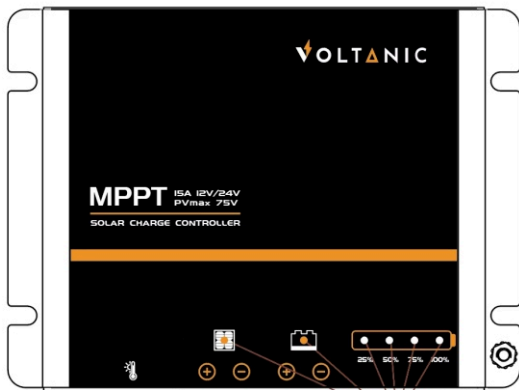




MPPT Solar Controller

12/24V 15A



User Manual

CE, RoHS, ISO9001:2015

Thank you for your purchase. Please take time to read this manual, especially the installation part. Most issues with solar systems are due to the incorrect installation & setting up of the controller. If after following this manual, you still face problems, please email us with your order number to support@voltanic.solar

1 - Overview

This controller is designed with the latest technical standards and represents the current level of advanced industrial technology.

1.1 Outstanding features

- Innovative Maximum Power Point Tracking (MPPT) technology with tracking efficiency over 99.9%.
- Fully digital design with high charging conversion efficiency up to 98%.
- Supports automatic 12V/24V system voltage recognition.
- Compatible with Liquid, Gel, AGM, and Lithium batteries.
- Dedicated port for a remote temperature sensor for more accurate battery temperature compensation.
- Four-stage charging process: MPPT, Boost, Equalization, Float.
- Automatic power reduction to protect against overheating.
- Dual automatic limiting function for over-power and over-current charging protection.
- Optional Bluetooth communication via iOS and Android apps.
- Common negative grounding design.

2 - Safety instructions and waiver of liability

2.1 Safety Instructions

The following symbols are used in this manual to highlight potential hazards or important safety instructions. Please pay attention when you see these symbols.



WARNING: Indicates a potentially dangerous situation. Proceed with extreme caution when performing this task.



CAUTION: Indicates an important procedure required for the safe and correct



CAUTION: There are no user-serviceable parts inside the controller. Do not disassemble or attempt to repair it. Keep children away from batteries and the charge controller.

2.2 Liability Exclusion

The manufacturer is not liable for any damages, especially to the battery, caused by improper use, use outside the scope of this manual, or ignoring the battery manufacturer's recommendations. The manufacturer also accepts no responsibility for damages resulting from unauthorized repairs, improper service, abnormal use, or incorrect installation.

3 - MPPT profile

3.1 MPPT Profile

MPPT stands for Maximum Power Point Tracking. It is an advanced charging method that continuously monitors the real-time power output of the solar module and adjusts to the maximum point on the I-V curve. This ensures the highest possible charging efficiency for the battery.

3.2 Current Boost

Under most conditions, MPPT technology will "boost" the solar charging current.

MPPT Charging Principle:

Power into the controller (P_{max}) = Power out of the controller (P_{out})

$I_{in} \times V_{mp} = I_{out} \times V_{out}$

(Some losses occur in wiring and conversion.)

When the solar module's V_{mp} is higher than the battery voltage, the controller boosts the output current to match the power balance. The greater the voltage difference, the higher the current boost.

3.3 Advantage Over Traditional Controllers

Traditional controllers connect the solar panel directly to the battery, forcing the panel to operate below its maximum power voltage (V_{mp}). This causes energy loss.

MPPT controllers adjust to the panel's V_{mp} , reducing waste and improving charging efficiency.

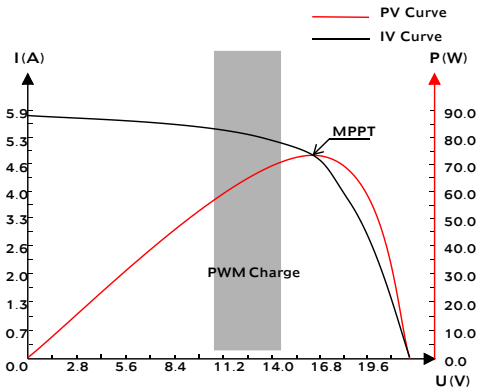


Figure 2-1 Output characteristic curve of the panel

Compared to traditional PWM controllers, an MPPT controller can maximize the power output of the solar panel, allowing it to deliver a higher charging current. On average, the energy utilization efficiency of an MPPT controller is 15% to 30% higher than that of a PWM controller.

