MPPT Solar Charge Controller

PTR Tracer AN Series (50A/60A/80A/100A 12V/24V/36V/48V)

User Manual

Models:

PTR5415AN
PTR6415AN
PTR8420AN
PTR10420AN

Important Safety Instructions

This manual contains important information about the safe installation and operation of the solar charge controller. Please keep this manual for future reference.

General Safety Information

- ➢ Read the full instruction manual before you begin the installation.

- ➢ There are no parts serviceable by users. Do not disassemble or attempt to repair the controller.

- ➢ Mount the controller indoors only. Prevent exposure to the elements, avoid direct sunlight and high temperatures. Do not allow any contact with water.

- ➢ Install the controller in a well-ventilated place to ensure adequate heat dissipation from the controller's heat sink which may get hot during operation.

- ➢ Install appropriate external fuses / breakers as recommended.

- ➢ Remove all connections between the controller and the battery / PV array or disconnect the appropriate fuses / breakers before the controller is installed.

- ➢ Power connections must remain tight to avoid excessive heating from a loose connection.

Contents

1 General Information

1.1 Overview

Thank you for choosing this Photonic Universe PTR Tracer AN series MPPT solar charge controller. Equipped with an advanced MPPT control algorithm, multiphase synchronous rectification technology (MSRT), dual-core processor, negative common ground and an inbuilt LCD display, this product is a practical and a high-performing solution for your solar system.

Using the MPPT algorithm, this controller can quickly and accurately track the ideal maximum power point (MPP) of a photovoltaic array in order to obtain the maximum solar energy output. This significantly improves the efficiency of the solar system. In addition, the current / power limiting function and automatic power reduction ensure system longevity and reliability.

With the adaptive three-stage charging mode based on a digital control circuit, PTR Tracer AN series controllers can effectively prolong the life-cycle of battery and significantly improve the system performance. The load, utility or generator auto-control relays make it easy to assemble a hybrid power system.

This solar charge controller features comprehensive electronic self-testing and enhanced electronic protection functions which allow it to operate safely and help to reduce the risk of damage to system components resulting from installation errors or system faults.
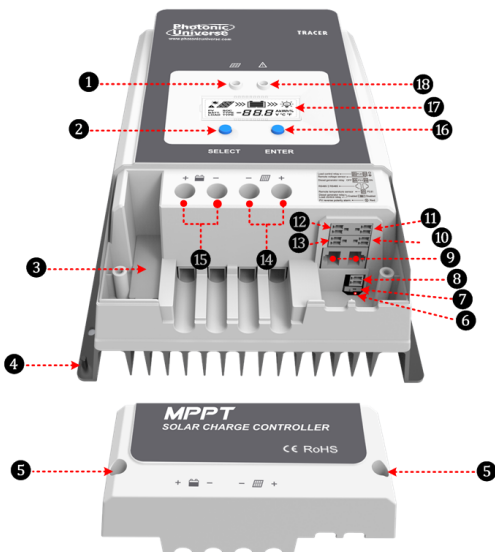
The isolated RS485 interface with standard MODBUS communication protocol and 5V power supply supports connection of up to 8 controllers in parallel to expand the system. This port is also compatible with remote display screens and networking devices for monitoring of the system in many different applications.

Features:

- Advanced MPPT technology & ultra-fast tracking with efficiency greater than 99.5%
- High quality components for excellent performance & conversion efficiency of up to 98.5%[*]
- Wide MPP voltage range with multiple-peak detection
- Current limiting function to protect the system against solar inputs greater than the nominal power
- Four charging programs for lead-acid batteries: Sealed, Gel, Flooded and User-defined
- Battery temperature compensation
- Real-time and recorded energy statistics
- Automatic over-temperature power reduction function
- Supports up to 8 units in parallel to expand the system
- Load relay for control of an external load switch
- Two-stage relay disconnect for better control of load power
- Generator auto-start function
- Isolated RS485 with 5VDC/200mA output for connection to devices with MODBUS protocol
- Monitor system or set parameters using the remote screen (MT50, optional), mobile app or PC software
- CE certification (LVD EN/IEC62109,EMC EN61000-6-1/3)

PTR10420AN in a 48V system

7

1.2 Characteristics

❶ - Charging LED indicator	❿ - Utility/Generator relay ON
❷ - SELECT button	⓫ - Battery voltage measurement terminals [4]
❸ - Fuse	⓬ - Load control relay [5]
❹ - Grounding terminal	⓭ - Utility/Generator relay OFF
❺ - Cover screw holes M4	⓮ - PV terminals [6]
❻ - PV reverse polarity alarm indicator	⓯ - Battery terminals [6]
❼ - Generator and load relay switch [1]	⓰ - ENTER button
❽ - Remote Temperature Sensor port [2]	⓱ - LCD display
❾ - RS485 comm. port (5VDC/200mA) [3]	⓲ - Fault LED indicator

(1)   Enabled `ON ☐ OFF` Disabled   Generator and load relay is enabled when the switch is ON; Generator and load relay is disabled when the switch is OFF.

(2)   Connection for a Remote Temperature Sensor (RTS) to remotely measure battery temperature; recommended cable distance is less than 20m.

⚠️**CAUTION: If the temperature sensor is short-circuited or damaged, the controller will charge or discharge at the default temperature setting of 25 °C.**

(3)   When connecting the controller to external devices, only one of the ports can be used; when using multiple controllers in parallel, the ports are for cascaded use.

```
2*RJ45

5VDC
B
A
GND

8  1  1  8

1/2—5VDC
3/4—B
5/6—A
7/8--GND
```
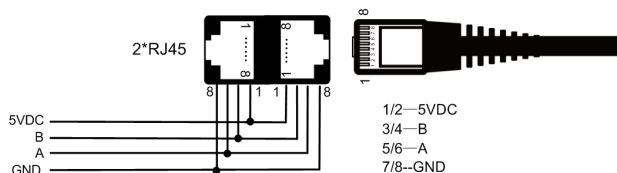
(4) Connection for a remote battery voltage measurement cable to measure the battery voltage accurately; recommended distance less than 20m.

(5) Low Voltage Disconnect Voltage (V_{LVD}) point is when the relay will turn off;
Low Voltage Reconnect Voltage (V_{LVR}) point is when the relay will turn back on after V_{LVD} is triggered.

(6) Common negative grounding design.

