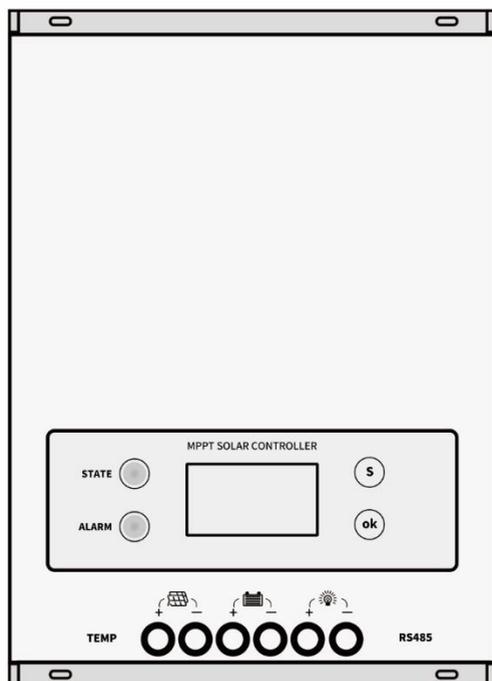


# MPPT

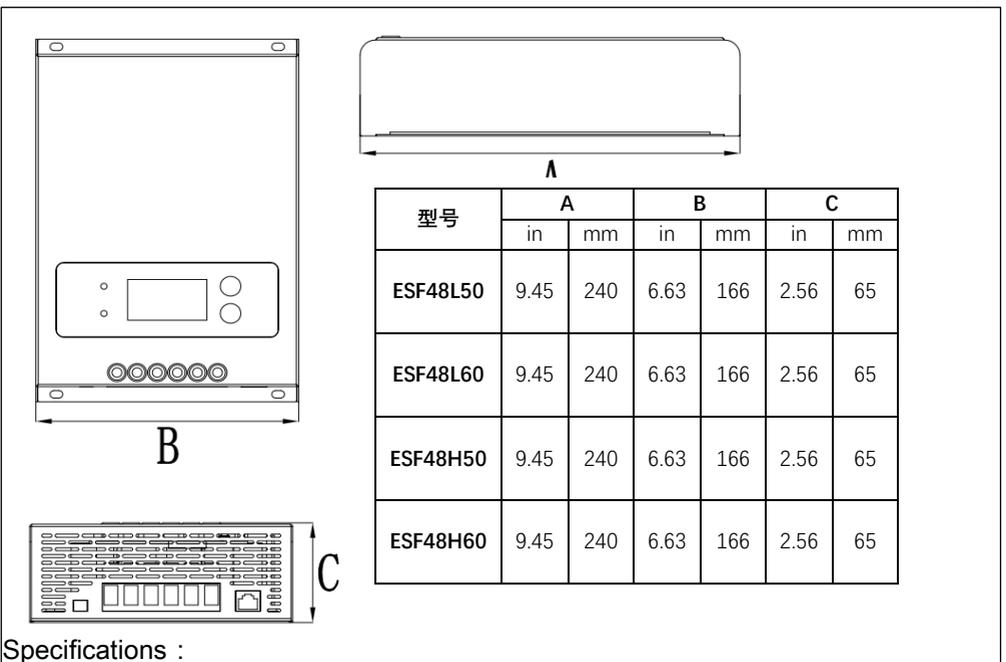
SOLAR CHARGE CONTROLLER

## 《USER MANUAL》





## size



Model		ESF48L50	ESF48L60	ESF48H50	ESF48H60
Maximum PV open circuit voltage *		150V		200V	
Rated input power **	12V	650W	780W	650W	780W
	24V	1300W	1560W	1300W	1560W
	36V	1950W	2340W	1950W	2340W
	48V	2600W	3120W	2600W	3120W
Maximum battery charging current		50A	60A	50A	60A
Rated load current		30A			

\*The voltage of the PV array cannot exceed this limit.

\*\*These power limits refer to the maximum power that the MPPT controller can handle. High power arrays can be used without damaging the controller.

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# 1.0 Important safety instructions

## It is recommended to keep this manual.

This manual contains important safety, installation and operation instructions for the MPPT solar controller.

The following symbols are used in this manual to indicate potentially hazardous conditions or to mark important safety instructions :



*Warning: Indicates a potentially hazardous situation. Be careful when performing related operations.*



*Reminder: Indicates critical procedures for safe and correct operation of the controller.*



*NOTE: Indicates a program or function that is important to the safe and correct operation of the controller.*

## Security Information

---

- Before installation, read all the instructions and precautions in this manual.
- There are no user repairable parts in the MPPT. Do not disassemble or attempt to repair the controller.



*WARNING: Danger of electric shock. No power or other terminals are galvanically isolated from the DC input and may be energized with dangerous solar voltages. Under certain fault conditions, the battery may overcharge. Before making contact, test the impedance between all terminals and ground.*



*WARNING: The communication port of the controller is not an isolated source and isolated signal, please be careful when connecting with other devices.*

- Requires external solar and battery disconnect.
- Disconnect all power from the controller before installing or adjusting the MPPT.

