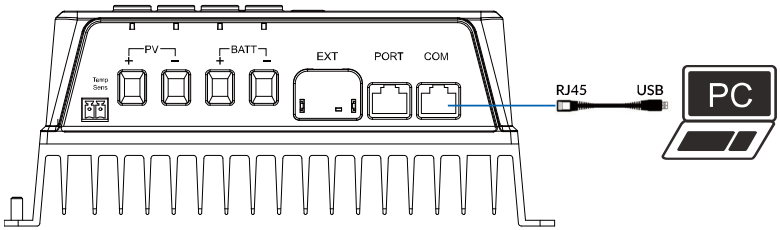
3.3.7 Setting parameters remotely

a) Setting the "USER" voltage parameters by PC software

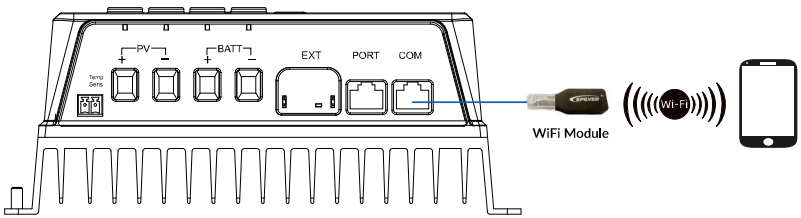
Connect the COM port of the controller to the PC USB port by the USB to RS485 communication cable. Set the "USER" voltage parameters by the PC software.



b) Setting by APP

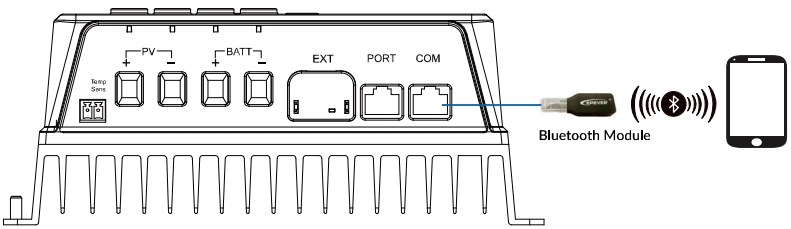
- Connecting the external WiFi module

Connect the WiFi module to the COM port of the controller, set the "USER" voltage parameters on the APP through the WiFi signal. For specific setting methods, please refer to the cloud APP manual.



- Connecting the external Bluetooth module

Connect the Bluetooth module to the COM port of the controller, set the "USER" voltage parameters on the APP through the Bluetooth signal. For specific setting methods, please refer to the cloud APP manual.



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4 Maintenance

To maintain long-term working performance, it is recommended to have the following items inspected twice a year.

- Ensure the airflow around the controller is not blocked, and remove dirt or debris from the heat sink.
- Check whether the insulation of exposed cables have been damaged by sunlight, friction with other surrounding objects, dryness, insects or rodents, etc. Repair or replace the cables if necessary.
- Check whether the indicator and display are consistent with the actual operation of the equipment, and note that corrective action should be taken in case of inconsistency or error.
- Check terminals for signs of corrosion, insulation damage, high temperature or burning/discoloration, tighten terminal screws.
- Check for signs of dirt, insect nesting and corrosion and clean up as required.
- If the lightning arrester has failed, replace it in time to avoid lightning strikes' damage to the controller or even other equipment.

⚠ DANGER

Electric shock hazard! Ensure that the power supply of the controller is disconnected when performing the above operations!

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5 Protections

Protections	Description
PV array current-limiting	When the charging current exceeds the rated current of the controller, the controller will charge the battery as per the rated current. **Note:** For PV arrays with mismatched parameters, they may not operate at the maximum power point.
PV array short circuit	When PV is not charging the battery and is short-circuit, the controller will not be damaged. **Note:** It is forbidden to short-circuit the PV array during charging. Otherwise, the controller may be damaged.
PV array reverse polarity	When the PV array polarity is reversed, the controller will not be damaged and will resume normal operation after correction. **Note:** When the actual operating power of the PV array exceeds 1.5 times the controller's rated charging power during reverse connection, the controller will be damaged.
(Lithium) Battery overvoltage	When the battery voltage is higher than the "OVD (Overvoltage Disconnect Voltage)", the controller will automatically stop charging the battery to protect the battery from over charging.
(Lithium) Battery over temperature	The controller detects the ambient temperature by an external temperature sensor. The battery stops working when its temperature goes higher than 65℃ and resumes operation when its temperature is below 55℃.
Lithium battery low temperature charging and discharging	The controller detects the battery temperature by an external temperature sensor. The battery stops charging and discharging when its temperature is less than the low temperature protection threshold, and resumes charging and discharging when its temperature goes higher than the low temperature protection threshold.

