POWERTECH

MP3768

MPPT Solar Charge Controller

for Lithium or SLA Batteries

Instruction Manual

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS:

Please reserve this manual for future review.

This manual contains all safety, installation, and operation instructions for the MPPT solar controller ("controller" referred to in this manual).

- Read all the instructions and warnings carefully in the manual before installation.
- No user-serviceable components inside the controller; please do not disassemble or attempt to repair the controller.
- Mount the controller indoors. Avoid exposure to the components and do not allow water to enter the controller.
- Install the controller in a well-ventilated place; the controller's heat sink may become very hot during operation.
- It is suggested to install appropriate external fuses/breakers.
- Make sure to switch off all PV array connections and the battery fuse/breakers before controller installation and adjustment.
- Power connections must remain tight to avoid excessive heating from a loose connection.
- The entire system should be installed by professional and technical personnel.

Explanation of Symbols

- To enable users to use the product efficiently and ensure personal and property safety, please read related literature accompanying the following symbols.
- Please read the literature accompanying the following symbols.

Symbol	Definition
TIP	**TIP:** Indicates any practical advice for reference.
	**IMPORTANT:** Indicates a critical tip during the operation, if ignored, may cause the device to run in error.
	**CAUTION:** Indicates potential hazards, if not avoided, may cause the device damaged.
	**WARNING:** Indicates the danger of electric shock, if not avoided, would cause casualties.
	**WARNING HOT SURFACE:** Indicates the risk of high temperature, if not avoided, would cause scalds.
	Read the user manual carefully before any operation.

QUICK START GUIDE:

1. For best results, use the thickest cable you can afford that will fit in the connectors.
2. Make sure all screwed connections are as tight as possible.
3. Panel (PV) voltage must be higher than battery voltage.
   A 12V battery is OK with a 12V or higher solar (PV) array, a 24V battery will only work with a 24V or higher solar (PV) array.
4. Maximum open-circuit Panel (PV) array voltage is 100V
5. Ensure battery line has an adequate fuse or circuit breaker.
6. Very Important: Connect battery to controller BEFORE solar panel, and check that the battery voltage is registering on the display. (Repeatedly press "select" button until you see "Batt Voltage").
7. Set your battery type before connecting the solar array to your regulator. Full instructions for setting the battery type can be found on page 22.

   A summary of common battery types can be found below.
   SEL = Sealed Lead Acid (SLA, AGM)
   GEL = Gel Battery
   FLD = Flooded Cell (Lead acid with filler caps, car batteries etc)
   LFP4S = 14.8V/12V Lithium Batteries
   LPF8S = 29.8V/24V Lithium Batteries
8. Finally connect up the solar (PV) array and check that charging is actually taking place (in the battery menu).

GENERAL INFORMATION:

OVERVIEW

Adopting the advanced MPPT control algorithm, the solar controller can minimize the maximum power point loss rate and loss time. It makes this product tracks the PV array's maximum power point and obtains maximum energy under any situation. Compared with the PWM charging method, MPPT solar controllers can increase the energy utilization ratio by 10%-30%. Charging current limit, charging power limit, and high temperature charging automatic power reduction; these functions fully ensure system stability when access to excess PV modules and high temperature running. Increase a professional protection chip for the RS485 port, which further improves the reliability and meets the different application requirements.

Based on a digital control circuit, the controller owns a self-adaptive three-stage charging mode. It can effectively prolong the battery lifespan and significantly improve the system's performance. They are equipped with comprehensive electronic protections to ensure the solar system more reliable and more durable. This controller can be widely used for RV, household systems, field monitoring, and many other applications.

Features:

- Advanced MPPT, with efficiency no less than 9 9.5%
- Ultra fast tracking speed and guaranteed tracking efficiency
- Advanced MPPT control algorithm to minimize the MPPT loss rate and loss time
- Accurate recognizing and tracking technology of multi peaks maximum power point
- Maximum DC/DC conversion efficiency of 98%
- Automatic limitation of the charging current and charging power
- Wider MPPT working voltage range
- Support the lead acid and lithium batteries voltage parameters can be set on the controller
- Programmable temperature compensation feature.
- Real time energy statistics function
- High temperature charging automatic power reduction function
- Multiple load work modes
- High quality and low failure rate components of ST or IR to ensure the service life
- 100% charging and discharging in the environment temperature range
- Standard Modbus communication protocol based on the RS485 communication bus, making the communication distance longer

GENERAL INFORMATION:

- A power protection chip, which can provide 5VDC/200mA power and over current, short circuit protections, is adopted by the communication interface
- Support monitoring and setting the parameters via the APP or PC software
- Comprehensive electronic protection

For the BCV, FCV, LVD, and LVR, users can modify them on the local controller when the battery type is "USE."

GENERAL INFORMATION:

CHARACTERISTICS

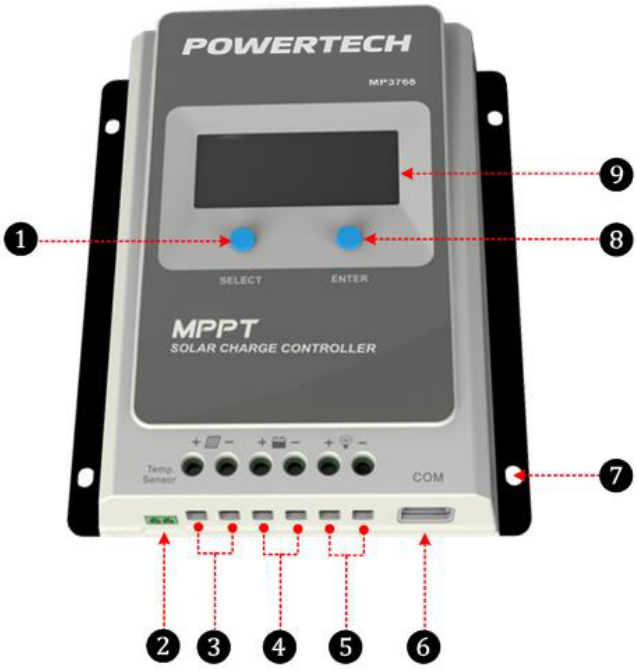


Figure 1 Product Characteristics

1	**SELECT** button
2	RTS interface
3	PV terminals
4	Battery terminals
5	Load terminals