3.4 MPPT – Four Charging Stages

Battery types: AGM, GEL, Lithium.

As shown in Figure 2-2, lead-acid batteries are charged in four stages:

MPPT Charge → Equalization Charge → Boost Charge → Float Charge.

The constant voltage stage includes Equalization, Boost, and Float charging phases to ensure full and safe battery charging.

■ MPPT Charge

When the battery voltage is below the target constant voltage, the controller performs MPPT charging. Once the voltage reaches the set level, it switches to constant voltage charging (Equalization, Boost, or Float).

■ Boost Charge

When the battery reaches the Boost voltage, the controller holds a constant voltage while the charging current slowly decreases. After 120 minutes, it switches to Float charge.

■ Equalization Charge

Some batteries benefit from periodic Equalization charging to stir the electrolyte, balance cell voltages, and complete chemical reactions. This process raises the battery voltage above normal levels to gasify the electrolyte.



WARNING: Explosion Risk!

Equalizing flooded batteries produces explosive gases. Ensure the battery box is well ventilated.

■ Float Charge

After the Boost stage, the controller lowers the voltage to the Float setpoint. At this point, the battery is fully charged, chemical reactions stop, and any excess charging current turns into heat and gas. To prevent this, the controller reduces voltage and charges with a small current, helping to lower battery temperature, reduce gassing, and maintain a full charge. The Float stage compensates for self-discharge and small loads in the system, keeping the battery topped up. Loads can continue to draw power during this stage. However, if the load exceeds the solar charging current, the controller may not maintain Float voltage. If the battery voltage drops below the Boost reconnect level, the controller will exit Float and return to Bulk charging.

3.5 Lithium battery charging mode

Lithium iron phosphate batteries are supported in 4-series and 8-series configurations.

As shown in Figure 2-3, the lithium charging process includes two stages: MPPT Charging and Constant Voltage Charging.

■ MPPT Charging Stage:

When the battery voltage is below the overcharge protection voltage, the controller performs MPPT charging. Once this voltage is reached, MPPT charging stops and the controller switches to constant voltage charging.

■ Constant Voltage Charging Stage:

In this stage, the controller holds a constant voltage while the charging current gradually decreases. This continues for 60 minutes, after which charging stops. The controller will restart charging only when the battery voltage drops to the overcharge recovery voltage.

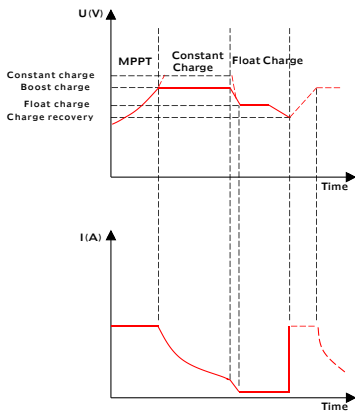


Figure 2-2 Lead-acid battery charging curve

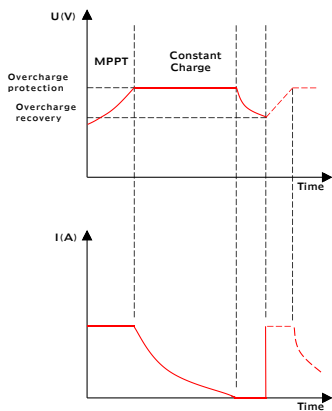
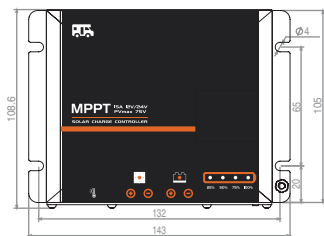