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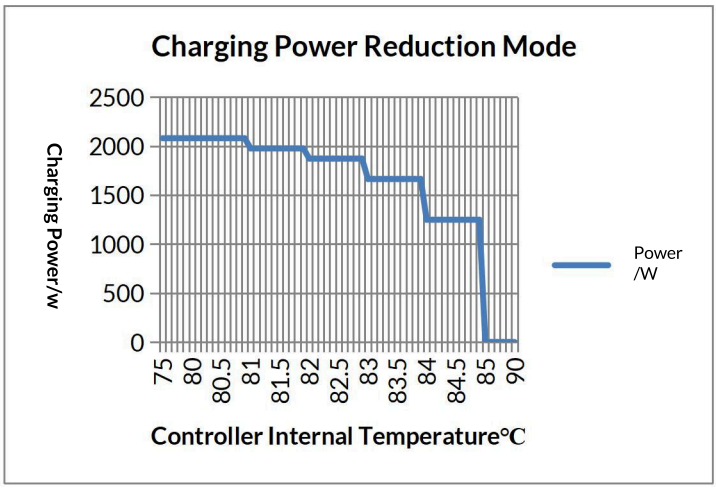
Lead temperature sensor damage	When the temperature sensor is short-circuit or damaged, the controller will charge or discharge at 25 ℃ by default, to protect the battery from over charging or over discharging.
TVS high voltage surge	The internal circuit of this controller is designed with Transient Voltage Suppressors (TVS), which can only protect against high-voltage surge pulses with less energy. If the controller is used in an area with frequent lightning strikes, it is recommended to install an external lightning arrester.
Controller over temperature★	The controller detects its internal temperature by the internal temperature sensor. The controller stops operating when its internal temperature is higher than 85 ℃ , and resumes operating when its internal temperature is below 75℃.

★ When the control's internal temperature is 81℃, the charging power reduction mode is turned on. For every 1℃ increase in temperature, the charging power is reduced by 5%, 10%, 20%, and 40% respectively. When the temperature is higher than 85℃, the charging is stopped. While the internal temperature is not more than 75℃, the controller will resume charging as per the rated charging power. For example, TRC4415 system:



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6 Troubleshooting

Status	Error Code	Possible Reasons	Troubleshooting
PV indicator is fast flashing green.	POV	PV Overvoltage	Check whether the connected PV open circuit voltage is higher than the PV maximum open circuit voltage, and the alarm is cleared when the PV open circuit voltage is lower than the PV maximum open circuit voltage minus 5V.
BATT indicator is solid orange.	BUV	Battery Undervoltage Alarm (including battery pack Undervoltage alarm)	Disconnect the loads connection, and check whether the battery voltage is too low. After the battery is charged and its voltage is restored above "UVAR (Undervoltage Alarm Recovery Voltage)", it will automatically resume normal operation, or recharge the battery with other methods.
	CUV	Cell Undervoltage Protection	Check the BMS communication status or BMS parameters settings.
BATT indicator is solid red.	BOD	Battery Over Discharging Protection	Disconnect the loads connected to the battery, and check whether the battery voltage is too low. After the battery is charged and its voltage is restored above "LVR (Low Voltage Recovery Voltage)", it will automatically resume normal operation, or use other methods to recharge the battery.
BATT indicator is fast flashing red.	BOF	BMS Other Fault	Check whether the battery BMS connection is normal.
	BSF	BMS Sensor Fault	
	LBVE	Lithium Battery Rated Voltage Identification Error	Check whether the lithium battery is connected to the controller correctly or the voltage uploaded by BMS is consistent with the voltage at the controller battery terminals.