6	RS485 port
7	Mounting Hole Φ5mm
8	**ENTER** button
9	LCD

Suppose the remote temperature sensor is not connected to the controller or damaged. In that case, the controller will charge or discharge the battery at the default temperature setting of 25°C (no temperature compensation).

GENERAL INFORMATION:

MAXIMUM POWER POINT TRACKING TECHNOLOGY

Due to the nonlinear characteristics of the solar array, there is a maximum energy output point (Max Power Point) on its curve. Traditional controllers, equipped with switch charging technology and PWM charging technology, can't charge the battery at the maximum power point and cannot obtain the maximum energy available from the PV array. In contrast, the solar charge controller with Maximum Power Point Tracking (MPPT) Technology can lock the point to obtain the maximum energy and deliver it to the battery.

The MPPT algorithm continuously compares and adjusts the operating points to locate the array's maximum power point. The tracking process is fully automatic and does not need the user's adjustment.

As Figure 1-2, the curve is also the array's characteristic curve; the MPPT technology will 'boost' the battery charge current through tracking the MPP. Assuming 100% conversion efficiency exist in the solar system, the following formula is established:

Input power (P_{PV}) = Output power (P_{Bat})

Input voltage (V_{Mpp}) x Input current (I_{PV}) =
Battery voltage (V_{Bat}) x battery current (I_{Bat})

Normally, the V_{Mpp} is always higher than V_{Bat}. Due to the principle of energy conservation, the I_{Bat} is always higher than I_{PV}. The greater the difference between V_{Mpp} & V_{Bat}, the greater the difference between I_{PV} & I_{Bat}. The greater the difference between the array and the battery will also decrease the system conversion efficiency. Therefore, the controller's conversion efficiency is particularly important in the PV system.

Figure 1-2 is the maximum power point curve, whose shaded area is the traditional solar charge controller (PWM Charging Mode). It is known that the MPPT mode can improve solar PV usage.

GENERAL INFORMATION:

According to the test, the MPPT controller can raise 20%-30% efficiency compared to the PWM controller. (Specified value may be fluctuant due to the influence of the circumstance and energy loss.)

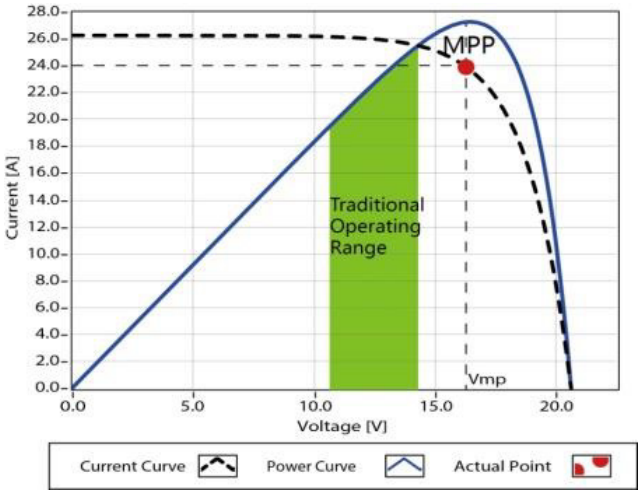


Figure 1-2 Maximum Power Point Tracking Technology

In actual application, as shading from cloud, tree, and snow, the panel may appear Multi-MPP. However, in actuality, there is only one real Maximum Power Point. As the below Figure 1-3 shows:

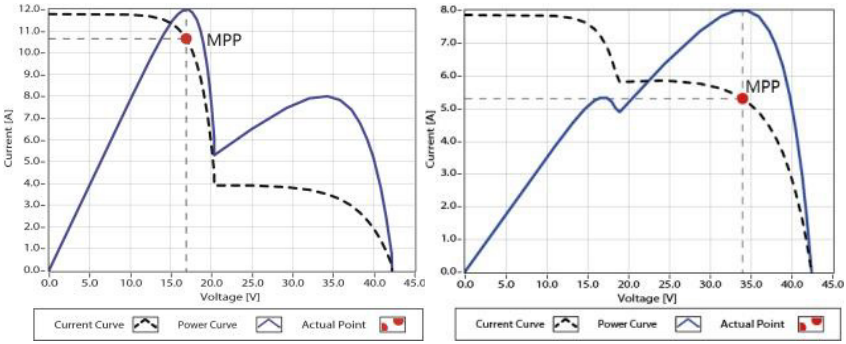


Figure 1-3 Mutil-MPP Curve

GENERAL INFORMATION:

Suppose the program works improperly after appearing Multi-MPP. In that case, the system will not work on the real max power point, which may waste most solar energy resources and seriously affect the system's normal operation. The typical MPPT algorithm, designed by our company, can track the real MPP quickly and accurately. It can improve the PV array's utilization rate and avoid resource waste.

BATTERY CHARGING STAGE

The controller has a three-stage battery charging algorithm, including Bulk Charging, Constant Charging, and Float Charging. Through the three-stage charging method, the system can extend the battery's lifespan.