## Installation Safety Precautions

---



*Warning: There is no GFDI (Ground Fault Detection Device) inside the controller*

- Install MPPT indoors. Prevent touch with components and do not allow water to enter the controller.
- Install the MPPT in a location that is not easily accessible touched by accident. MPPT heat sinks can get very hot during operation.
- When using batteries, use insulated tools.
- Avoid wearing jewelry during installation.
- The battery pack must consist of batteries of the same type, brand and age.
- Do not smoke near the battery pack.
- Power connections must be kept tight to avoid overheating due to loose connections.
- Use appropriately sized wires and circuit breakers.
- Grounding can be performed at the bottom fixing holes of the chassis.
- The MPPT controller must be installed by a qualified technician in accordance with the country's electrical codes.
- A means of disconnecting all power electrodes must be provided. These disconnects must be included in the fixed wiring.
- The MPPT positive power terminal is connected (common positive). If necessary, ground in accordance with instructions, local codes and regulations.
- The grounding position of the MPPT shell must be connected to a reliable ground wire.
- The ground conductor must be secured to prevent accidental separation.

## Battery safety

---



*WARNING: Batteries may present a risk of electric shock or burn due to high short-circuit current, fire or explosion of exhaust gas. Follow proper precautions.*



*WARNING: Danger of explosion. Batteries need to be disposed of properly. Do not dispose of batteries in a fire. Refer to local regulations or codes for requirements.*



*Reminder: When replacing batteries, use the correctly specified quantity, size, type and rating based on the application and system design.*



*Reminder: Do not open or damage the battery. The electrolytes released are harmful to the skin and may be toxic.*

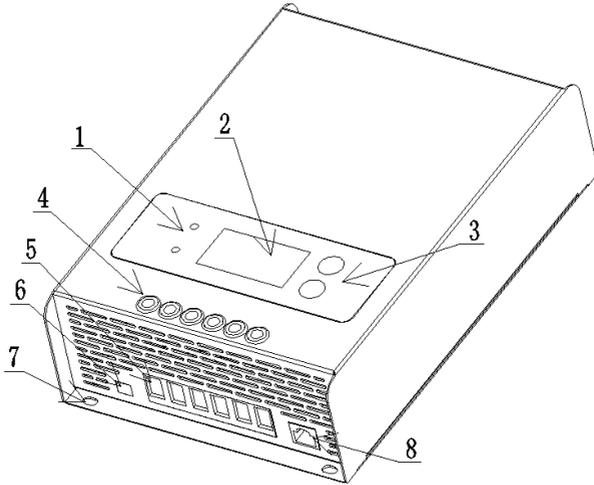
- Repairs to batteries should be performed or supervised by personnel who understand batteries and appropriate safety precautions.
- Be very careful when using large lead-acid batteries. Wear safety goggles and have fresh water available to prevent contact with battery acid.
- Remove watches, rings, jewelry and other metal objects before using the battery.
- Wear rubber gloves and boots.
- Use tools with insulated handles and avoid placing tools or metal objects on top of the battery.
- Disconnect the solar panel or other charging power source before connecting or disconnecting the battery terminals.
- Determine if the battery is accidentally grounded. If so, remove the ground source. Contact with any part of a grounded battery may result in electric shock. The possibility of this type of shock is reduced if the battery ground is removed during installation and maintenance (applies to equipment without a grounded power circuit and to remote battery power).
- Please read the battery manufacturer's instructions carefully before installing / connecting the MPPT or removing the battery from the MPPT.
- Be careful not to short the cables connected to the battery.
- If in the event of an accident, ask someone nearby for assistance.
- Explosive battery gas may exist during charging. Make sure there is adequate ventilation to release the gas.
- No smoking in the battery area.
- If battery acid comes into contact with skin, wash with soap and water. If acid contacts eyes, flush with fresh water and seek medical attention.
- Before starting to charge the lead-acid battery, make sure that the battery electrolyte level is correct. Do not attempt to charge a frozen battery.
- When replacing the battery, pay attention to recycling the battery.

## 2.0 Product Introduction

### 2.1 Feature Illustrations

---

The features and illustration of the controller are as follows:



- 1 – Charge status and fault indicators.
- 2 – LCD display.
- 3 – Operation buttons.
- 4 – Holes for wiring screws.
- 5 – Input and output power line connectors. (PV+/PV-/BAT+/BAT-/LOAD+/LOAD-).
- 6 – Temperature sensing wire connector.
- 7 – Mounting hole for grounding.
- 8 – RJ45 serial communication interface.

## 2.2 Optional accessories

---

The following accessories can be purchased separately from authorized dealers:

### **MH-M80(Meter)**

Digital remote instruments display system working information. The information is displayed on the OLED display and the parameters of the controller can be easily set. It can be mounted on the wall or close to the surface of ferrous material using the mounting bracket (accessory). The MH-M80 comes with a 3.3 ft (1.0 m) cable (extendable), mounting bracket and mounting screws. The MH-M80 connects to the RJ-45 communication port on the MPPT. The MH-M80 cannot be used with other communication equipment.

### **MH-S80(Meter)**

Digital remote instrument displays system working information and error indication. The information is displayed on the OLED display and the parameters of the controller can be easily set. This meter can connect up to 4 controllers, and the controllers of the same battery system can work in parallel. The head can be mounted on the wall or close to the surface of ferrous material using the mounting bracket (accessory). The MH-S80 comes with a 3.3 ft (1.0 m) cable (extendable), mounting bracket and mounting screws. The MH-S80 connects to the RJ-45 communication port on the MPPT. The MH-S80 cannot be used with other communication equipment.

### **USB-RS485 communication line**

The USB-RS485 communication line converts the RJ45 electrical interface into a standard USB interface, thereby realizing the communication between the MPPT and the personal computer (PC). This communication line can be used to modify the controller's custom charging setpoint and record data in SolarMate. This communication cable cannot be used with other external devices.