1.3 Included Accessories

Item	Accessory	Model	Number	Picture
1	Local temperature sensor	RT-MF58R47K3.81A (2P-3.81mm)	1Pcs	
2	Battery voltage measurement terminal	2P-3.81mm	1Pcs	
3	Load control relay terminal	2P-3.81mm	1Pcs	
4	Diesel generator relay terminal	2P-3.5mm	2Pcs	

⚠️ **CAUTION: The above accessories may be pre-installed in the related ports. Please open the controller case when checking they are present.**

⚠️ **WARNING: The Battery voltage measurement terminals (11) and Load control relay terminals (12) should not be mixed up, otherwise the controller may be damaged.**

1.4 Optional Accessories

Remote Temperature Sensor TEMP_VS (2P-3.81mm)		Detects battery temperature for undertaking temperature compensation of control parameters, the standard length of the cable is 3m. The TEMP_VS connects to the port ❽ on the controller. **NOTE: If the temperature sensor is short-circuited or damaged, the controller will be charging or discharging at the default temperature 25 ºC.**
USB to RS485 cable PTR-USB		USB to RS485 converter is used to monitor each controller using Solar Station PC software. The length of cable is 1.5m. The PTR-USB connects to the RS485 Port on the controller.
Remote Meter MT50		MT50 displays various operating data and fault info from the system and allows easy changing of the settings. The information is displayed on a backlit LCD screen, the buttons are easy to operate, and the numeric display is clearly readable.
WIFI Serial Adapter EBOX-WIFI		After the controller is connected with the EBOX-WIFI through a standard Ethernet cable (parallel cable), the operating status and related parameters of the controller can be monitored by the mobile app software through WIFI signals.
RS485 to Bluetooth Adapter eBox-BLE-01		After the controller is connected with the eBox-BLE-01 through the standard Ethernet cable (parallel cable), the operating status and related parameters of the controller can be monitored by the mobile app software through Bluetooth signals.
Logger eLOG01		After the controller is connected with the eLOG-01 through the RS485 communication cable, it can record the operating data of the controller or monitor the real-time operating status of the controller via PC software.
PT Adapter PT-ADP-PORT		Manages and communicates with 2 to 8 controllers in parallel. Please refer to the user manual of PT adapter for more details.
NOTE: ① for setting and operation of an accessory, please refer to the accessory's user manual. **②When you connect the above accessories to the controller, only one of the ports can be used.**		

2 Installation

2.1 General Installation Notes

- Before you begin installation please read through the entire installation instructions to familiarise yourself with the installation steps.

- Be very careful when working with batteries, especially flooded lead-acid batteries. Wear eye protection and have fresh water available to wash with in case of any contact with battery acid.

- Keep the battery away from any metal objects which may cause a short circuit of the battery terminals.

- Explosive battery gases may be released out from the battery during charging, therefore sufficient ventilation is vital.

- This controller has been designed for **lead acid batteries**, with programs for Gel, Sealed and Flooded battery types. It also supports a User defined battery type for models of lead acid batteries that need customised settings. In order to choose the right battery program and charging voltage for your battery please refer to the battery supplier or manufacturer.

- Ventilation is highly recommended when mounting the controller in an enclosure. Never install the controller in a sealed enclosure with flooded batteries! Battery gases from flooded batteries may cause corrosion and destroy the controller circuits, as well as increase the risk of explosion.

- Loose power connections and corroded wires may result in high heat that can melt wire insulation, burn surrounding materials, or even cause fire. Ensure tight connections and use cable clamps to secure cables and prevent them from unnecessary movement.

- Battery connecting cables may be wired to one battery or a bank of batteries. This user manual always refers to a single battery, but it is implied that the battery connection can be made to either one battery or a group of batteries in a battery bank.

- This model of the solar charge controller allows for the installation of more solar charge controllers in parallel (all controllers should be identical), connected to the same battery bank, to achieve a higher charging current. Each controller must have its own solar panel(s). The battery (bank) should be able to accept combined current from all controllers.

- Select the system cables according to 5A per 1 mm^2 cross-section or less current density in accordance with this manual and all the appropriate regulations and national guidelines.

2.2 PV Array Requirements

(1) Series connection (string) of PV modules
The maximum number of PV modules which can be connected in series and fed into this solar charge controller can be calculated according to the open circuit voltage (V_{oc}) of the PV module and the maximum power point voltage (V_{Mpp}) of the controller. The following table is provided for general guidance only; always refer to the exact parameters of your modules to make sure they are within the allowed range.

Battery voltage	Max controller PV input	36cell Voc<23V		48cell Voc<31V		54cell Voc<34V		60cell Voc<38V	
		MAX.	Best	MAX.	Best	MAX.	Best	MAX.	Best
12V	150V	4	2	2	1	2	1	2	1
	200V	4	2	3	1	2	1	2	1
24V	150V	6	3	4	2	4	2	3	2
	200V	6	3	4	2	4	2	3	2
48V	150V	6	5	4	3	4	3	3	3
	200V	8	5	5	4	5	3	4	3

Battery voltage	Max controller PV input	72cell, Voc<46V		96cell, Voc<62V		Thin-Film Module Voc>80V
		MAX.	Best	MAX.	Best	
12V	150V	2	1	1	1	1
	200V	2	1	1	1	1
24V	150V	3	2	2	1	1
	200V	3	2	2	1	1
48V	150V	3	2	2	2	1
	200V	4	3	2	2	2

NOTE: *The above parameter values are calculated under standard test conditions (STC - Standard Test Conditions): solar irradiance 1000W/m^2, module temperature 25°C, air mass 1.5.*

(2) PV array maximum power

The MPPT controller has a current/power-limiting function. During the charging process, when the solar panel current or power exceeds the rated charging current or power, the controller will automatically limit the charging to the rated level. This protects the charging circuits of the controller and reduces the risk of damage caused by connection of over-specification PV modules. The current/power-limiting function operates as follows:

Condition 1:
Actual charging power of PV array ≤ Rated charging power of controller

Condition 2:
Actual charging current of PV array ≤ Rated charging current of controller

When the controller operates under "**Condition 1**" or "**Condition 2**", it will carry out the charging as per the actual current or power; at this time, the controller can work at the maximum power point of PV array.

Condition 3:
Actual charging power of PV array > Rated charging power of controller

Condition 4:
Actual charging current of PV array > Rated charging current of controller

When the controller operates under "**Condition 3**" or "**Condition 4**", it will carry out the charging as per the rated current or power.

⚠ **WARNING:** When the power of the PV array is greater than the rated charging power, and the maximum open-circuit voltage of PV array is more than 150V for Tracer**15AN or 200V for Tracer**20AN (at the lowest environmental temperature), the controller may be damaged.

If the PV array power is higher than the nominal rated power of the controller and the controller has to limit the PV power, the battery charging time will be extended accordingly.

WARNING: The controller will be damaged if a PV array is connected to the controller PV terminals with the *right or reverse polarity* and the max PV power is **more than 1.5 times** the rated controller power!

When the PV array is connected to the controller with either the correct or reverse polarity, the maximum PV array power **must NOT** exceed **1.5** times the nominal (rated) controller power. Please refer to the table below:

Item	Rated Charge Current	Rated Charge Power	Max. PV Power	Max. PV Open Circuit
Tracer5415AN	50A	625W/12V 1250W/24V 1875W/36V 2500W/48V	937.5W/12V 1875W/24V 2812.5W/36V 3750W/48V	150V① 138V②
Tracer6415AN	60A	750W/12V 1500W/24V 2250W/36V 3000W/48V	1125W/12V 2250W/24V 3375W/36V 4500W/48V	
Tracer8420AN	80A	1000W/12V 2000W/24V 3000W/36V 4000W/48V	1500W/12V 3000W/24V 4500W/36V 6000W/48V	200V① 180V②
Tracer10420AN	100A	1250W/12V 2500W/24V 3750W/36V 5000W/48V	1875W/12V 3750W/24V 5625W/36V 7500W/48V	

① At minimum operating environment temperature
② At 25°C environment temperature

2.3 Wire Size

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

➢ **PV Wire Size**

Since PV array output can vary due to the PV module size, connection method or sunlight angle, the minimum wire size can be calculated based on the maximum current (Isc) of PV array. Please refer to the value of Isc in the PV module specification.