Figure 2-3 Lithium battery charging curve

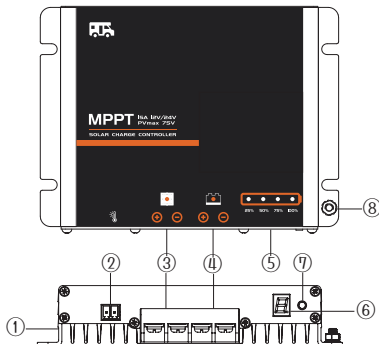
4 - Dimensions

Unit: mm



5 - Structure & Accessory

5.1 Structure and Characteristics



1. Aluminum Case
Helps dissipate heat and provides internal protection.
2. Temperature Sensor Port
Collects temperature data for battery temperature compensation.
3. Solar Module Terminals
Connect to the solar panel.
4. Battery Terminals
Connect to the battery.
5. LED Display
Shows the controller's operating status.
6. LED Segment Display
Indicates the selected battery type.
7. Button
Used to set the battery type.
8. Ground Terminal
Grounding connection.

5.2 Remote Temperature Sensor

The controller comes with a standard temperature sensor. If a longer sensor is required, it can be purchased separately.

The remote sensor measures the battery's temperature to provide accurate temperature compensation. The sensor connects to port 2.

The connection is non-polarized (no positive or negative side).



If the external temperature sensor is not connected or is damaged, the controller will default to charging at 25°C.

If the controller and battery are in different locations, an external temperature sensor must be installed to accurately measure the battery temperature.

6 - Installation



Please read all instructions and safety precautions in this manual before

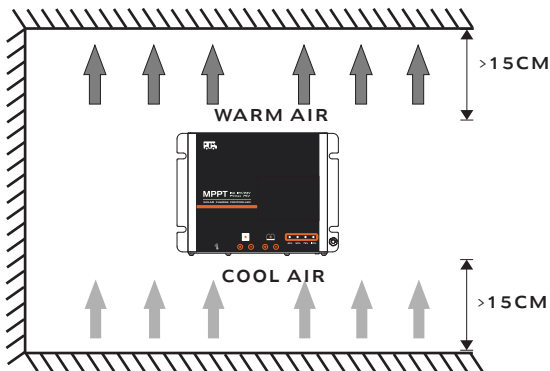
6.1 Installation Notes

- 1- The solar charge controller must only be used in PV systems as specified in this manual and according to other equipment manufacturers' guidelines. Do not connect any power source other than a solar panel to the controller.
- 2- Batteries store large amounts of energy. Never short-circuit a battery under any circumstances. We strongly recommend installing a fuse directly at the battery terminal to protect against wiring short circuits.
- 3- Batteries can produce flammable gases. Avoid sparks, open flames, and ensure the battery area is well-ventilated.
- 4- Do not touch or short-circuit wires or terminals. Some terminals may carry voltages up to twice the battery voltage. Always use insulated tools, stand on dry ground, and keep your hands dry.
- 5- Keep children away from batteries and the charge controller.

6.2 Mounting Location Requirements

Do not expose the solar charge controller to direct sunlight or other heat sources. Protect it from dust and moisture. Mount the controller upright on a wall using a non-flammable surface. Ensure at least 15 cm of clearance below and around the unit for proper air circulation. Install the controller as close to the batteries as possible to minimize voltage drop.

Mark the positions of the mounting holes on the wall, drill 4 holes, and insert wall plugs. Secure the controller to the wall with the cable openings facing downwards.



6.3 Wiring Specifications

Wiring and installation must comply with national and local electrical regulations. The cable sizes for the solar modules and battery connections should be selected based on the rated current. Refer to the following table for recommended wiring specifications:

Rated charging current	Solar wire diameter(mm ²)	Battery wire diameter(mm ²)
15A	4	4

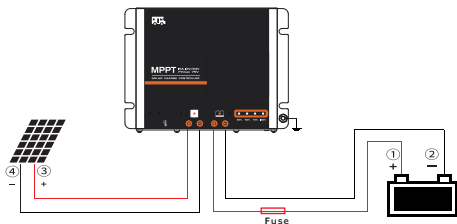
Wire sizes are for reference. For longer distances, use larger cables to reduce voltage drop and improve performance.

6.4 Connection

We strongly recommend installing a fuse directly at the battery terminal to protect against short circuits in the battery wiring.

Solar panels generate current as soon as light hits them. Even in low light, they can produce full voltage. Always cover the panels during installation to prevent accidental current flow. Never touch bare wire ends. Use insulated tools and ensure the wire size matches the expected current of the solar charge controller.