### **BT-02**

A wireless communication box that can be used in connection with the controller. The communication box acts as a transceiver (near-field remote control), and the user can use the mobile phone software to monitor the MPPT controller via Bluetooth. The comm box cannot be used with other external devices.

### **Cloud-Box-M2**

A wireless communication box that can be used in connection with the controller. The communication box acts as a transceiver (remote control), and the user can use the mobile phone software to monitor the MPPT controller through the Internet cloud server. The comm box cannot be used with other external devices.

## 3.0 Installation Instructions

### 3.1 Installation Precautions

---

- Please read through the entire installation section before beginning the installation.
- Be very careful when using batteries. Wear goggles and use fresh water to wash and clean any contact with battery acid.
- Use insulated tools and avoid placing metal objects near the battery.



*Warning: Do not install the MPPT in an enclosure with an open/flooded battery. Battery fumes are flammable and can corrode and destroy MPPT circuits.*



*Reminder: When installing the MPPT in the enclosure, ensure adequate ventilation. Installation in a sealed enclosure can result in overheating, reduced power operation, and shortened product life.*

- Do not install in a location prone to water ingress and very humid.
- Loose power cord connections and corroded wires may cause contact points or line impedance to increase, melt wire insulation, burn surrounding materials, or even cause a fire. Ensure that the cables are securely connected and secured using cable clips to prevent the cables from shaking during mobile applications
- This MPPT controller can be connected to a battery or a battery pack.
- This MPPT controller prevents reverse current leakage at night, so diodes in series are not required in the system.
- This MPPT controller is only used for solar power generation. Connection to any other type of power source (such as a wind turbine or generator) may void the warranty.



*Warning: Serial solar and battery fuses or DC circuit breakers are required in the system. These guards are located outside the MPPT controller.*



*Warning: Installation must comply with electrical code requirements. Select suitable specifications for circuit breakers and fuses based on application requirements.*

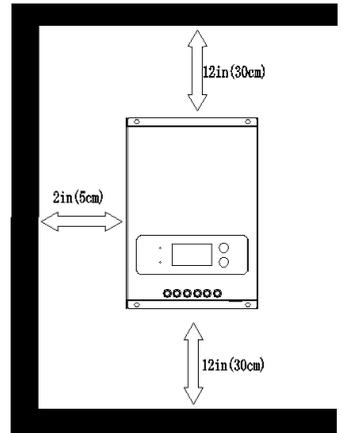
## 3.2 Installation Steps

Check the controller for shipping damage. Do not install directly on flammable surfaces as the radiator may become hot under certain operating conditions.

To ensure room for airflow, allow at least 30 cm (12 in) above and below the controller and 50 mm (2 in) on both sides. Do not install in a container where accumulator gas may accumulate.



*Note: There should be enough space between the top and bottom for the fan to dissipate heat.*

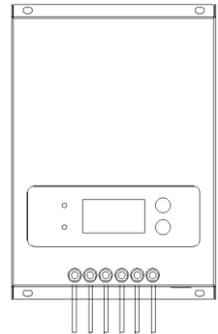


### Step 1: Check Controller Parameter Limits

Check that the maximum temperature compensated solar array open circuit voltage (Voc) and load current do not exceed the ratings of the MPPT version being installed. Multiple controllers can be installed in parallel on the same battery pack for greater total charge current. In this type of system, each MPPT must have its own solar panel. The load terminals of multiple controllers can be connected together only if the total load does not exceed the rated current of a single controller.

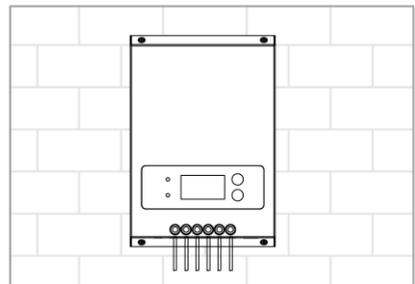
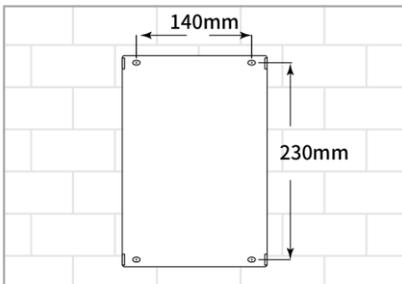
### Step 2: Connect the input and output power cables

Follow the wiring sequence ①, ②, ③ to wire and tighten the screws.



### Step 4: Make mounting holes in the mounting wall

Measure and mark the distance on the wall, drill 4 holes of 6mm diameter and fill the 4 holes with plastic expansion pellets.



## Step 5: Mount the Controller to the Wall

Align the fixing holes of the controller with the mounting holes made in step 4, use M4 self-tapping screws to fix the controller on the installation wall and tighten the screws.

## Step 6: Power on and run

Check to make sure the solar panel and battery are in normal condition, double check that the input and output cables are connected correctly, then power up the battery first, then the solar panel, the controller will run automatically.