When PV modules are connected in series, the Isc is equal to one PV modules Isc. When PV modules are connected in parallel, the Isc is equal to the sum of the Isc of all the PV modules. The Isc of the PV array must not exceed the controller's maximum PV input current. Please refer to the table as below:

NOTE: All PV modules in a given array are assumed to be identical.

Model	Max. PV input current	Max. PV wire size*
PTR5415AN	50A	16mm²/6AWG
PTR6415AN	60A	16mm²/5AWG

| PTR8420AN | 80A | 25mm^2/4AWG |
| PTR10420AN | 100A | 35mm^2/2AWG |

*These are the maximum wire sizes that will fit the controller terminals.

⚠️**CAUTION:** When the PV modules connect in series, the open circuit voltage of the PV array must not exceed 138V at 25°C environment temperature for Tracer**15AN or 180V for Tracer**20AN.

➢ **Battery Wire Size**

The battery wire size must conform to the rated current, the reference size as below:

Model	Rated charge current	Battery wire size
PTR5415AN	50A	16mm^2/6AWG
PTR6415AN	60A	16mm^2/5AWG
PTR8420AN	80A	25mm^2/4AWG
PTR10420AN	100A	35mm^2/2AWG

⚠️**CAUTION:** 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, larger wires should be used to reduce the voltage drop and improve performance.

⚠️**CAUTION:** The battery cable size recommendations assume that the charge controller is the only device connected to this cable (no inverter connected to the same cable etc).

2.4 Relay Instruction

Utility/Generator Relay and Load Parameter

Rated Value: 5A/30VDC

Maximum Value: 0.5A/60VDC

1) Control the utility/generator ON/OFF via the utility/generator relay

Utility/Generator start-up Voltage (V_{ON})=Under Voltage Warning Voltage (V_{UVW})

Utility/Generator stop Voltage (V_{OFF})= Under Voltage Warning Recover Voltage (V_{UVWR})

Low Voltage Disconnect Voltage (V_{LVD})

Battery Voltage (V_{BAT})

✦**Utility/Generator activates:**

$V_{BAT} < V_{ON}$

✦**Utility/Generator deactivates:**

$V_{BAT} > V_{OFF}$

⚠️**CAUTION: The V_{ON} and V_{OFF} can only be set via the PC software, for the Battery Control Voltage Parameters refer to chapter 3.4 Settings.**

2) Control the first and second load disconnection

The controller can disconnect different classes of loads in two stages, leaving the most important loads connected for longer to allow them to discharge the batteries deeper. In such case, both generator control relay output and load control relay output of the controller will need to be used:

- The generator control relay will disconnect the first class of loads earlier and reconnect later;
- The load control relay will disconnect the second class of loads later (allowing it to discharge the battery deeper) and reconnect earlier.

Parameters to note: Battery Voltage (V_{BAT}); Under Voltage Warning Voltage (V_{UVW}); Under Voltage Warning Recover Voltage (V_{UVWR}); Low Voltage Disconnect Voltage (V_{LVD}); Low Voltage Reconnect Voltage (V_{LVR})

First class of loads disconnection (Utility/Generator Relay, normally closed contact):

$V_{BAT} \leqslant V_{UVW}$: The Utility/Generator Relay normally closed contact will turn OFF the first load

$V_{BAT} \geqslant V_{UVWR}$: The Utility/Generator Relay normally closed contact will turn ON the first load

2) Second class of loads disconnection (Load Relay)：

$V_{BAT} \leqslant V_{LVD}$: The Load Relay will turn OFF the second load

$V_{BAT} \geqslant V_{LVR}$: The Load Relay will turn ON the second load
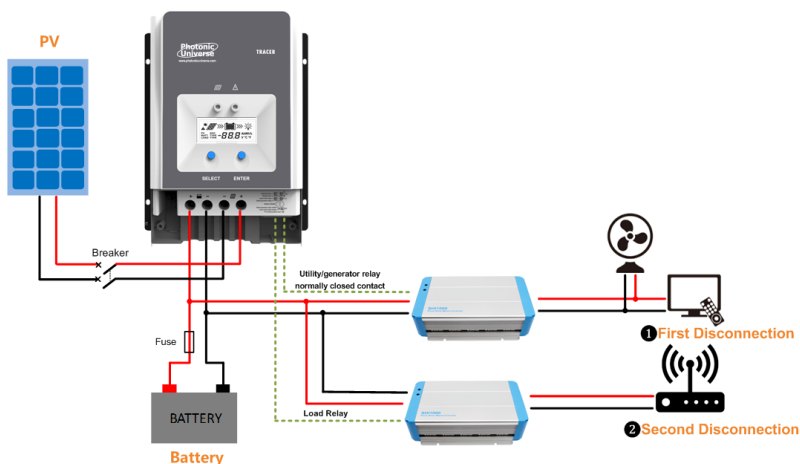
⚠️**CAUTION: For the Battery Control Voltage Parameters refer to the chapter 3.4 Settings.**

⚡**WARNING: When the system power is off, the utility/generator relay normally closed contact is closed, please check that this will not cause problems for your setup.**

Refer to the below the diagram:

2.5 Mounting

⚠️**WARNING:** Do not reverse the polarity of the batteries. Reverse polarity will damage the charge controller permanently. Damage caused by reverse polarity is not covered by warranty.

⚠️**WARNING:** Risk of explosion! Never install the controller in a sealed enclosure with flooded batteries! Do not install in a confined area where battery gas can accumulate.

⚠️**WARNING:** Risk of electric shock! The solar array high voltage can cause serious shock or injury. Make use of fuses/breakers for isolation or cover the entire solar array prior to performing any work on the solar charge controller.

⚠️**CAUTION:** The controller requires at least 150mm of clearance above and below for proper air flow. Ventilation is required if mounted in an enclosure.

Installation steps:

Step 1: Determine the installation location and heat-dissipation space

The controller should be installed in a place that allows sufficient air flow through the heat sink of the controller and a minimum clearance of 150 mm from the upper and lower edges of the controller to ensure natural thermal convection. Please see the figure below.

Fix the controller firmly in place to a rigid surface using the mounting holes. Non-combustible surface is recommended.

⚠️**CAUTION: If the controller is to be installed in an enclosed box, it is important to ensure reliable heat dissipation through the box and ventilation.**

Step 2：Remove the terminal protective cover
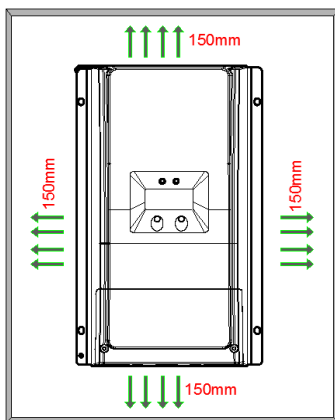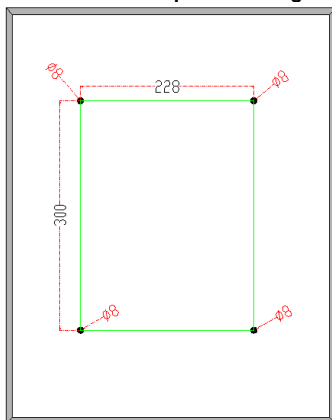
※Please remove the terminal protective cover before wiring.