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BATT indicator is fast flashing green.	BOV	Battery Overvoltage Protection	Disconnect all charging and measure whether the battery voltage is too high, and check whether the voltage of the connected battery matches the rated voltage level of the controller, or check whether the setting value of the battery "OVD (Overvoltage Disconnect Voltage)" is inconsistent with the battery specifications. After the battery voltage drops below the set value of “OVR (Overvoltage Recovery Voltage)”, the alarm will automatically be cleared.
	COV	Cell Overvoltage Protection	Check the BMS communication status or BMS parameters settings.
BATT indicator is slowly flashing red.	BOT	Battery Over Temperature	Ensure the battery is installed in a cool and well-ventilated place, check that the battery actual charging and discharging current does not exceed the set values of "Battery Max Charging Current". (If BMS is connected, “MCC” is the read value from the BMS, which cannot be set. When the battery temperature drops below the "BATT OTPR (Battery Over Temperature Recovery)", the controller resumes normal charging control.
	BLT	Battery Low Temperature	Check whether the ambient temperature is lower than the “LTCL (Low Temperature Charging Limit)”, when the ambient temperature is higher than the "LTCL + 2℃", the battery resumes normal operating.
	COT	Cell Over Temperature Protection	Check the BMS communication status or BMS parameters settings.
	CLT	Cell Low Temperature Protection	
	BCP	BMS Charging Protection	
	BDP	BMS Discharging Protection	

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BATT indicator is slowly flashing green.	SLBP	SOC Low Battery Protection	Charge the battery to LBAR (Low Battery Alarm Recovery SOC)
--	BOCD	BMS Over Current Discharging Alarm	Check the BMS communication status or BMS parameters settings.
	BOCC	BMS Over Current Charging Alarm	
	BLC	BMS voltage and current limiting parameters are taking effect	BMS is normal and no troubleshooting is required.
	PIDR	Parallel ID Repetition	Check whether the IDs of parallel equipment is repeated.
PV indicator is fast flashing green. BATT indicator is fast flashing orange.	DOT	Device Over Temperature	Ensure the controller is installed in a cool and well-ventilated place, When the controller temperature drops below the "DOT (Device Over Temperature)", the controller resumes normal charging control.

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7 Technical Specifications

Model	TRC3106	TRC5106	TRC1206	TRC2206
PV Input (DC)				
Maximum Open-circuit Voltage	60V (@lowest temperature); 46V (@25℃)			
MPPT Voltage Range	(Battery voltage plus 2V) to 36V			
Battery				
Rated Voltage	12V		12/24VDC Auto	
Rated Charging Current	30A	50A	10A	20A
Maximum Charging Power	390W/12V	650W/12V	130W/12V 260W/24V	260W/12V 520W/24V
Controller				
Output Voltage Range	8–16V		8–31V	
Static Loss (Enabled Communication)(1)	12V/16mA	12V/16mA	12V/14mA 24V/8mA	12V/14mA 24V/8mA
Static Loss (Disabled Communication)(1)	12V/7mA	12V/7mA	12V/7mA 24V/5mA	12V/8mA 24V/5mA
Communication Method	CAN (RV-C Protocol)/RS485 (5VDC/200mA)/LIN (CI-BUS COM Protocol)/Bluetooth(2)			
Display	LCD/No LCD(3)			
Efficiency				
Maximum Conversion Efficiency	96.1%	96.2%	98.1%	98.6%
Environmental Parameters				

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Operating Temperature	-30℃ to +60℃ (not require derating when the temperature is within 40℃)			
Storage Temperature	-40℃ to +70℃			
Relative Humidity	≤ 95% (N.C.)			
Altitude	< 5,000m (> 2,000m derating)			
Ingress Protection	IP32		IP20	
Mechanical Parameters				
Dimensions (L × W × H)	176mm × 120mm × 73mm	191mm × 181mm × 76.5mm	135mm × 104mm × 39.4mm	144mm × 115.8mm × 64.2mm
Weight	0.75kg	1.5kg	0.31kg	0.59kg

(1) The static loss data is only valid for RR series products and varies by model.

(2) Model with an LCD description: I indicates communication port isolation; RR indicates two 485 ports; RC indicates one 485 port and one CAN port; RL indicates one 485 port and one LIN port. Six communication modes are available for selection: IRR, IRC, IRL, RR, RC, and RL. Model without LCD description: A indicates one CAN port, one 485 port, and built-in Bluetooth; B indicates one CAN port, one 485 port, and without built-in Bluetooth.

(3) A and B indicate no LCD.