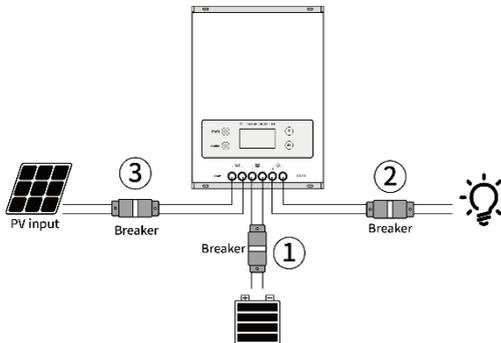
*Note: Before connecting the battery, the open circuit voltage of the battery must be measured. It must exceed 10 volts to activate the controller. If the system voltage is set to auto detect, battery voltages over 18V will be detected as a nominal 24V battery and the device will charge the 24V battery. 12/24/48V only auto-selected at power-up.*



*Warning: Potential for damage*  
*Disconnect the battery from the MPPT as soon as possible after the solar input is disconnected. If the battery is removed during MPPT charging, there is a low chance of damage to the controller.*



*Note: To prevent damage, power must be turned on in the following order; power off must be reversed from power on*



**Start steps: step 1:** Turn on the circuit breaker connected to the battery first, make sure that the controller is connected to the battery (the controller LCD will display the content), and set the battery type;

**step 2:** If a DC output is required to control the load, Please set the output control mode first, Then open the DC output "breaker";

**step 3:** Connect a circuit breaker that turns on the PV input of the solar panel, If the voltage of the PV input is within the charging operating range of the controller, the controller will enter the charging state;

shutdown process: Turn off the "circuit breaker" in turn ③②①

# 4.0 Working principle and operation guide

## 4.1 The maximum power point tracking technology

Power is equal to the product of voltage and current. The following equation holds \*:

(1) Input power of MPPT = output power of MPPT

(2) Input voltage × input current = output voltage × output current

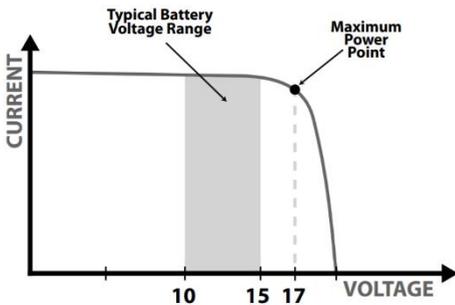
\* Assumes 100% conversion efficiency, ignoring line losses and energy conversion losses.

If the  $V_{mp}$  of the solar panel array is greater than the battery voltage, the battery current must be proportionally greater than the solar input current to balance the input and output power. The greater the difference between the maximum photovoltaic input voltage and the battery voltage, the greater the difference between the input and output currents.

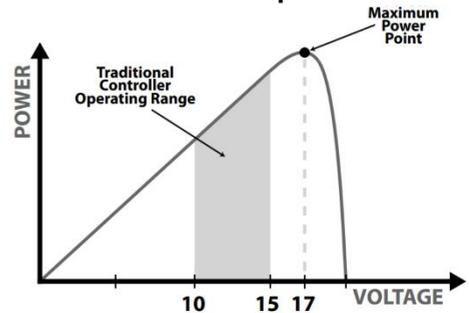
For a given input power, a higher input voltage of a solar module array results in a lower solar input current. An array of high voltage solar input modules allows the use of smaller gauge solar wiring. This is very beneficial for systems that require long wiring between the solar module array and the MPPT.

Compared to the traditional controller, the principle of it is to connect the solar module directly to the battery when charging. This requires the solar module to operate in a voltage range lower than the module  $V_{mp}$ . For example, in a 12V system, the battery voltage may be between 10-15VDC, but the  $V_{mp}$  of the module is usually around 17V. The figure below shows a typical current vs. voltage output curve for a nominal 12V charging system.

12 Volt Module Current vs. Voltage



12 Volt Module Output Power



## 4.2 Charge status and parameters

---

### The controller charges the lead-acid battery

The MPPT controller has a 4-stage battery charging algorithm for fast, efficient and safe charging of lead-acid batteries.

- 1 - CC State (Constant Current Charging): Fast Charging Phase - FAST
- 2 - CV state (constant voltage charging): regulated charging phase - KEEP
- 3 - CF Status (Float Charging): Prevents the battery from being overcharged for a long time. And make up for the loss of self-discharge. -FULL
- 4 – Boost charging: activate battery chemistry, desulphurization effect

### The controller charges the lithium-ion battery

The MPPT controller will charge according to the specifications of the lithium-ion battery, mainly in two stages. In the first stage, when the battery voltage is lower than the saturation voltage, it will rapidly charge according to the maximum power point that is tracked; in the second stage, when the battery voltage is equal to the saturation voltage, it will charge at a constant voltage, and the charging current will gradually decrease to 0.

### Charging parameter settings

---

The charging parameters of commonly used lead-acid battery. All voltage settings listed are for standard 12 volt batteries. Example: For a 24 volt battery, multiply the voltage setting by 2.

Battery Type	Constant pressure pressure	Float charge	Equalization voltage	Equalization charging time	Undervoltage protection	Brownout Recovery
Gel (GEL)	14.2V	13.8V	14.2V	30 points user-defined	11.1V	12.6V
Sealed (SEL)	14.4V	13.8V	14.6V	30 points user-defined	11.1V	12.6V
Flooded (FLD)	14.6V	13.8V	14.8V	30 分 user-defined	11.1V	12.6V
Custom(CUS)	user-defined	user-defined	user-defined	30 points user-defined	user-defined	user-defined

The charging parameters of commonly used lithium-ion batteries.