Step3：Connect the battery❶(Left) then the PV❷(Right)

NOTE: Disconnect the system in the reverse order, PV first, then battery second.

WARNING: Do not reverse the polarity of the batteries. Reverse polarity will damage the charge controller permanently. Damage caused by reverse polarity is not covered by warranty.

CAUTION: While wiring the controller do not turn on the breaker or fuse and make sure that the leads of "+" and "-" poles are connected correctly.
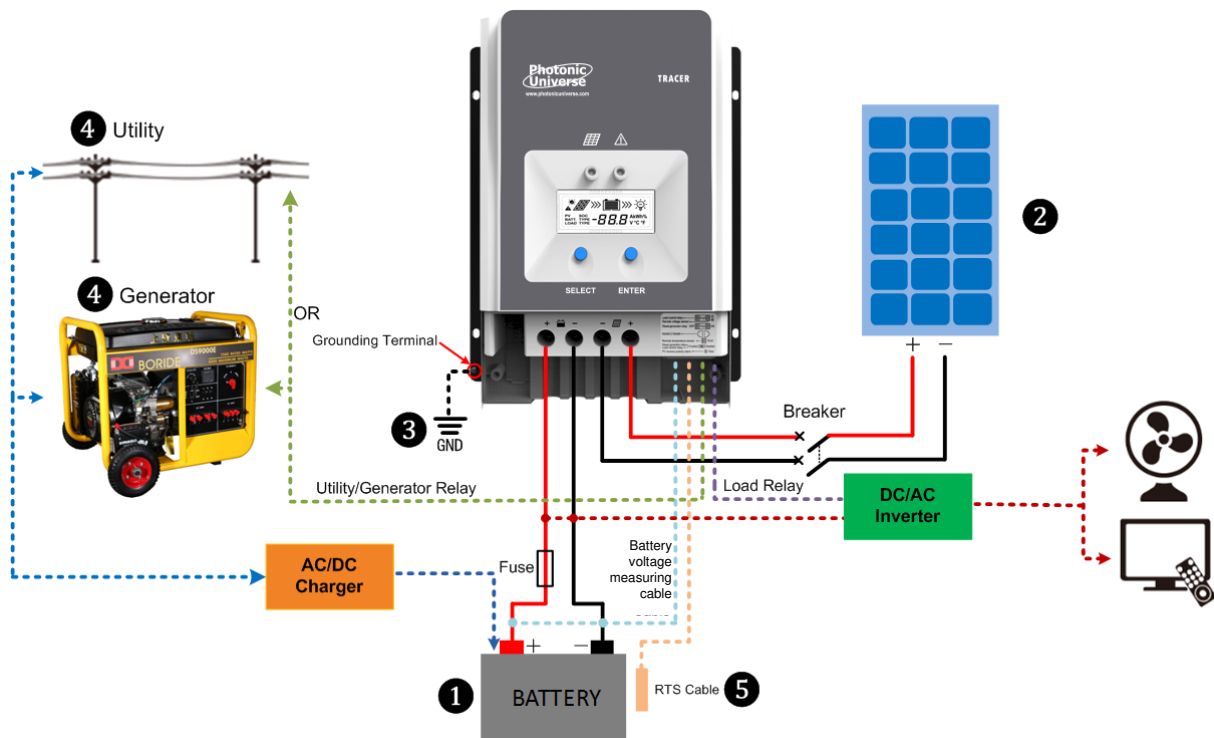
CAUTION: A fuse or an over-current circuit breaker with the current rating 1.25 to 2 times the rated current of the controller must be installed on the battery cable with a distance from the battery not greater than 150 mm.
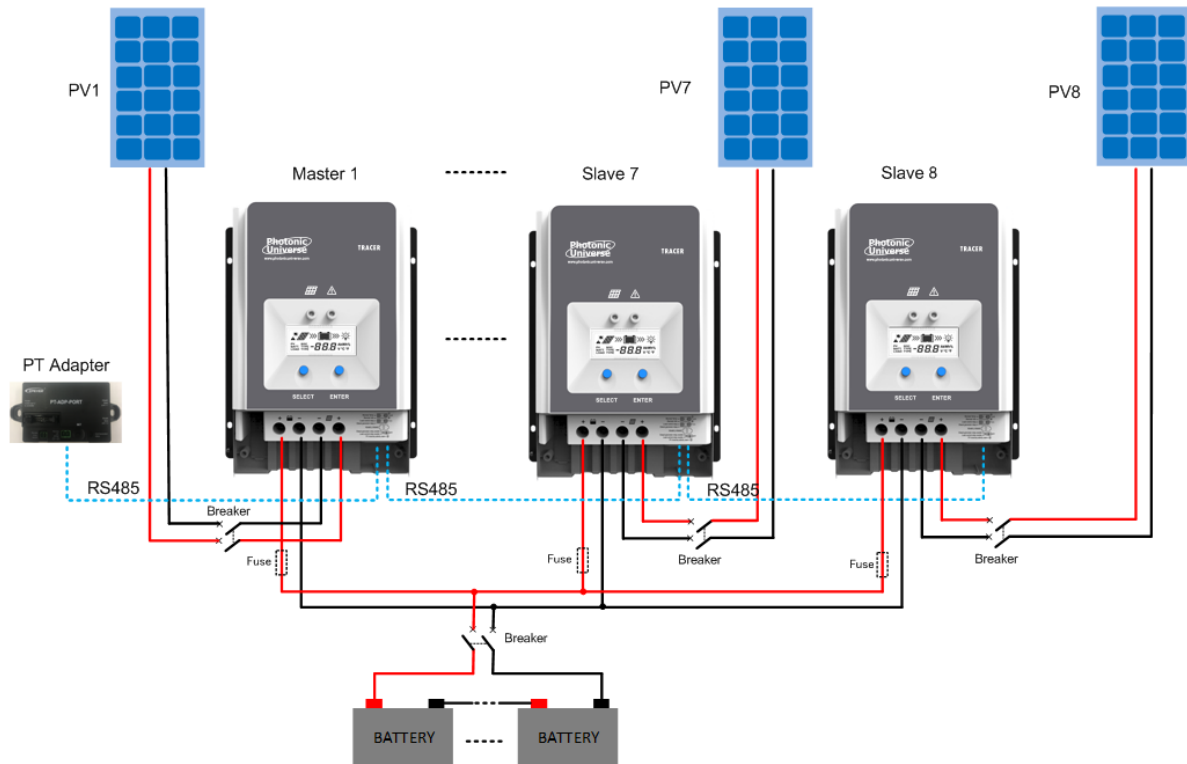
CAUTION: If an inverter is to be connected to the system, connect the inverter directly to the battery.