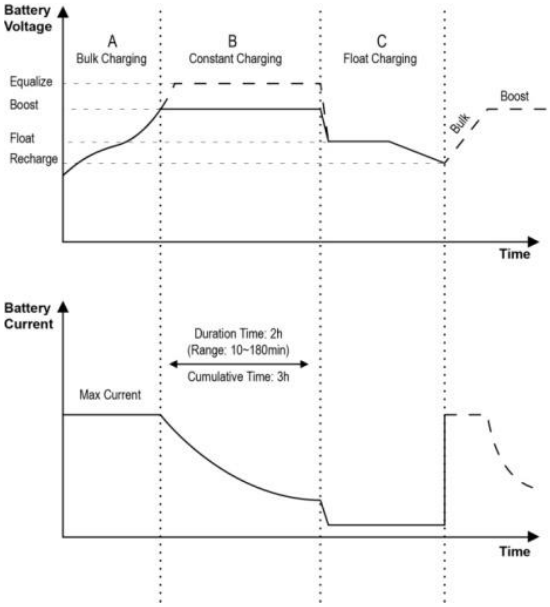


Figure 1-4 Battery charging stage curve

A) Bulk Charging

The battery voltage has not yet reached constant voltage (Equalize or Boost Charging Voltage). The controller operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging). When the battery voltage reaches the constant voltage set point, the controller will start to operate in constant charging mode.

B) Constant Charging

When the battery voltage reaches the constant voltage set point, the controller will start to operate in constant charging mode. The MPPT charging stops during this process, and the charging current will drop gradually at the same time. Constant charging has two stages, namely, equalize charging and boost charging. These two charging processes are not repeated. Among them, equalize charging starts on the 28th of each month.

- **Boost Charging**

The default duration of the boost charging stage is generally 2 hours. Customers can also adjust the constant time and preset value according to actual needs. When the duration is equal to the set value, the system will switch to the float charging stage.

- **Equalize Charging**

WARNING	Explosive Risk! Equalizing flooded batteries would produce explosive gases, so well ventilation of the battery box is recommended.

CAUTION	• Equipment damage! • Equalization may increase battery voltage to the level that damages sensitive DC loads. Verify that the load s allowable input voltages are greater than the equalising charging setpoint voltage. • Over charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high an equalize charging or for too long may cause damage. Please carefully review the specific requirements of the battery used in the system.

Some battery types benefit from equalizing charging, stirring electrolytes, balancing battery voltage, and accomplishing chemical reactions. Equalize charging increases the battery voltage to make it higher than the standard complement voltage, gasifying the battery electrolyte.

If the controller automatically controls the next charge for equalizing charging, the equalizing charging time is 120 minutes. Equalize charge and boost charge are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

GENERAL INFORMATION:

IMPORTANT	• Due to the installation environment or load work , t he system may not stabilize the battery voltage at a constant voltage. The controller will accumulate the time when the battery voltage is equal to the set value. When the accumulative time is equal to 3 hours, the system will automatically switch to float charging. • If the controller time is not adjusted, the controller will equalize charging following the inner time.

• Float Charging

After the constant charging stage, the controller will reduce the battery voltage to the float charging preset voltage by reducing the charging current. During the floating charge stage, the battery is charged weakly to ensure that the battery is maintained in a fully charged state. In the float charging stage, loads can obtain almost all power from the solar panel. Suppose loads' power exceeds the solar array's power. In that case, the controller will no longer maintain the battery voltage in the float charging stage. When the battery voltage goes lower than the set value of the boost recharge voltage, the system will exit the float charging stage and enter the bulk charging stage again.

INSTALLATION:

ATTENTION

- Be very careful when installing the batteries. Please wear eye protection when installing the open-type lead-acid battery and rinse with clean water in time for battery acid contact.
- Keep the battery away from any metal objects, which may cause a battery short circuit.
- Acid gas may be generated when the battery is charged. Ensure that the surrounding environment is well ventilated.
- Avoid direct sunlight and rain infiltration when installing it outdoor.
- Loose power connections and corroded wires may result in high heat that can melt wire insulation, burn surrounding materials, or even cause a fire. Ensure tight connections and secure cables with clamps to prevent them from swaying while moving the inverter.
- Only charge the lead-acid and lithium-ion batteries within the control range of this controller.
- The battery connector may be wired to another battery or a bank of batteries. The following instructions refer to a singular battery. Still, it is implied that the battery connection can be made to either one battery or a group of batteries in a battery bank.
- Select the system cables according to 5A/mm2 or less current density.

REQUIREMENTS FOR THE PV ARRAY

(1) Serial connection (string) of PV modules

As the core component of the solar system, the controller needs to suit various PV modules and maximize solar energy conversion into electricity. According to the open-circuit voltage (VOC) and the maximum power point voltage (VMPP) of the MPPT controller, the serial connection of PV modules suitable for different controllers can be calculated. The below table is for reference only.

System voltage	36cell Voc < 23V		48cell Voc < 31V		54cell Voc < 34V		60cell 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

System voltage	72cell Voc < 46V		96cell Voc < 62V		Thin-Film module Voc > 80V
	Max.	Best	Max.	Best	
12V	2	1	1	1	1
24V	2	1	1	1	1

INSTALLATION:

IMPORTANT	The above parameters are calculated under standard test conditions (STC (Standard Test Condition): Module Temperature 25°C, Air Mass 1.5, Irradiance 1000W/m2.)