Follow the connection sequence below for safe installation. Connections must always be made in the sequence described below.



WARNING: Risk of Electric Shock!

Use caution during installation. The solar PV array can generate open-circuit voltages over 100V when exposed to sunlight. Handle with care.



WARNING: Risk of Explosion!

Short-circuiting the battery's positive and negative terminals, or the cables connected to them, can cause fire or explosion. Always operate with extreme caution.

1st Step: Connect the Battery

Connect the battery cables to the controller's battery terminals (marked with the battery symbol), ensuring correct polarity. For a 12V system, the battery voltage should be between 5V and 15.5V. For a 24V system, the voltage should be between 20V and 31V.

2nd Step: Connect the Solar Module

Ensure the solar module is covered or shaded from light. Verify that the panel's current does not exceed the controller's maximum input rating. Connect the solar panel cables to the controller's solar terminals (marked with the solar module symbol), with correct polarity.

3rd Step: Final Check

Securely tighten all cable connections. Clear away any debris around the controller and maintain at least 15 cm of clearance for ventilation.

6.5 Grounding

The controller is equipped with a grounding stud. Always connect the ground wire to this grounding point. Do not ground any other part of the controller.



For common-negative systems, such as motorhomes, it is recommended to use a common-negative controller. However, if common-positive equipment is used in the same system and the positive terminal is grounded, it may cause damage to the controller.

7- Bluetooth

7.1 Bluetooth Communication

The controller supports Bluetooth communication with the following features:

- Compatible with Android and iOS apps (Solar Life BT for Android, Solar Life for iOS).
- Enables wireless monitoring of the solar controller.
- Uses a high-performance, ultra-low power Bluetooth chip.
- Supports Bluetooth 4.2 and BLE technology.
- Communication range up to 10 meters.

 For detailed instructions on using the mobile app, please refer to the Bluetooth APP

7.2 Battery Type

The controller supports Liquid, Gel, AGM, and Lithium batteries. The default setting is for Gel batteries.

7.2.1 Liquid, GEL, AGM

When selecting Liquid, Gel, or AGM, the Boost, Equalization, and Float voltages can be adjusted via the mobile app. The voltage ranges below are based on 25°C for a 12V system;

Liquid, GEL (Note: GEL batteries do not support Equalization charging):

Charging stage	Boost	Equalization	Float
Charging voltage range	14.0~ 14.8V	14.0~ 15.0V	13.0~ 14.5V
Default charging voltage	14.5V	14.8V	13.7V

AGM:

Charging stage	Boost	Equalization	Float
Charging voltage range	14.0~ 14.8V	14.0~ 15.0V	13.0~ 14.5V
Default charging voltage	14.4V	14.7V	13.6V

The Low Voltage Disconnect (LVD) and Low Voltage Reconnect (LVR) values can be adjusted via the mobile app.

LVD Range: 10.8~11.8V (12V system) / 21.6~23.6V (24V system) — Default: 11.2V / 22.4V

LVR Range: 11.4~12.8V (12V system) / 22.8~25.6V (24V system) — Default: 12.0V / 24.0V

6.2.2 Lithium

1)Parameter Settings

For Lithium batteries, the Charge Target Voltage (CVT), Charge Recovery Voltage (CVR), Low Voltage Disconnect (LVD), and Low Voltage Reconnect (LVR) can be set via the mobile app.

CVT Range: 10.0~32.0V (Default: 14.4V / 28.8V)

CVR Range: 9.2~31.8V (Default: 14.0V / 28.0V)

LVD Range: 9.0~30.0V (Default: 11.0V / 22.0V)

LVR Range: 9.6~31.0V (Default: 12.0V / 24.0V)

2) 0°C Charging Function

This function applies to Lithium batteries and can be set to Yes, Slow, or No:

- Yes: Normal charging above or below 0°C .

- Slow: Below 0°C, charging current is limited to 20% of the rated current.

- No: Charging is disabled below 0°C .

Users can choose the suitable mode based on their battery requirements.



The Low Voltage Reconnect (LVR) must be at least 0.6V (12V system) or 1.2V (24V system) higher than the Low Voltage Disconnect (LVD). If you need to increase the LVD, you must first raise the LVR accordingly.