One controller:

Photonic Universe TRACER

Utility

Generator

OR

Grounding Terminal

3 GND

Utility/Generator Relay

AC/DC Charger

Fuse

Battery voltage measuring cable

1 BATTERY

RTS Cable **5**

Breaker

Load Relay

DC/AC Inverter

2

Multiple controllers:

PV1

PV7

PV8

Master 1

Slave 7

Slave 8

PT Adapter

RS485

RS485

RS485

Breaker

Fuse

Fuse

Breaker

Fuse

Breaker

Breaker

BATTERY

BATTERY

Step 4: Grounding

The PTR Tracer AN series is a common-negative controller. If any negative terminal is grounded, then both negative terminals of PV and battery will be grounded simultaneously. Grounding these terminals is not necessary for typical operation, but the grounding terminal on the case must be grounded. This shields the internal components from electromagnetic interference and reduces risk of electric shock to the user due to the electrification of the shell.

⚠️ **CAUTION:** For common-negative applications, such as vehicles or boats, it is recommended to use a common-negative controller. If the common-negative system includes some common-positive equipment where the positive electrode is grounded, the controller may be damaged.

Step 5: Connect accessories

• Connect the remote temperature sensor cable (Model: TEMP_VS)

Connect the remote temperature sensor cable to the interface ❽ and place

the other end close to or on the battery.
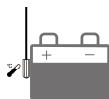
⚠️ **CAUTION:** If the remote temperature sensor is not connected to the controller, the default setting for battery charging or discharging temperature is 25°C without temperature compensation.

• Connect the remote battery voltage measurement cable

Connect the remote battery voltage measurement cable to the interface ⓫ and connect the other end to the battery terminals.

• Connect the accessories for RS485 communication (refer to the accessories list).

Step 6: Power on the controller

Turn on the battery fuse/circuit breaker to power on the controller. Check that the unit powers on and the fault indicator does not stay lit.

⚠️ **CAUTION:** If the controller is not operating properly or the battery indicator on the controller shows an abnormality, please refer to **4.2** "Troubleshooting".

Step 7: Connect the solar array

Turn on the solar circuit breaker to connect the solar panels to the controller. If the solar panels are exposed to light, check that the controller started charging the battery.

Note that the disconnection should follow the reverse order: disconnect the solar array first, then disconnect the battery from the controller.

3 Operation
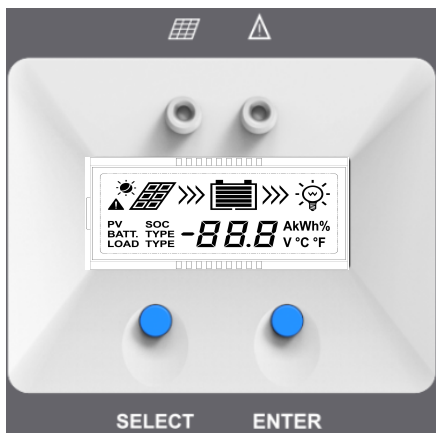
3.1 Indicator

Indicator	Colour	Status	Instruction
Charging LED indicator	Green	On Solid	PV connection normal but low voltage (irradiance) from PV, no charging
	Green	OFF	No PV voltage (night time) or PV connection problem
	Green	Slowly Flashing	In charging
	Green	Fast Flashing	PV over voltage
NOTE: For the fault indicator refer to "Fault Indication" in chapter 3.3			

3.2 Button

| Button	Function
SELECT button	• Browse interface • Setting parameter
ENTER button	• Load ON/OFF • Clear error • Enter into Set Mode • Save data

3.3 LCD Display

➢ Status Description

Item	Icon	Status
PV array		Day
		Night
		No charging
		Charging
	PV	PV Voltage, Current, Power
Battery		Approximate battery capacity*, In Charging
	BATT.	Battery Voltage, Current, Temperature
	BATT. TYPE	Battery Type
Load		Load control relay turn ON
		Load control relay turn OFF

Battery capacity on the battery icon is linked to the battery voltage and therefore it might not be accurate during the active charging or discharging when the voltage increases or drops sharply.

➢ Browse interface
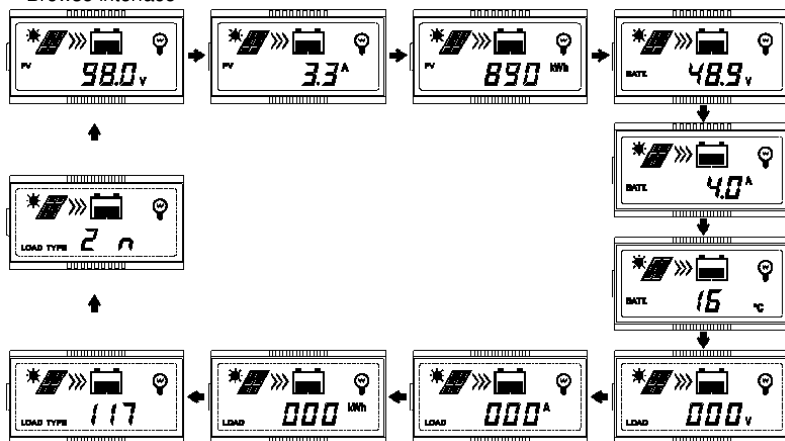
NOTE: When no keys are pressed the interface will automatically cycle, but the load type timer interfaces will not be displayed.

➢ Fault Indication

Status	Fault indicator	Charging indicator	Icon	Description
Battery over discharged	Red on solid	——	⚠ 🔋	Battery level shows empty, battery icon and the fault icon blink.
Battery over voltage	Red slowly flashing	——	⚠ 🔋	Battery level shows full, battery frame blinks, fault icon blinks.
Battery over temperature	Red slowly flashing	——	⚠ 🔋	Battery level shows current value, battery frame blinks, fault icon blinks.
Controller over temperature	Red slowly flashing	Green slowly flashing	⚠ 🔋	Battery level shows current value, battery frame blinks, fault icon blinks.
System voltage error	Red slowly flashing	Green fast flashing	⚠ 🔋	Battery level shows current value, battery frame blinks, fault icon blinks.

3.4 Settings

(1) Reset the solar PV energy counter

Step 1: Press the ENTER button and hold 5s on the PV power interface, the value will start flashing.
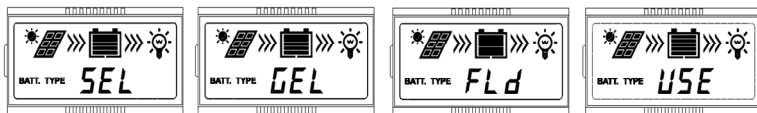
Step 2: Press the ENTER button to clear the generated energy.

(2) Switch the battery temperature unit

Press the ENTER button and hold 5s on the battery temperature interface.

(3) Battery type

➢**Battery Type**

①Sealed (Default)   ②Gel   ③Flooded
④ User (Can be set via MT50 remote display or PC software "Solar Station Monitor")

➢**Operating Steps**

Under Battery Voltage interface, press and hold the ENTER button to enter the Battery type setting interface. After choosing the battery type by pressing SELECT button, wait for 5 seconds or press the ENTER button again to apply the setting.