(2) Max. PV Array Power

This MPPT controller has the function of charging current/power-limiting. During the charging process, when the actual charging current or charging power exceeds the rated charging current or charging power, the controller automatically limits the current or power. It charges the battery as per the rated charging current or charging power. This function can effectively protect the controller's charging modules and prevent damage to the controller due to the over-connected PV array. The actual running status of the PV array is as follows:

Condition 1: Actual PV array's charging power ≤ Rated controller's charging power

Condition 2: Actual PV array's charging current ≤ Rated controller's charging current

When the controller works under "Condition 1" or "Condition 2," it charges the battery as per the actual charging current or actual charging power. At this time, the controller can work at the maximum power point of the PV array.

WARNING	When the PV module's power is not greater than the rated charging power, the PV array's maximum open-circuit voltage is more than 100V at the lowest temperature, the controller is damaged.

Condition 3: Actual PV array's charging power >Rated controller's charging power

Condition 4: Actual PV array's charging current >Rated controller's charging current

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 PV module's power is greater than the rated charging power, the PV array's maximum open-circuit voltage is more than 100V at the lowest temperature), the controller is damaged.

According to the "Peak Sun Hours diagram," if the PV array's power exceeds the controller's rated charging power, the charging time as per the rated power is prolonged. The controller can obtain more energy. However, in the practical application, the PV array's maximum power shall be not higher

than 1.5 times the controller's rated charging power. Suppose the PV array's maximum power exceeds the controller's rated charging power too much. In that case, it may cause the PV array's waste and increase the PV array's open-circuit voltage due to the environmental temperature. It may increase the damage probability to the controller. For the recommended maximum power of the PV array, please refer to the table below:

Model	Rated charge current	Rated charge power	Max. PV power	Max. PV open circuit voltage
MP3768	30A	390W/12V 780W/24V	580W/12V 1170W/24V	100V (lowest temperature) 92V (25°C)

WIRE SIZE

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

- **PV wire size**

The PV array's output current varies with its size, connection method, and sunlight angle. The minimum wire size can be calculated by its ISC(short circuit current). Please refer to the ISC value in the PV module's specifications. When the PV modules are connected in series, the total ISC is equal to any PV module's ISC. When the PV modules are connected in parallel, the total ISC is equal to the sum of all the PV module's ISC. The PV array's ISC must not exceed the controller's maximum PV input current. For max. PV input current and max. PV wire size, please refer to the table as below:

Model	Max. PV input current	Max. PV wire size
MP3768	30A	10mm²/8AWG

⚠ CAUTION	When the PV modules are connected in series, the total voltage must not exceed the max. PV open circuit voltage at 25°C environment temperature.

- **Battery and Load wire size**

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

Model	Rated charge current	Rated discharge current	Battery wire size	Load wire size
MP3768	30A	30A	10mm²/8AWG	10mm²/8AWG

INSTALLATION:

CAUTION	• The wire size is only for reference. Suppose a long-distance exists between the PV array and the controller or between the controller and the battery. In that case, larger wires shall be used to reduce the voltage drop and improve the system performance. • The recommended wire for the battery is that its terminals are not connected to any additional inverter.

MOUNTING

WARNING	• Risk of explosion! Never install the controller in a sealed enclose with flooded batteries! Do not install the controller in a confined area where battery gas can accumulate. • Risk of electric shock! When wiring the solar modules, the PV array can produce a high open-circuit voltage, so turn off the breaker before wiring and be careful when wiring. • Controllers have no battery reverse protection. Do not reverse the battery during the wiring. Otherwise, the controller may be damaged.

CAUTION	The controller requires at least 150mm of clearance above and below for proper airflow. Ventilation is highly recommended if mounted in an enclosure.

Installation procedures:

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

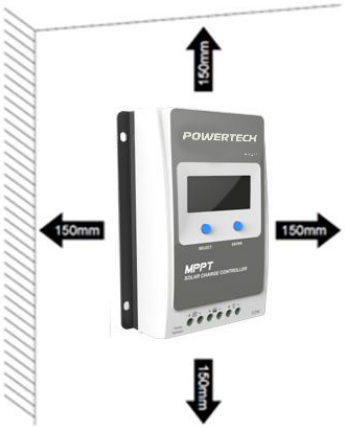


Figure 2-1 Mounting

INSTALLATION:

Step 2: Connect the system in the order of battery - load - PV array following Figure 2-2, " Schematic Wiring Diagram," and disconnect the system in the reverse order.

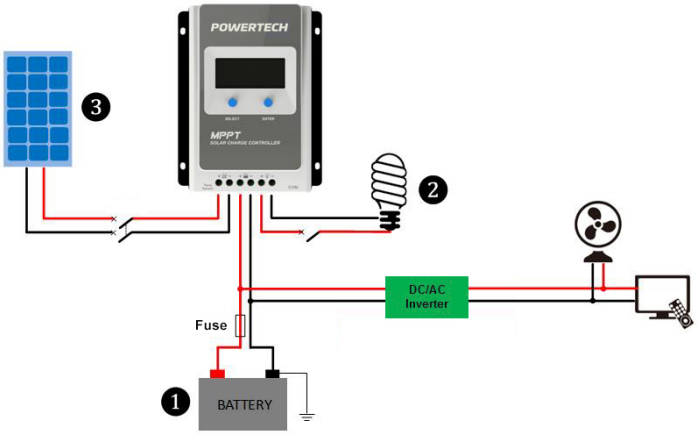


Figure 2-2 Wiring Diagram

⚠ **CAUTION**	• Please do not close the circuit breaker or fuse during the wiring and ensure that the leads of "+" and "-" poles are in the correct polarity. • A 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 150 mm. • If an inverter is to be connected to the system, connect the inverter directly to the battery, not to the load side of the controller.