The Lithium Charge Target Voltage must be within: $(\text{Charge Recovery Voltage} + 0.2V) \leq \text{Charge Target Voltage} \leq (\text{Charge Recovery Voltage} + 1.5V)$. The mobile app will not accept values outside this range.



WARNING: The BMS (Battery Management System) must have an accuracy of at least $\pm 0.2V$. If the deviation exceeds 0.2V, the manufacturer is not liable for any system malfunctions resulting from this.

8 - LED indications, Protections and Maintenance

8.1 LED Display



Solar LED



Battery LED



Battery Capacity LED

25% 50% 75% 100%

LED	Status	Function
Solar LED (Red)	On	Solar panel is correctly connected, but not charged
	Fast Flash(0.1s on/0.1s off)	MPPT charging
	Flash(0.5s on/0.5s off)	Equal or Boost charging
	Slow Flash(0.5s on/2s off)	Float charging
	Off	Night
	Super slow flash(2s on/2s off)	PV overvoltage
Battery LED (Blue)	On	Battery is normal
	Flash(0.2s on/0.2s off)	Over temperature
Battery Capacity LED (Red, Yellow, Green, Green)	25% LED Flash(0.2s on/0.2s off, Red)	Low voltage protection
	100% LED Flash(0.2s on/0.2s off, Green)	Over voltage protection
	25% LED On (Red)	Battery capacity < 25%
	50% LED On (Yellow)	25% < Battery capacity < 50%
	75% LED On (Green)	50% < Battery capacity < 90%
	100% LED On (Green)	Battery capacity > 90%

8.2 LED Segment Display and Button



8.2.1 Button setting mode:

Long press the button to enter the setting mode; the display will start flashing. Press the button briefly to cycle through battery types. Once the desired battery type is selected, long press again to save and exit. All indicators will flash three times to confirm the setting was successful.

Note: The LED segment display will turn off after 30 seconds of inactivity. Pressing the button will wake up the display, which will return to the first interface.

8.2.2 Digital tube display

Display	Battery type	Boost voltage	Float voltage	Overvoltage protection	Low voltage
1	AGM	14.4V	13.6V	15.8/31.3V	11.2/22.4V
2	GEL	14.5V	13.7V	15.8/31.3V	11.2/22.4V
3	LIQ	14.5V	13.7V	15.8/31.3V	11.2/22.4V
4	LiFePO4*	14.4V	—	14.6V	11.0V
5	LiFePO4	28.8V	—	29.0V	22.0V

Note:

If the Bluetooth settings are inconsistent with the display parameters, the LED display will show "0".

The Bluetooth app allows custom parameter settings.

The letters are shown as below:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
S	T	U	V	W	X	Y	Z	0	1	2	3	4	5	6	7	8	9
s	t	u	v	w	x	y	z	0	1	2	3	4	5	6	7	8	9

8.3 Faults & Alarms

Fault	Reason	Troubleshooting
High voltage at battery terminal	Battery voltage is too high	Check if any external power sources are overcharging the battery. If no other sources are connected, the controller may be damaged.
Can't recognize bluetooth	Communication failure	Disconnect the battery for about 1 minute, then reconnect it and re-pair the Bluetooth device.
Can't recognize system voltage	Battery voltage is abnormal at start-up	Charge or discharge the battery until its voltage is within the normal operating range (5–15.5V for 12V systems or 20–31V for 24V systems).
Full sunlight shines on the solar panel, but the charging icon is not	PV panel fault or reverse polarity connection.	Check the solar panels and connection cables for faults or loose connections.
Full sunlight shines on the solar panel, but the charging icon flashes very slowly.	The solar panel's open-circuit voltage exceeds the controller's rated maximum open-circuit voltage.	Check the solar panel's specifications and wiring configuration. Ensure that the open-circuit voltage (Voc) is within the controller's maximum allowable input voltage. Replace or reconfigure panels if necessary.

8.4 Protection

● Charging power limit function

The controller will limit the charging power to its rated capacity. An oversized PV array will not operate at its maximum power point and may result in power loss.

● **PV Short Circuit**

If a short circuit occurs at the solar input when the PV is not generating power, it will not damage the controller.

Warning: Do not short-circuit the PV during charging, as this may damage the controller.