Model	**TRC3210**	TRC4210
PV Input (DC)		
Maximum Open-circuit Voltage	100V (@lowest temperature); 92V (@25℃)	
MPPT Voltage Range	(Battery voltage plus 2V) to 72V	
Battery		
Rated Voltage	12/24VDC Auto	
Rated Charging Current	30A	40A
Maximum Charging Power	390W/12V; 780W/24V	520W/12V; 1,040W/24V
Controller		
Output Voltage Range	8–31V	

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Static Loss (Enabled Communication)(1)	12V/21mA 24V/12mA	12V/21mA 24V/12mA
Static Loss (Disabled Communication)(1)	12V/7mA 24V/4mA	12V/7mA 24V/4mA
Communication Method	CAN (RV-C Protocol)/RS485 (5VDC/200mA)/LIN (CI-BUS COM Protocol)/Bluetooth(2)	
Display	LCD/No LCD(3)	
Efficiency		
Maximum Conversion Efficiency	98.4%	
Environmental Parameters		
Operating Temperature	-30℃ to +60℃ (not require derating when the temperature is within 40℃)	
Storage Temperature	-40℃ to +70℃	
Relative Humidity	≤ 95% (N.C.)	
Altitude	< 5,000m (> 2,000m derating)	
Ingress Protection	IP32	
Mechanical Parameters		
Dimensions (L × W × H)	178mm × 168mm × 71.5mm	191mm × 181mm × 76.5mm
Weight	1.2kg	1.5kg

(1) The static loss data is only valid for RR series products and varies by model.

(2) Model with an LCD description: I indicates communication port isolation; RR indicates two 485 ports; RC indicates one 485 port and one CAN port; RL indicates one 485 port and one LIN port. Six communication modes are available for selection: IRR, IRC, IRL, RR, RC, and RL. Model without LCD description: A indicates one CAN port, one 485 port, and built-in Bluetooth; B indicates one CAN port, one 485 port, and without built-in Bluetooth.

(3) A and B indicate no LCD.

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Model	TRC5215	TRC4215	TRC4415
PV Input (DC)			
Maximum Open-circuit Voltage	150V (@lowest temperature); 138V (@25℃)		
MPPT Voltage Range	(Battery voltage plus 2V) to 108V		
Battery			
Rated Voltage	12/24VDC Auto		12/24/48VDC Auto
Rated Charging Current	50A	40A	40A
Maximum Charging Power	650W/12V 1,300W/24V	520W/12V 1,040W/24V	520W/12V 1,040W/24V 2,080/48V
Controller			
Output Voltage Range	8–31V	8–31V	8–62V
Static Loss (Enabled Communication)(1)	12V/23mA 24V/13mA	12V/23mA 24V/13mA	12V/22mA 24V/13mA 48V/11mA
Static Loss (Disabled Communication)(1)	12V/7mA 24V/5mA	12V/7mA 24V/5mA	12V/7mA 24V/5mA 48V/5mA
Communication Method	CAN (RV-C Protocol)/RS485 (5VDC/200mA)/LIN (CI-BUS COM Protocol)/Bluetooth(2)		
Display	LCD/No LCD(3)		
Efficiency			
Maximum Conversion Efficiency	98.2%	98.5%	98.5%
Environmental Parameters			
Operating Temperature	-30℃ to +60℃ (not require derating when the temperature is within 40℃)		
Storage Temperature	-40℃ to +70℃		

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Relative Humidity	≤ 95% (N.C.)		
Altitude	< 5,000m (> 2,000m derating)		
Ingress Protection	IP32		
Mechanical Parameters			
Dimensions (L × W × H)	195mm × 211mm × 96.5mm	193mm × 211mm × 88mm	
Weight	2.5kg	2.15kg	2.25kg

(1) The static loss data is only valid for RR series products and varies by model.

(2) Model with an LCD description: I indicates communication port isolation; RR indicates two 485 ports; RC indicates one 485 port and one CAN port; RL indicates one 485 port and one LIN port. Six communication modes are available for selection: IRR, IRC, IRL, RR, RC, and RL. Model without LCD description: A indicates one CAN port, one 485 port, and built-in Bluetooth; B indicates one CAN port, one 485 port, and without built-in Bluetooth.

(3) A and B indicate no LCD.

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8 Technical Support

For technical inquiries regarding our products, please contact us through the following channels:

Service Hotline: 010-82894896/82894112

0752-3889706

0755-89236770

Email: support@epever.com

For more product information, please visit: www.epever.com.

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