Battery Type	Standard Voltage	Saturation voltage	Discharge cut-off voltage	cut-off recovery voltage
LiFePO4-12V (4 strings of lithium iron phosphate)	12.8V	14.4V	10.8V	12.4V
LiFePO4-24V (8 strings of lithium iron phosphate)	25.6V	28.8V	21.6V	24.8V
LiFePO4-48V (15 strings of lithium iron phosphate)	48V	54V	40.5V	46.5V
Ternary-12V (3 strings of ternary lithium)	11.1V	12.6V	9.6V	10.5V
Ternary-24V (6 strings of ternary lithium)	22.2V	25.2V	19.2V	21.0V
Ternary-48V (13 strings of ternary lithium)	48.1V	54.6V	41.6V	45.5V
user-defined	user-defined	user-defined	user-defined	user-defined



*Note: These settings are general guidelines for user operation. MPPT can be set to meet various charging parameters. Check with the battery manufacturer for the best battery charging settings.*

### 4.3 Load Control

---

The main purpose of the load control function is to disconnect the system load when the battery is discharged to a low voltage state and reconnect the system load when the battery is charged back to a certain level. System loads can be lamps, DC appliances, or other electronic equipment. The total current of all loads must not exceed the MPPT maximum load rating.



*Reminder: Risk of Equipment Damage*

*Do not connect any AC inverter to the load terminals of the MPPT. The load control circuit may be damaged. The inverter should be connected to the battery. If any other load may sometimes exceed the maximum voltage or current limit, the device should be connected directly to the battery or battery pack.*

**Brief description of load control:**

Do not connect multiple MPPT load outputs in parallel to power supply dc loads that consume more than 30A current, depending on the MPPT model used.

Be careful when connecting loads with specific polarities to controller load terminals. Reverse polarity connections may damage the load. Be sure to check the load connection carefully before powering on.

The load output voltage of the controller is the same as that of the battery string. For example, when the battery voltage is 25.2V, the load output voltage is also 25.2V.

When the load output current is lower than the rated load current, the system provides stable power to the load.

When the load output current exceeds the preset load current and lasts for 5 minutes in the range of 100% to 120%, the load output is shut down and switches to the normal off mode.

When the load output current is detected to exceed 120% of the rated load current, the load output will be shut down immediately and switch to the normal off mode.

 *Attention: When the Load switches to normal off mode, in order to restart the Load, the user needs to reset the Load to "ON" mode ON the controller or reset the Load mode through the mobile APP, upper computer, and meter header.*

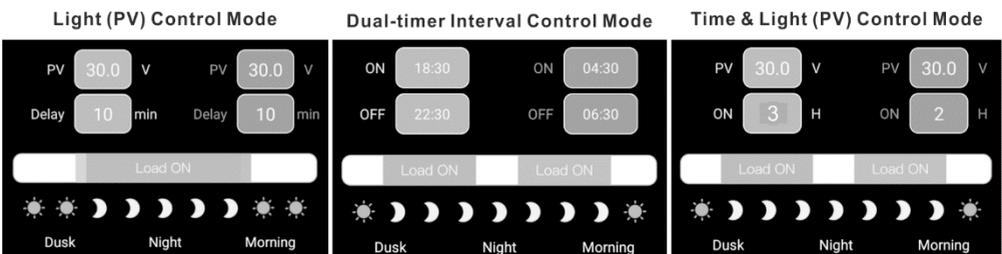
### Load Control Mode:

1 - Normal on/Normal Off mode: The load output state is on or off.

2 - Optical control mode: The load output is turned on or off according to whether there is light (input voltage limit). Refer to the following diagram for the working mechanism.

3 - Dual-period timing control mode: The load switch of two different periods is controlled according to two timers. Refer to the following diagram for the working mechanism.

4 - Fixed time light control mode: according to whether there is light (input voltage limit), the load output is controlled to turn on or off in hourly units.





*Attention: Only the normal ON/normal OFF mode can be set on the controller panel. Other modes need to be set through other optional accessories.*



*Attention: Please refer to Section 4.5 for setting the normally on/OFF mode*

## **4.4 LED Indicators**

---

Green: Indicates charging status. When flashing fast, it means it is in fast charging state (CC mode); when flashing slowly, it means it is in constant voltage charging state (constant voltage charging CV); when it is always on, it means it is in floating charging state (CF) or standby mode.

Red: If a fault occurs, the indicator is steady on. If it is off, it indicates that the device is running normally without faults.

## **4.5 Display and key operation**

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The controller has a backlit LED display and function buttons. You can only set the battery type with preset parameters. The detailed operation and display logic are shown in the following figure.

## **4.6 Key operation**

---

Press the "OK" and "S" keys at the same time for 6 seconds to restore the factory settings. The specific operation and display logic are shown in the following figure.

battery system, load,  
Alarm status indication

BAT SYS: 88v STOP FAST KEEP FULL

LOAD PV BAT **88:8.8** °FV%  
°CA  
kkWh

GEL SEL FLD CUS FePO4 LI TERNARY

Charging status indication

real-time data display

battery type display

BAT SYS: 24v STOP FAST KEEP FULL

PV **60.2** V  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

LOAD **0.60** kWh  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

BAT **24.5** V  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

PV **0.65** kWh  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

BAT **50.6** A  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

LOAD **630** W  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

LOAD **23.8** A  
LI

Press S

BAT SYS: 24v STOP FAST KEEP FULL

PV **2022** W  
LI



## 5.0 Common faults and handling



WARNING: Danger of electric shock.

Inputs and outputs are not electrically isolated and may be energized with dangerous solar voltages. Under certain fault conditions, the battery may overcharge. Before making contact, test the impedance between all terminals and ground.