● **PV Reverse Polarity**

The controller is fully protected against PV reverse polarity. No damage will occur, but the system will not operate until the connection is corrected.

● **Battery Reverse Polarity**

The controller is fully protected against battery reverse polarity, with no damage to the controller. However, polarity reversal is strictly prohibited for lithium batteries. Correct the connection to resume normal operation.

● **Battery Overvoltage**

If an external energy source charges the battery and the voltage exceeds 15.8V (12V system) / 31.3V (24V system), the controller will stop charging to prevent battery damage. For lithium batteries, the overvoltage protection is triggered at Charge Target Voltage + 0.2V.

● **Battery Over-discharge**

When the battery voltage drops to the Low Voltage Disconnect (LVD) setpoint, the controller enters a low voltage protection state to prevent excessive battery discharge and damage.

● **Over Temperature Protection**

The controller monitors its internal temperature via a built-in sensor. If the temperature exceeds the set threshold, the charging current will reduce to lower the temperature. If the temperature continues to rise and reaches the critical over-temperature limit, the controller will shut down. It will automatically resume operation once the temperature drops back to a safe level.

● **Damaged Remote Temperature Sensor**

If the external temperature sensor is damaged or not connected, the controller will default to charging at 25°C to prevent overcharging and protect the battery.

8.5 Maintenance

For optimal performance, the following inspections and maintenance tasks are recommended at least twice a year.

- Ensure airflow around the controller is not blocked. Clean any dust or debris from the heat sink.
- Inspect all exposed wires for damaged insulation. Repair or replace if necessary.
- Tighten all terminal connections. Check for loose, broken, or burnt wires.
- Monitor the controller for any fault or error indicators. Take corrective actions if needed.
- Verify that all system components are properly and securely grounded.
- Inspect all terminals for corrosion, insulation damage, overheating, or burn marks. Tighten terminal screws to the recommended torque.
- Check for dirt, insect nests, or corrosion inside the controller and clean as needed.



WARNING: Risk of Electric Shock!

Ensure all power sources are turned off before performing any of the above maintenance tasks. Proceed with inspections and operations only after confirming the system is fully powered down.

9 - Technical Data

	Controller	15-75 MPPT
Battery Parameters	Battery type	Gel, AGM, Liquid, Lithium(default: Gel)
	System voltage	12V/24V Automatic Voltage Recognition
	Max charging current	15A
	MPPT charging voltage	<14.5/29.0V@25℃
	Boost voltage	14.0~14.8V/28.0~29.6V(default: 14.5/29.0V@25℃)
	Equalization voltage	14.0~15.0V/28.0~30.0V(default: 14.8/29.6V@25℃) Liquid AGM
	Float voltage	13.0~14.5V/26.0~29.0V(default: 13.7/27.4V@25℃)
	Low voltage disconnect	10.8~11.8V/21.6~23.6V(default: 11.2/22.4V)
	Low voltage reconnect	11.4~12.8V/22.8~25.6V(default: 12.0/24.0V)
	Battery high voltage	15.8/31.3V(Liquid,GEL,AGM)
	Max Volt on Bat.	35V
	Temperature compensation	-4.17mV/K per cell (Boost, Equalization), 3.33mV/K per cell (Float)
	Charging target voltage	10.0 32.0V(Lithium,default: 14.4/28.8V)
	Charging recovery volt	9.2 31.8V(Lithium,default: 14.0/28.0V)
	Low voltage disconnect	9.0 30.0V(Lithium,default: 11.0/22.0V)
	Low voltage reconnect	9.6 31.0V(Lithium,default: 12.0/24.0V)
Panel Parameters	Max voltage on PV	75V
	Max voltage on PV	70V
	Max input power	200W/400W
System Parameters	Max tracking efficiency	>99.9%
	Max conversion efficiency	98%
	Dimensions	108.6*143*28.1mm
	Weight	534g
	Communication	BLE(Selectable)
	Grounding	Negative grounding
	Power terminals	10AWG(5mm ²)
	Ambient temperature	-20~+55℃
	Ambient humidity	0~100%RH
	Storage temperature	-40~+80℃
	Protection degree	IP54
	Max Altitude	4000m

10 - Charging efficiency diagram