INSTALLATION:

Step 3: Grounding

The MP3768 uses a common-negative controller. Negative terminals of the PV array, the battery can be grounded simultaneously, or any terminal is grounded. However, according to the practical application, the PV array's negative terminals, battery, and load can also be ungrounded. Simultaneously, the grounding terminal on the shell must be grounded, which effectively shields the electromagnetic interference from the outside and prevents some electric shock to the human body due to the electrification of the shell.

⚠ **CAUTION**	For common-negative systems, such as the RV system, it is recommended to use a common-negative controller. If a common-positive controller is used and the positive electrode is grounded in the common-negative system, the controller may be damaged.

Step 4: Connect Accessories

- **Connect the remote temperature sensor cable**
  Connect the remote temperature sensor cable to the interface and place the other end close to the battery.

⚠ **CAUTION**	Suppose the remote temperature sensor is not connected to the controller. In that case, the controller can charge or discharge the battery at the default 25 °C (no temperature compensation).

- **Connect the accessories for RS485 communication; refer to the SETTINGS section.**

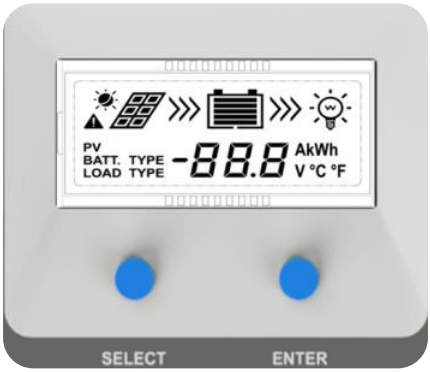
⚠ **CAUTION**	The internal circuit of the RS485 port has no isolation design. It is recommended to connect an RS485 communication isolator to the port before communicating.

Step 5: Power on the controller

Closing the battery fuse will power on the controller. Check the battery indicator status (the controller is operating normally when the indicator is lit green). Close the fuse and circuit breaker of the load and PV array. Then the system will be operating in the preprogrammed mode.

⚠ **CAUTION**	If the controller can not work properly or the fault indicator shows an abnormality, please refer to the Troubleshooting Section.

OPERATION:



BUTTONS

Modes	Note
Load ON/OFF	It can turn the load On/Off via the "ENTER" button in manual load mode.
Clear fault	Press the "ENTER" button
Browsing mode	Short press the "SELECT" button
Setting mode	Long-press the "ENTER" button to enter the Setting mode, and short press the "SELECT" button to modify the parameter. Then short press the "ENTER" button to confirm or exit the current interface automatically after more than 10S.

OPERATION:

INTERFACE

1. Status Description

Name	Symbol	Status
PV array		Day
		Night
		No charge
		Charging
	PV	PV array's voltage, current, and generate energy
Battery		Battery capacity, In Charging
	BATT.	Battery Voltage, Current, Temperature
	BATT. TYPE	Battery Type
Load		Load ON
		Load OFF
	LOAD	Current/Consumed energy/Load mode

2. Error Codes

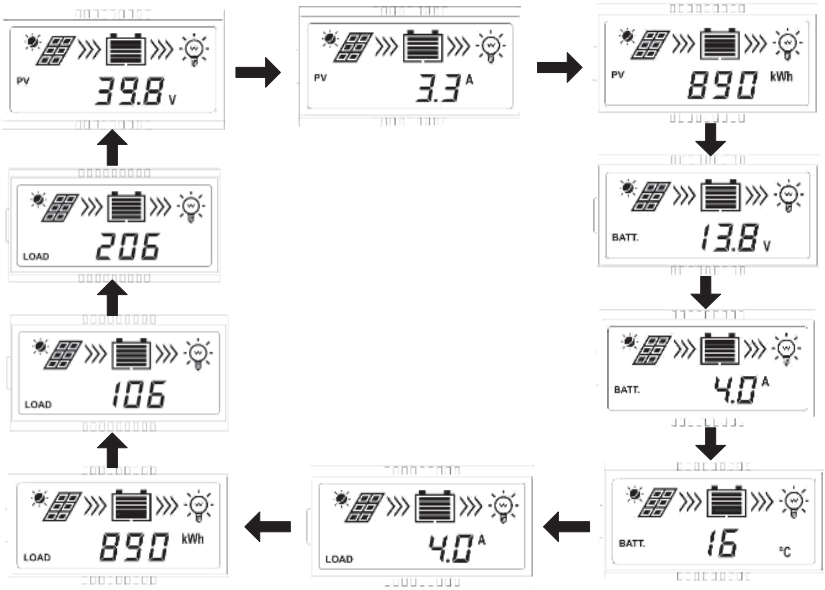
Status	Symbol	Instruction
Battery over discharged		Battery level shows empty, battery frame blink, fault icon blink.
Battery over voltage		Battery level shows full, battery frame blink, fault icon blink.
Battery over heating		Battery level shows current value, battery frame blink, fault icon blink.
Load failure		Overload[1], Load short circuit

[1] When the load current reaches 1.02-1.05 times, 1.05-1.25 times, 1.25-1.35 times, and 1.35-1.5 times more than the rated value, the controller will automatically turn off the loads in 50 seconds, 30 seconds,10 seconds, and 2 seconds respectively.

OPERATION:

3. Browse Interface

Press the **SELECT** button to cycle display the following interfaces.



OPERATION:

SETTINGS

1. Clear the generated energy

In the PV power interface, long press the “ENTER” button until the value flashes. Then it enters the reset mode; press the “ENTER” button again to confirm and reset.