Warning: Danger of electric shock

A means of disconnecting all power electrodes must be provided. These disconnections must be included in the fixed wiring. Disconnect all power supplies before removing the controller wiring cover or repairing the wiring.

Fault:

The LCD screen doesn't light up, and the controller doesn't seem to be powered on.

Solution: Use a multimeter to check the voltage of the battery terminals on the MPPT. The battery voltage must be 10 VDC or higher. If the voltage on the controller battery terminal is between 10 and 60 VDC and no indicator light is on, contact the authorized distributor for repair. If the voltage is not measured, check the wiring, fuses, and circuit breakers.

Fault:

The controller is not charging.

Solution:

Check fuses, circuit breakers, and wiring connections in power wiring. Using a multimeter, check the array voltage directly on the MPPT solar input terminals. Before starting charging, the input voltage must be greater than the battery voltage. Check whether the battery voltage displayed on the LCD screen is within the recognition range of the controller system.

Fault:

The battery has been in a low or dead state for a long time.

Solution:

Possible reasons: 1. There are too few solar panels to generate enough energy to meet the system use, and the solar panel array can be increased appropriately. 2. The battery capacity is too small to store enough energy for the system to use, and the capacity of the battery pack can be appropriately increased.

# 6.0 Specification

		ESF48L50	ESF48L60	ESF48H50	ESF48H60	
<b>Product Category</b>	MPPT efficiency	≥99.5%				
	No-load static loss	0.5W~1.2W				
	system voltage	Auto				
	Cooling method	Fan cooling				
<b>Input characteristics</b>	PV Maximum Open Circuit Voltage (VOC)	150Vdc		200Vdc		
	Turn on the charging voltage point	3V higher than battery voltage				
	Input low voltage protection point	2V higher than the current battery voltage				
	Input overvoltage protection point	150Vdc		200Vdc		
	Rated input power	12V system	650W	780W	650W	780W
		24V system	1300W	1560W	1300W	1560W
		36V system	1950W	2340W	1950W	2340W
48V system		2600W	3120W	2600W	3120W	
<b>Charging characteristics</b>	Applicable battery type	Lead-acid battery / Li-ion battery				
	Lithium battery activation function	Optional				
	Charge rated current	50A	60A	50A	60A	
	charging method	Lead-acid battery: fast charge, equal charge, floating charge; lithium battery: fast charge, equal charge				
<b>Load characteristics</b>	load voltage	same battery voltage				
	Rated load current	30A				
	Load control method	Normally open and normally closed mode/dual period control mode/light control mode/light control-fixed time control mode				
<b>Display/Communication</b>	Display method	High-definition LCD segment code backlight display				
	communication method	8-pin RJ45 interface/RS485/support host computer monitoring/support external Bluetooth, WIFI module expansion to realize app cloud monitoring/support external monitoring header				
<b>other properties</b>	Protective function	Input and output over-voltage protection, anti-reverse connection protection, battery drop protection, etc.				
	Working temperature	-20°C~+50°C				
	Storage temperature	-40°C~+75°C				
	IP protection class	IP21				
	Maximum wire size	20mm <sup>2</sup>				
	Net weight (kg)	1962.7g				
	Gross weight (kg)					
	Product size (mm)	240*166*65				
Packaging size (mm)	299*203*70					

## Protective function

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Anti-reverse connection protection - battery end and photovoltaic array end

Photovoltaic array short circuit

Internal overtemperature - Reduced power operation

Load short circuit protection

Load overcurrent protection

Heat sink temperature limit

Overvoltage and undervoltage protection

Battery drop protection

## Cable Specification Table

---

### 2% Voltage Drop Charts for 75°C Stranded Copper Wire

1-Way Wire Distance (feet), 12 Volt System									
Wire Size (AWG)	60A	55A	50A	45A	40A	35A	30A	25A	20A
2/0*	22.4	24.4	26.9	29.9	33.6	38.4	44.8	53.8	67.2
1/0*	17.7	19.3	21.3	23.6	26.6	30.4	35.5	42.6	53.2
2	11.2	12.2	13.4	14.9	16.8	19.2	22.4	26.9	33.6
4	7.1	7.7	8.5	9.4	10.6	12.1	14.1	17.0	21.2
6	4.4	4.8	5.3	5.9	6.6	7.5	8.8	10.6	13.2
8	2.8	3.1	3.4	3.7	4.2	4.8	5.6	6.7	8.4
10	1.7	1.9	2.1	2.3	2.6	3.0	3.5	4.2	5.2
1-Way Wire Distance (meters), 12 Volt System									
Wire Size (mm <sup>2</sup> )	60A	55A	50A	45A	40A	35A	30A	25A	20A
70*	6.8	7.4	8.2	9.1	10.2	11.7	13.7	16.4	20.5
50*	5.4	5.9	6.5	7.2	8.1	9.3	10.8	13.0	16.2
35*	3.4	3.7	4.1	4.5	5.1	5.8	6.8	8.2	10.2
25	2.1	2.3	2.6	2.9	3.2	3.7	4.3	5.2	6.4
16	1.3	1.5	1.6	1.8	2.0	2.3	2.7	3.2	4.0
10	0.8	0.9	1.0	1.1	1.3	1.5	1.7	2.0	2.5
6	0.5	0.6	0.6	0.8	0.8	0.9	1.1	1.3	1.6

Maximum 1-way wire distance for 12 Volt systems, stranded copper, 2% voltage drop