➢**Battery Control Voltage Parameters**

The parameters are given for a 12V system at 25°C. Please double the values in 24V systems, triple in 36V systems and quadruple the values in 48V systems.

Battery charging setting	Sealed	Gel	Flooded	User
Over Voltage Disconnect Voltage	16.0V	16.0V	16.0V	9~17V
Charging Limit Voltage	15.0V	15.0V	15.0V	9~17V
Over Voltage Reconnect Voltage	15.0V	15.0V	15.0V	9~17V
Equalize Charging Voltage	14.6V	——	14.8V	9~17V
Boost Charging Voltage	14.4V	14.2V	14.6V	9~17V
Float Charging Voltage	13.8V	13.8V	13.8V	9~17V
Boost Reconnect Charging Voltage	13.2V	13.2V	13.2V	9~17V
Low Voltage Reconnect Voltage	12.6V	12.6V	12.6V	9~17V
Under Voltage Warning Reconnect Voltage	12.2V	12.2V	12.2V	9~17V
Under Volt. Warning Volt.	12.0V	12.0V	12.0V	9~17V
Low Volt. Disconnect Volt.	11.1V	11.1V	11.1V	9~17V
Discharging Limit Voltage	10.6V	10.6V	10.6V	9~17V
Equalize Duration (min.)	120	——	120	0~180
Boost Duration (min.)	120	120	120	10~180

NOTE:

1. When the battery type is sealed, gel or flooded, the adjustable range of equalize duration is 0 to 180min and boost duration is 10 to 180min.
2. The following rules must be observed when modifying the parameters value in user battery type (factory default value is the same as sealed type):
   a. Over Voltage Disconnect Voltage > Charging Limit Voltage ≥ Equalize Charging Voltage ≥ Boost Charging Voltage ≥ Float Charging Voltage > Boost Reconnect Charging Voltage.
   b. Over Voltage Disconnect Voltage > Over Voltage Reconnect Voltage
   c. Low Voltage Reconnect Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage.
   d. Under Voltage Warning Reconnect Voltage > Under Voltage Warning Voltage ≥ Discharging Limit Voltage.
   e. Boost Reconnect Charging voltage > Low Voltage Disconnect Voltage.

⚠️**CAUTION:** Always refer to the user manual or technical specifications of your lead acid battery for the correct type and charging settings. If required, contact the supplier of your battery or the manufacturer to confirm charging parameters.

4 Protections, Troubleshooting & Maintenance
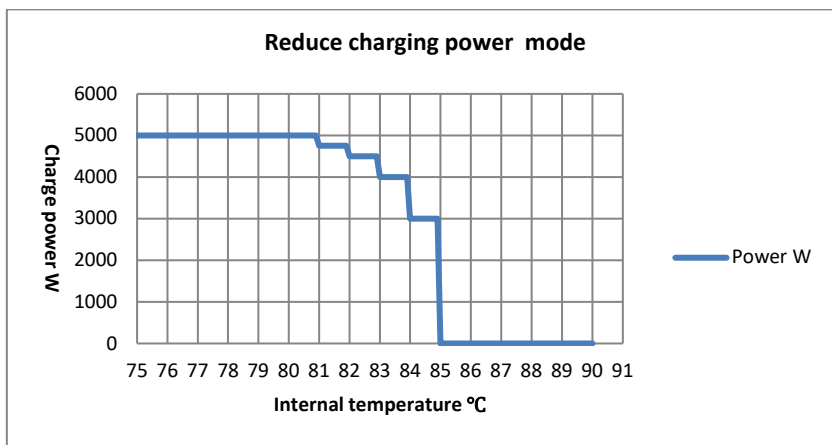
4.1 Protections

⚠️**WARNING:** Do not reverse the polarity of the batteries. Reverse polarity will damage the charge controller permanently. Damage caused by reverse polarity is not covered by warranty.

PV Over Current/power	When the charging current or power of the PV array exceeds the controller's rated current or power, it will charge at the rated current or power. **NOTE: When the PV modules are in series, ensure that the open-circuit voltage of the PV array does not exceed 138V for Tracer**15AN or 180V for Tracer**20AN, otherwise the controller may be damaged.**
PV Short-Circuit	When **not in PV charging state**, the controller will not be damaged in case of a short-circuit in the PV array.
PV Reverse Polarity	When the polarity of the PV array is reversed, the controller will not be damaged and can continue to operate normally after the polarity is corrected. **NOTE: This will not protect against PV arrays with rated power more than 1.5x the nominal power**
Night Reverse Charging	The controller prevents the battery from discharging through the PV array at night.
Battery Over Voltage	When the battery voltage reaches the over voltage disconnect voltage, it will automatically stop battery charging to prevent battery damage caused by over-charging.
Battery Over Discharge	When the battery voltage reaches the low voltage disconnect voltage, it will automatically stop battery discharging to prevent battery damage caused by over-discharging (any loads managed by the controller relay will be disconnected). **NOTE: loads connected to the battery directly will not be affected and may continue to discharge the battery.**
Battery Overheating	The controller can detect the battery temperature through an external temperature sensor (optional). The controller stops working when its temperature exceeds 65°C and resumes when the battery temperature is below 55°C.

Controller Overheating*	The controller is able to detect the temperature of its internal components. The controller stops working when the temperature exceeds 85°C and resumes when its temperature is below 75°C.
TVS High Voltage Transients	The internal circuitry of the controller includes Transient Voltage Suppressors (TVS) which provide limited protection against high-voltage surge pulses. If the controller is to be used in an area with frequent lightning strikes, it is recommended to install an external surge arrester.

When the internal temperature is 81°C, the overheating protection function will reduce the charging power by 5%,10%,20%,40% for each 1°C increase. If the internal temperature is greater than 85°C, the controller will stop charging.

Example of the controller overheating protection for **PTR10420AN** in a **48V** system:

Reduce charging power mode

4.2 Troubleshooting

Faults	Possible reasons	Troubleshooting
The LCD display is off	Battery disconnection	Confirm that battery wire connections are correct and tight
Wire connection is correct, LCD display is still off	Battery voltage is lower than 8V	Please check the voltage of battery. **At least 8V voltage is required** to start the controller.
The LCD display is on, the solar panel is in good light but it is not charging	Incorrect polarity of the solar PV connection or low PV voltage	Check the PV connection polarity and the voltage. The voltage from the PV panels should be higher than the battery charging voltage.
Fault LED indicator flashing ⚠ 🔋 Interface blink	Battery voltage higher than over voltage disconnect voltage (OVD)	Check if the battery voltage is too high, disconnect the solar panels
Fault LED indicator flashing ⚠ 🔋 Interface blink	Battery under voltage	Load output is off, battery is being charged with all available power. Disconnect any other loads connected to the battery and allow it to recharge in full.
Charging and fault LED indicator flashing ⚠ 🔋 Interface blink	Battery over temperature	The controller will automatically turn the system off at 65°C. When the temperature falls below 55°C, operation will resume.