2. Switch the battery temperature unit

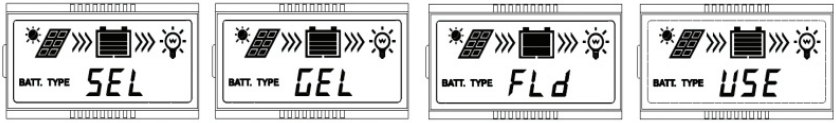
In the battery temperature interface, long press the “ENTER” button to switch the unit.

3. Battery type

Supported Battery Types

Lead-acid battery	Sealed(default)
	Gel
	Flooded
	User
Lithium battery	LiFePO4 (4S/8S)
	Li(NiCoMn)O2 (3S/6S/7S)
	User

Setting the battery type via the LCD



① Sealed (Default) ② Gel ③ Flooded ④ User

Operation:

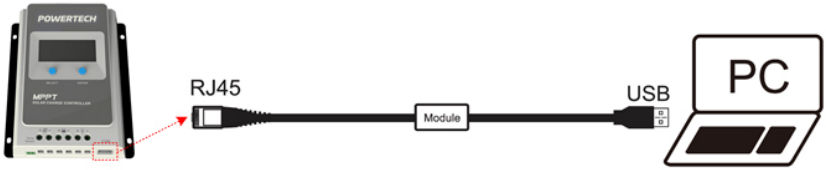
On the battery voltage interface, long press the “ENTER” button until the battery type interface flashes. Then press the “SELECT” button to change the battery type, and press the “ENTER” button to confirm.

OPERATION:

Setting the battery type via the PC software or APP software

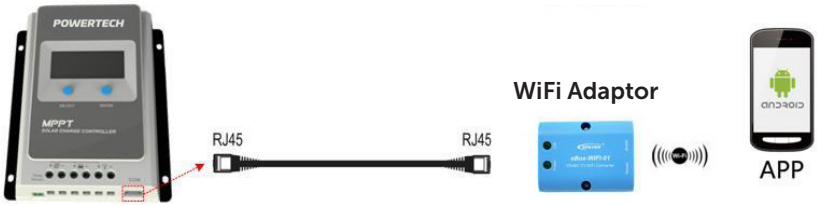
- **PC software**

Connect the controller and the PC through the USB to the RS485 converter, and set the controller's parameters through the PC software. Please refer to the cloud platform manual for the specific setting.



- **APP software**

Connect the controller and the WIFI module or Bluetooth module through a standard network cable (parallel cable). The mobile phone APP sets the controller's parameters through the WIFI signal or the Bluetooth signal. For the specific setting, please refer to the cloud APP manual.



Setting the battery parameters via the LCD

Operation:

1. On the battery voltage interface, press and hold the "ENTER" button to enter the battery type interface.
2. Press the "SELECT" button to change the battery type, such as selecting the "GEL"; and then press the "ENTER" button to confirm and back to the battery voltage interface automatically.
3. On the battery voltage interface, press and hold the "ENTER" button to enter the battery type interface again.
4. Press the "SELECT" button to change the battery type to the "USE". Under the "USE" battery type, the battery parameters that can be set via the "LCD" are shown in the table below:

OPERATION:

Parameters	Default	Range	Operation Steps
SYS*	12VDC	12/24 VDC	**1.** Under the " USE " interface, press the ENTER button to enter the "SYS" interface. **2.** Press the ENTER button again to display the current "SYS" value. **3.** Press the SELECT button to modify the parameter. **4.** Press the ENTER button to confirm and enter the next parameter.
BCV	14.4V	9~17V	**5.** Press the ENTER button again to display the current voltage value. **6.** Press the SELECT button to modify the parameter (short press to increase 0.1V, long press to decrease 0.1V). **7.** Press the ENTER button to confirm and enter the next parameter.
FCV	13.8V	9~17V	
LVR	12.6V	9~17V	
LVD	11.1V	9~17V	
LEN	NO	YES/NO	Press the SELECT button to modify the switch status. **NOTE:** It exists automatically from the current interface after no operation of more than 10S.

*The SYS value can only be modified under the non-lithium "USE" type. That is, the battery type is Sealed, Gel, or Flooded before entering the "USE" type, the SYS value can be modified; if it is lithium battery type before entering the "USE" type, the SYS value cannot be modified.

Only the above battery parameters can be set on the local controller, and the remaining battery parameters follow the following logic (the voltage level of 12V system is 1, the voltage level of 24V system is 2).

Voltage control parameters	Sealed/Gel/Flooded User	LiFePO4 User	Li(NiCoMn)O2 User
Over voltage disconnect voltage	BCV+1.4V* voltage level	BCV+0.3V* voltage level	BCV+0.3V* voltage level
Charging limit voltage	BCV+0.6V* voltage level	BCV+0.1V* voltage level	BCV+0.1V* voltage level
Over voltage reconnect voltage	BCV+0.6V* voltage level	BCV+0.1V* voltage level	Boost charging voltage
Equalize charging voltage	BCV+0.2V* voltage level	Boost charging voltage	Boost charging voltage
Boost reconnect charging voltage	FCV-0.6V* voltage level	FCV-0.6V* voltage level	FCV-0.1V* voltage level
Under voltage warning reconnect voltage	UVW+0.2V* voltage level	UVW+0.2V* voltage level	UVW+1.7V* voltage level
Under voltage warning voltage	LVD+0.9V* voltage level	LVD+0.9V* voltage level	LVD+1.2V* voltage level
Discharging limit voltage	LVD-0.5V* voltage level	LVD-0.1V* voltage level	LVD-0.1V* voltage level

OPERATION:

Battery voltage control parameters

◆ Lead-acid Battery Parameters

The parameters are measured in the condition of 12V/25°C. Please double the values in the 24V system and quadruple the values in the 48V system.