## 2% Voltage Drop Charts for 75°C Solid Copper Wire

1-Way Wire Distance (feet), 12 Volt System									
Wire Size (AWG)	60A	55A	50A	45A	40A	35A	30A	25A	20A
2/0*	27.8	30.3	33.4	37.1	41.7	47.7	55.6	66.7	83.4
1/0*	22.1	24.1	26.5	29.4	33.1	37.8	44.1	53.0	66.2
2	13.9	15.1	16.6	18.5	20.8	23.8	27.7	33.3	41.6
4	8.7	9.5	10.5	11.6	13.1	15.0	17.5	21.0	26.2
6	5.5	6.0	6.6	7.3	8.2	9.4	10.9	13.1	16.4
8	3.5	3.8	4.2	4.6	5.2	5.9	6.9	8.3	10.4
10	2.2	2.4	2.6	2.9	3.3	3.8	4.4	5.3	6.6
1-Way Wire Distance (meters), 12 Volt System									
Wire Size (mm <sup>2</sup> )	60A	55A	50A	45A	40A	35A	30A	25A	20A
70*	8.5	9.2	10.2	11.3	12.7	14.5	16.9	20.3	25.4
50*	6.7	7.3	8.1	9.0	10.1	11.5	13.4	16.1	20.2
35*	4.2	4.6	5.1	5.6	6.3	7.2	8.5	10.1	12.7
25	2.7	2.9	3.2	3.5	4.0	4.6	5.3	6.4	8.0
16	1.7	1.8	2.0	2.2	2.5	2.9	3.3	4.0	5.0
10	1.1	1.1	1.3	1.4	1.6	1.8	2.1	2.5	3.2
6	0.7	0.7	0.8	0.9	1.0	1.1	1.3	1.6	2.0

Maximum 1-way wire distance for 12 Volt systems, solid copper, 2% voltage drop



*Attention: \*Wires larger than 4 AWG (25 mm<sup>2</sup>) must be terminated at the combiner box outside the MPPT. Use 4 AWG (25 mm<sup>2</sup>) or smaller wire to connect the MPPT to the combiner box.*

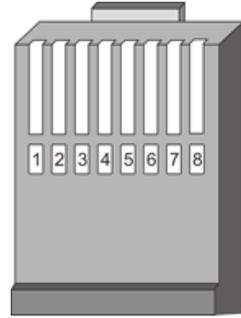


*Attention: • The specified wire lengths are for a pair of wires (one-way distance) from the solar or battery power source to the controller.*

*• For a 24-volt system, multiply the length in the table by 2.*

## RJ45 Port definitions

Pin	Function
1	RS485-A
2	RS485-B
3	-
4	-
5	GND
6	GND
7	+5V
8	+5V



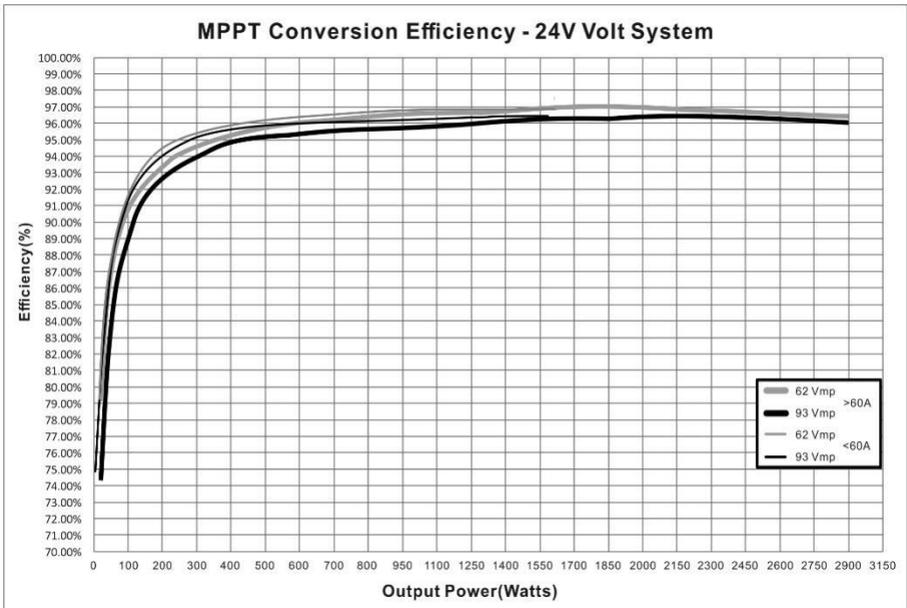
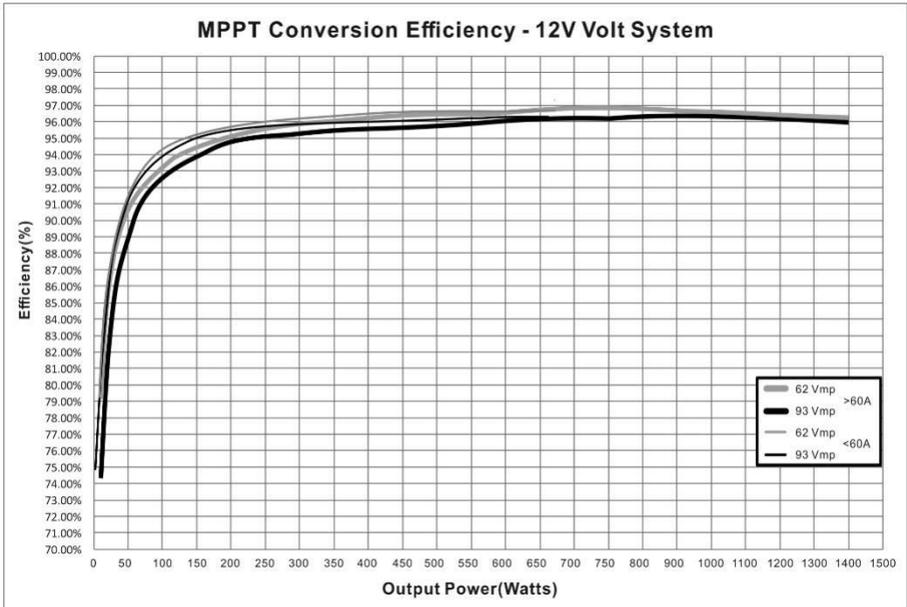
## Number of PV modules in series reference table