4.3 Maintenance

The following inspections and maintenance tasks are recommended at least twice a year for the best performance:

- Make sure the controller is firmly mounted in a clean and dry place.

- Make sure the air flow is not blocked around the controller. Clear up any dirt and fragments on the heat sink.

- Check all the exposed wires to make sure insulation is not damaged due to sunlight exposure, frictional wear, dryness, insects or rats etc. Repair or replace the wires if necessary.

- Inspect for loose, broken, or burnt wire connections.

- Check and confirm that LCD is consistent with your expectations. Pay attention to any troubleshooting or error indication. Take corrective actions if necessary.

- Confirm that the system components are correctly and tightly grounded.

- Confirm that all the terminals have no signs of corrosion, insulation damage, high temperature or burning / discolouration. Tighten terminal screws to the suggested torque.

- Check for dirt, nesting insects and corrosion. If present clear up in good time.

- Check and confirm that the lightning arrester is in good condition. Replace with a new one if necessary, to reduce the risk of damage to the controller and other equipment.

WARNING: Risk of electric shock or equipment damage! Ensure that the power is turned off before performing the above steps.

5 Specifications

Electrical Parameters

Controller model	PTR****AN			
	5415	**6415**	**8420**	**10420**
Nominal System Voltage	12/24/36/48VDC or Auto			
Battery Input Voltage Range	8V ～ 68V			
Battery Type	Sealed (Default) / Gel / Flooded / User			
Battery fuse	80A / 58V		125A / 58V	150A / 58V
Rated charge current	50A	60A	80A	100A
Rated charge Power	625W/12V 1250W/24V 1875W/36V 2500W/48V	750W/12V 1500W/24V 2250W/36V 3000W/48V	1000W/12V 2000W/24V 3000W/36V 4000W/48V	1250W/12V 2500W/24V 3750W/36V 5000W/48V
Max. PV open circuit voltage	150V① 138V②		200V① 180V②	
MPP Voltage Range	(Battery Voltage +2V) ～ 108V		(Battery Voltage+2V) ～ 144V③	
Tracking efficiency	≥99.5%			
Max. conversion efficiency	98.3%	98.6%	98.5%	98.5%
Full load efficiency	97.8%	98.0%	98.0%	97.6%
Temperature compensate coefficient	－ 3mV/ °C /2V (Default)			
Self-consumption	98mA/12V; 60mA/24V; 50mA/36V; 46mA/48V			
Grounding	Common negative			
Relay	Rated Value: 5A/30VDC; Maximum Value: 0.5A/60VDC			
RS485 interface	RS485(5VDC/200mA, Two RJ45 ports in parallel) ④			
LCD backlight time	Default: 60S, Range:0 ～ 999S (0S: the backlight is ON all the time)			

① At minimum operating environment temperature；

② At 25°C environment temperature；

③ The maximum PV open circuit voltage must never exceed 138V for Tracer**15AN or 180V for Tracer**20AN at 25°C environment temperature.

④ When you connect accessories to the controller, only one of the ports can be used; when multiple controllers are used in parallel, the port are for cascaded use.

Environmental Parameters

Ambient temperature range	-25℃～+60℃ (Derate above 45℃)
LCD temperature range	-20℃～+70℃
Storage temperature range	-30℃～+85℃
Relative humidity range	5% to 95% (N.C.)
Enclosure	IP20
Pollution degree	PD2

Mechanical Parameters

Item	PTR5415AN	PTR6415AN	PTR8420AN	PTR10420AN
Dimension	261×216×119mm	340×236×119mm	394×240×134mm	394×242×143mm
Mounting dimension	180×204mm	260×224mm	300×228mm	300×230mm
Mounting hole size	Φ7			
Terminal	6AWG/16mm^2	2AWG/35mm^2	2AWG/35mm^2	2AWG/35mm^2
Recommended cable	6AWG/16mm^2	6AWG/16mm^2	4AWG/25mm^2	2AWG/35mm^2
Weight	3.5kg	4.5kg	6.1kg	7.4kg

Certification

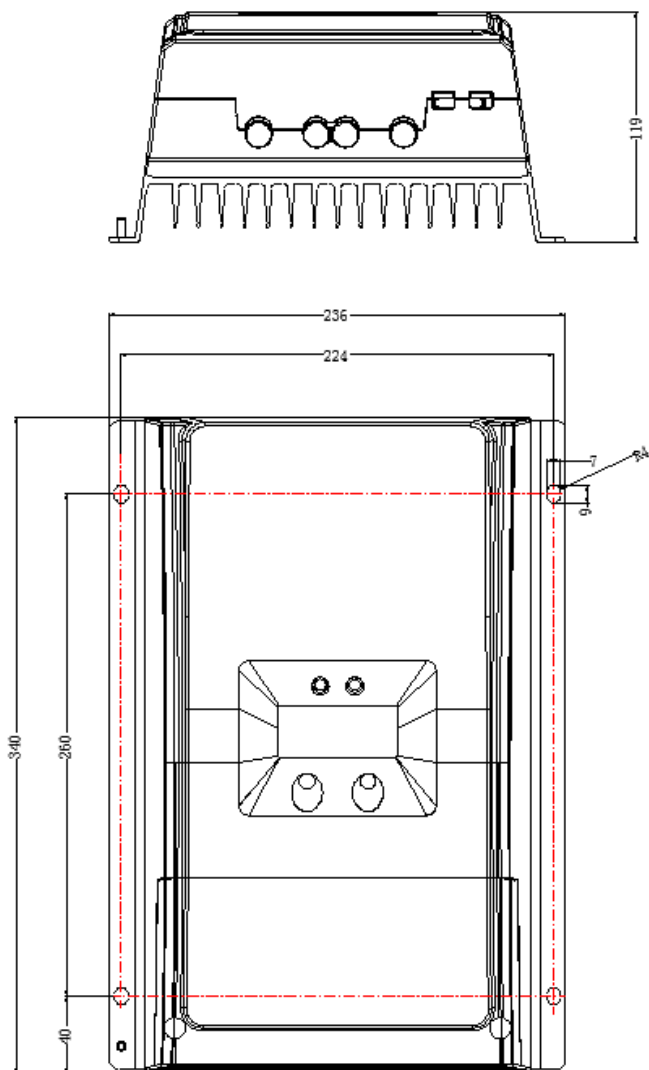|	
Safety	EN/IEC62109-1
EMC	EN61000-6-3/EN61000-6-1
FCC	47 CFR Part 15, Subpart B
ROHS	IEC62321-3-1