Voltage control parameters	Sealed	GEL	FLD	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 voltage warning voltage	12.0V	12.0V	12.0V	9~17V
Low voltage disconnect voltage	11.1V	11.1V	11.1V	9~17V
Discharging limit voltage	10.6V	10.6V	10.6V	9~17V
Equalize Duration	120 minutes	--	120 minutes	0~180 minutes
Boost Duration	120 minutes	120 minutes	120 minutes	10~180 minutes

(1) To change these parameters, select "User" battery type.

(2) The following rules must be observed when modifying the parameter's value in user battery type (factory default value is the same as sealed type):

OPERATION:

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 Reconnect Voltage.

◆ Lithium battery voltage parameters

The parameters are measured in the condition of 12V/25 °C. Please double the values in the 24V system and quadruple the values in the 48V system.

Voltage control parameters	LFP	Li(NiCoMn)O2	User
Over voltage disconnect voltage	15.6V	13.5V	9~17V
Charging limit voltage	14.6V	12.6V	9~17V
Over voltage reconnect voltage	14.7V	12.7V	9~17V
Equalize charging voltage	14.5V	12.5V	9~17V
Boost charging voltage	14.5V	12.5V	9~17V
Float charging voltage	13.8V	12.2V	9~17V
Boost reconnect charging voltage	13.2V	12.1V	9~17V
Low voltage reconnect voltage	12.8V	10.5V	9~17V
Under voltage warning reconnect voltage	12.8V	11.0V	9~17V
Under voltage warning voltage	12.0V	10.5V	9~17V
Low voltage disconnect voltage	11.1V	9.3V	9~17V
Discharging limit voltage	10.6V	9.3V	9~17V

OPERATION:

- **The following rules must be observed when modifying the parameter values in User for a lithium battery.**

A. Over Voltage Disconnect Voltage > Over Charging Protection Voltage(Protection Circuit Modules(BMS))+0.2V;

B. Over Voltage Disconnect Voltage > Over Voltage Reconnect Voltage = Charging Limit Voltage ≥ Equalize Charging Voltage = Boost Charging Voltage ≥ Float Charging Voltage > Boost Reconnect Charging Voltage;

C. Low Voltage Reconnect Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage.

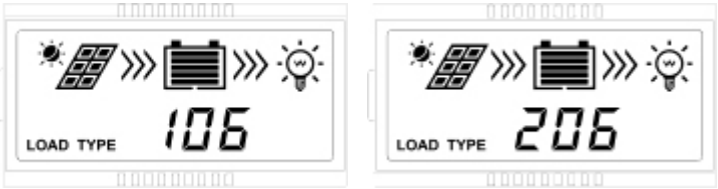
D. Under Voltage Warning Reconnect Voltage > Under Voltage Warning Voltage ≥ Discharging Limit Voltage;

E. Boost Reconnect Charging voltage > Low Voltage Reconnect Voltage;

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

WARNING	• The voltage parameters of a lithium battery can be set according to the lithium battery BMS's voltage parameters. • The required accuracy of BMS shall be no higher than 0.2V. We will not assume any responsibility for the system abnormal when the accuracy of BMS is higher than 0.2 v.

Local load mode Setting



When the LCD shows the above interface, operate as follows:

Operation:

1. Press the "SELECT" button to jump to the load type interface.
2. Press and hold the "ENTER" button until the load type interface flashes.
3. Press the "SELECT" button to modify the load type.
4. Press the "ENTER" button to confirm.

OPERATION:

- **Load Mode Setting**

Operating Steps:
Under load mode setting interface, press SET button and hold on 5s till the number begin flashing, then press MENU button to set the parameter, press SET button to confirm.

1**	Timer 1	2**	Timer 2
100	Light ON/OFF	2 n	Disabled
101	Load will be on for 1 hour since sunset	201	Load will be on for 1 hour before sunrise
102	Load will be on for 2 hours since sunset	202	Load will be on for 2 hours before sunrise
103~113	Load will be on for 3~13 hours since sunset	203~213	Load will be on for 3~13 hours before sunrise
114	Load will be on for 14 hours since sunset	214	Load will be on for 14 hours before sunrise
115	Load will be on for 15 hours since sunset	215	Load will be on for 15 hours before sunrise
116	Test mode	2 n	Disabled
117	Manual mode (Default load ON)	2 n	Disabled

CAUTION	When selecting the load mode as the Light ON/OFF mode, Test mode, and Manual mode, only the Timer 1 can be set; and the Timer 2 is disabled and display "2 n".

ADDITIONAL INFO:

PROTECTION

Protection	Instruction
PV over current	When the PV array's actual charging current or power exceeds the controller's rated charging current or power, the controller charges the battery as per the rated current or power.
PV short-circuit protection	When not in the PV charging state, the controller will not be damaged in the case of short-circuiting in the PV array.  **WARNING** It is forbidden to short-circuit the PV array during charging. Otherwise, the controller may be damaged.
PV reverse polarity protection	When the PV array's polarity is reversed, the controller may not be damaged and resume work after the mis-wiring is corrected.  **CAUTION** If the PV array is reversed and its actual power is 1.5 times the controller's rated power, the controller may be damaged.
Night reverse charging protection	Prevent the battery from discharging to the PV module at night.
Battery over voltage protection	When the battery voltage reaches the over voltage disconnect voltage, the PV array will automatically stop charging the battery to prevent the battery damage caused by overcharging.
Battery over discharging protection	When the battery voltage reaches the low voltage disconnect voltage, the battery discharging is automatically stopped to prevent battery damage caused by over discharging.  **CAUTION** When a load is connected to the battery and the load is connected to the controller's (Load) dry contact, the battery over-discharge protection takes effect.
Battery over heating protection	The controller detects the battery temperature through an external temperature sensor. The battery stops working when its temperature exceeds 65°C and resumes work when its temperature is below 55°C.
Lithium battery low temperature protection	When the temperature detected by the optional temperature sensor is lower than the Low Temperature Protection Threshold(LTPT), the controller stops charging and discharging automatically. When the detected temperature is higher than the LTPT, the controller resumes work automatically. (The LTPT is 0 °C by default and can be set within the range of 10 ~ -40 °C. Detail settings refer to the LTPT V1.0.)