<b>Voc * N = PV input &lt; 150dc</b>												
Syst em Volt age	Voc<23V		Voc<31V		Voc<34V		Voc<38V		Voc<46V		Voc<62V	
	The maxi mum	The opti mum										
12V	6	2	4	1	4	1	3	1	3	1	2	1
24V	6	3	4	2	4	2	3	2	3	2	2	1
36V	6	4	4	3	4	3	3	3	3	2	2	1
48V	6	5	4	4	4	3	3	3	3	2	2	2
<b>Voc * N = PV input &lt; 200Vdc</b>												
Syst em Volt age	Voc<23V		Voc<31V		Voc<34V		Voc<38V		Voc<46V		Voc<62V	
	The maxi mum	The opti mum										
12V	8	2	6	1	5	1	5	1	4	1	3	1
24V	8	3	6	2	5	2	5	2	4	2	3	1
36V	8	4	6	3	5	3	5	3	4	2	3	1
48V	8	5	6	4	5	3	5	3	4	2	3	2

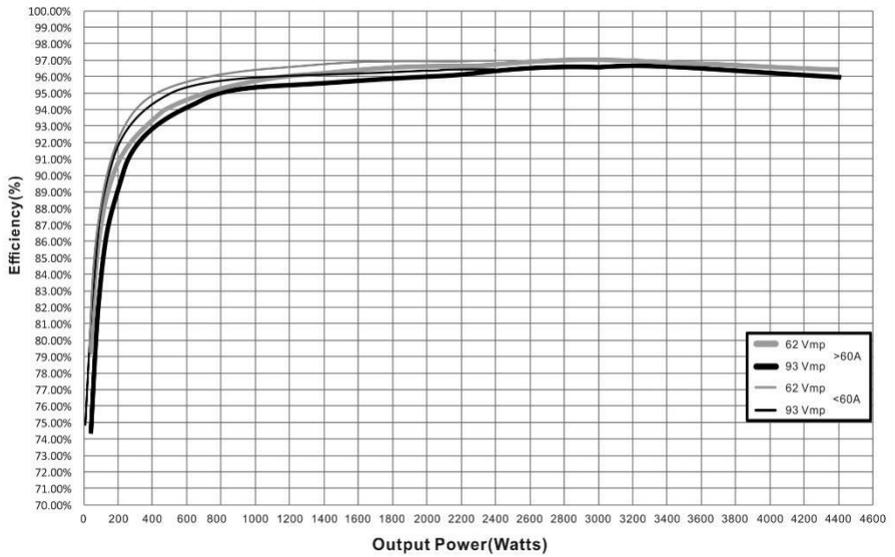


*Attention: N in the table represents the number of series, the data is for reference only.*

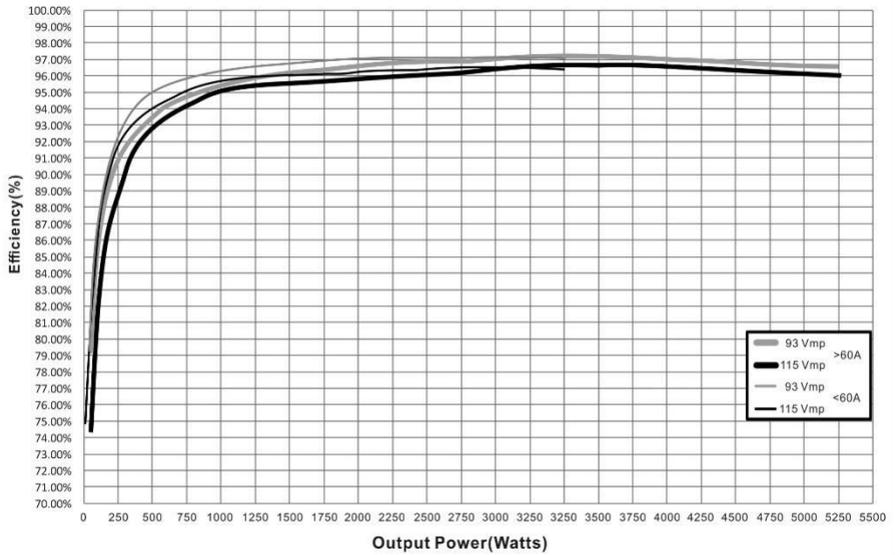
# Efficiency chart



### MPPT Conversion Efficiency - 36V Volt System



### MPPT Conversion Efficiency - 48V Volt System





# Solar Charging System Controller