Annex I Dimensions
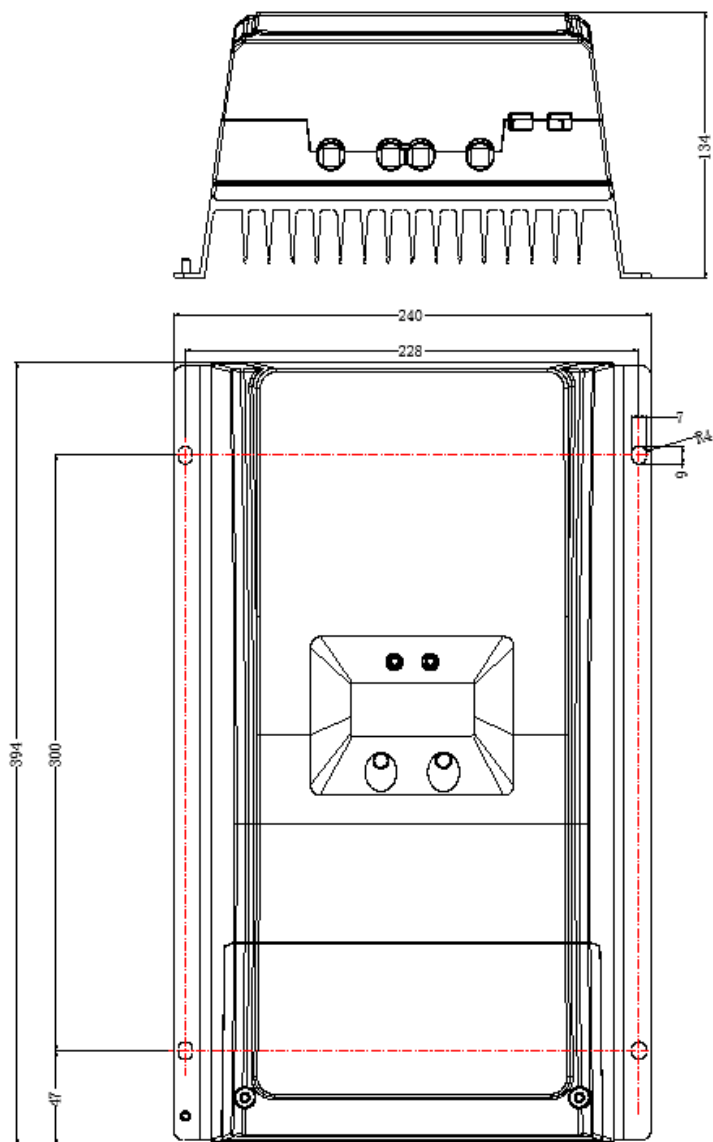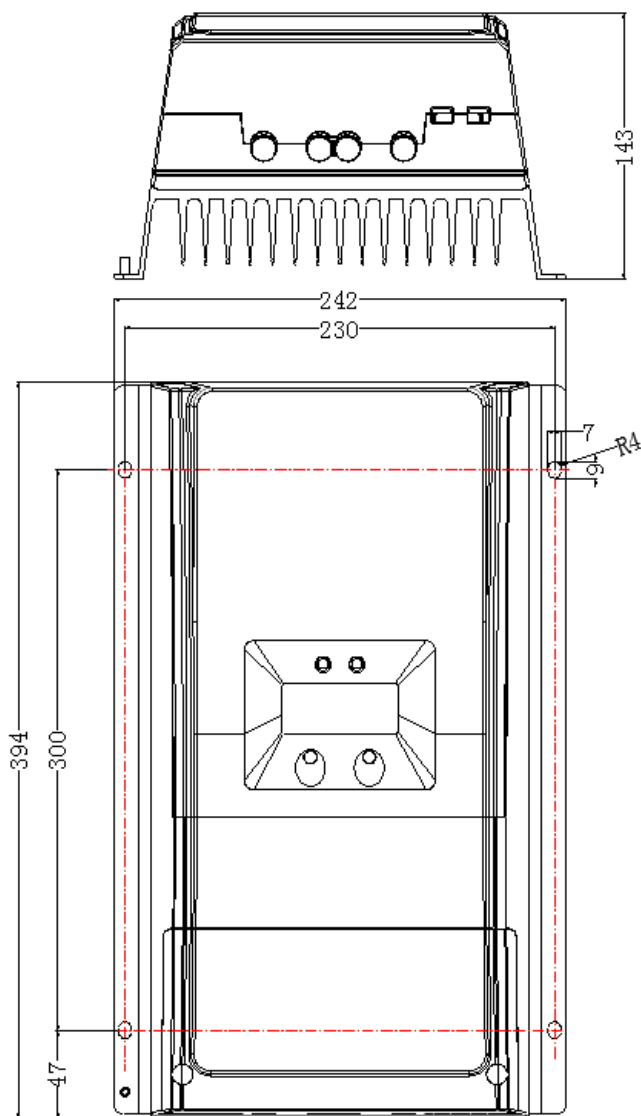
PTR5415AN Dimensions (Unit:mm)
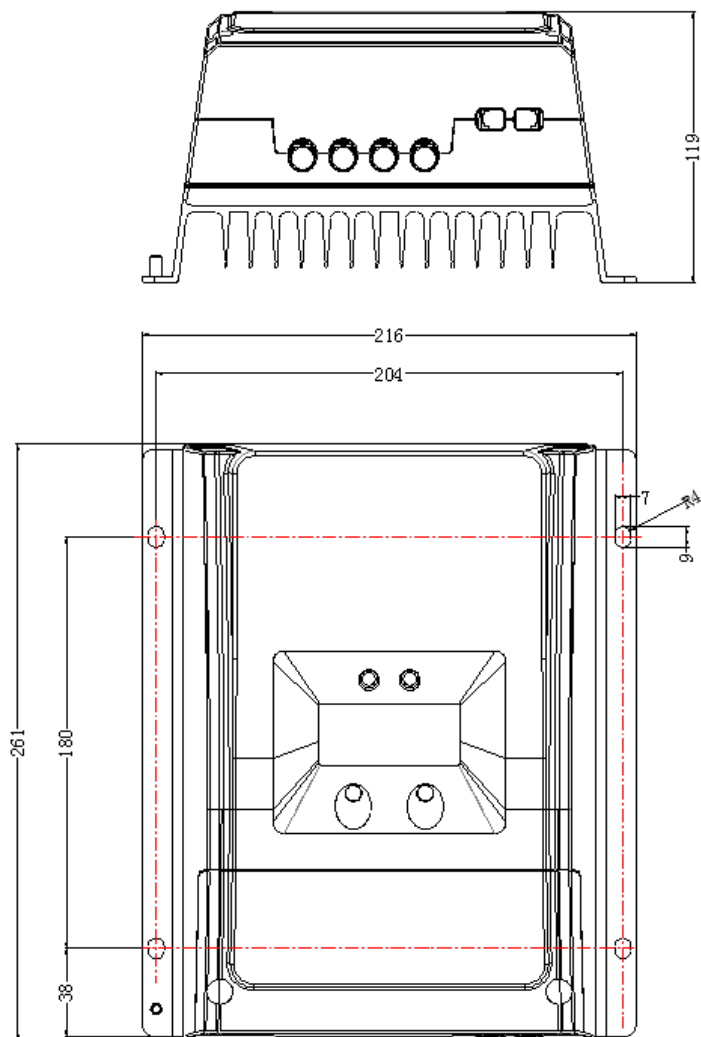
PTR6415AN Dimensions (Unit:mm)

PTR8420AN Dimensions (Unit:mm)

PTR10420AN Dimensions (Unit:mm)

143

242
230

7
R4
9

394
300

47

We reserve the right to change this manual at our discretion. Please check for updated versions on our website www.PhotonicUniverse.com

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