ADDITIONAL INFO:

Load short circuit protection	When a short circuit occurs on the load side (which is 4 times higher than the rated load current), the controller automatically cuts off the output. The output still attempts to resume five times automatically (delay 5 seconds, 10 seconds, 15 seconds, 20 seconds, 25 seconds). Suppose you want the controller to restart the auto recovery process. In that case , you need to press the Load button, or restart the controller, or experience a night to day change (night time 3 hours).
Overload protection	If the load current exceeds 1.05 times the controller's rating, the controller will cut off the output after a delay. After the overload occurs, the output attempts to resume automatically five times (delay of 5 seconds, 10 seconds, 15 seconds, 20 seconds ,25 seconds). Suppose you want the controller to restart the auto recovery process. In that case, you need to press the Load button, or restart the controller, or experience a night to day change (night time 3 hours).
Controller Overheating*	An internal temperature sensor can detect the internal temperature of the controller. The controller stops working when the internal temperature exceeds 85°C and resumes work when the internal temperature is below 75°C.
TVS high voltage transients protection	The controller's internal circuitry is designed with Transient Voltage Suppressors (TVS), which can only protect against high-voltage surge pulses with less energy. Suppose the controller is to be used in an area with frequent lightning strikes. In that case, it is recommended to install an external surge arrester.

* When the control's internal temperature is 81°C, the reducing power charging mode is turned on, reducing the charging power of 5%, 10%, 20%, 40% every increase of 1°C. If the internal temperature is greater than 85°C, the controller stops charging. When the internal temperature is not more than 75°C, the controller will resume charge as per the rated power.

ADDITIONAL INFO:

TROUBLESHOOTING

Issue		Fault	Solution
Charging LED is OFF during daytime when sunshine falls on PV array properly		PV array open-circuit	Confirm whether the connection of the PV array is correct and tight
The wire connection is correct; the controller is not working.		The battery voltage is lower than 8V.	Please check the voltage of the battery(at least 8V voltage to activate the controller).
Battery frame blink, fault icon blink		Battery over voltage	Check whether the battery voltage is higher than OVD (over voltage disconnect voltage) and disconnect the PV array connection.
		Battery over discharged	① When the battery voltage is restored to or above LVR(low voltage reconnect voltage), the load recovers. ② Other ways to recharge the battery.
		Battery over heating	While the battery temperature decline to 55°C or below, the controller resumes work.
Load Off	**LOAD OFF**	Overload	① Please reduce the number of electric devices. ② Restart the controller or press the button to clear faults.
Load and Fault		Load short-circuit	① Check carefully loads connection, clear the fault, ② Restart the controller or press the button to clear faults.

① When the load current goes higher than 1.02-1.05 times, 1.05-1.25 times, 1.25-1.35 times, and 1.35-1.5 times the rated value, the controller may automatically turn offloads in 50 seconds, 30 seconds,10 seconds, and 2 seconds respectively.

ADDITIONAL INFO:

MAINTENANCE

The following inspections and maintenance tasks are recommended at least two times per year for the best performance.

- Make sure no block on airflow around the controller. Clear up any dirt and fragments on the radiator.
- Check all the naked wires to ensure insulation is not damaged for sun exposure, frictional wear, dryness, insects or rats, etc. Repair or replace some wires if necessary.
- Check and confirm that LED is consistent with required. Pay attention to any troubleshooting or error indication. Take necessary corrective action.
- Confirm that all terminals have no corrosion, insulation damaged, high temperature, or burnt/discolored sign, and tighten terminal screws to the suggested torque.
- Clear up dirt, nesting insects, and corrosion in time.
- Check and confirm that the lightning arrester is in good condition. Replace a new one in time to avoid damaging the controller and even other equipment.

 **WARNING**	Risk of electric shock! Ensure that all the power is turned off before the above operations, and then follow the corresponding inspections and operations.

SPECIFICATIONS:

Model:	MP3768
Electrical Parameters	
System rated voltage	12/24VDC or Auto ①
Controller working voltage range	8V~32V
Lead-acid battery type	Sealed (default), GEL, FLD, and user-defined.
Lithium battery type	LiFePO4/ Li(NiCoMn)O2/ User
Battery fuse	80A/ 58V
Rated charging current	30A
Rated discharge current	30A
Max. PV open-circuit voltage	100V (at the lowest temperature) 92V (at 25°C)
MPPT voltage range	(Battery voltage +2V) ~72V (at 25°C)
Temperature compensate coefficient ②	-3mV/°C/2V (Default)
Self-consumption	≤12mA
Grounding type	Common negative grounding
Communication method	RS485 (5VDC/200mA, Two RJ45 ports in parallel)
LCD backlight time	Default: 60S, Range:0~999S (0S: the backlight is ON all the time)
Mechanical parameters	
Dimension	228x164x55mm
Mounting dimension	170x155mm
Mounting hole size	Ø5mm
Wire size	6AWG (16mm^2)
Recommended cable	8AWG (10mm^2)
Net Weight	1.26kg

① When a lithium battery is used, the system voltage can't be identified automatically.

② When a lithium battery is used, the temperature compensation coefficient will be 0 and can't be changed.

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