

# User Manual of MPPT Solar Charge Controller

Suitable for 12V/24V batteries or Li-ion batteries  
20A/30A/40A/50A/60A



**Important safety instructions (Please keep this handbook for future reference. Please read all instructions and precautions in the manual carefully before installation.)**

This manual contains all the safety, installation and operation instructions of this series solar charge controller (hereinafter referred to as "controller"):

- Install the controller in a well ventilated place. The controller's case temperature may be very high during operation. Please don't touch the metal shell directly to prevent burns.
- It is recommended to connect fuse or circuit breakers to the input, load and battery terminals to prevent electric shock hazard during use.
- After installation, check all wiring connections are secure, so as to avoid the danger of heat build-up caused by virtual connection.
- If the controller does not display properly when first use, please cut off the fuse or circuit breaker immediately and check whether the wiring connection is correct or not.
- If the solar system needs to connect the inverter, please connect the inverter directly to the battery, instead of the load terminal of the controller.
- Don't disconnect the battery when the controller is charging. Otherwise, it may damage the DC load.

## Operation fault codes description

| Code | Description          | Code | Description               | Code | Description                     |
|------|----------------------|------|---------------------------|------|---------------------------------|
| 001  | Battery over-voltage | 010  | Battery over-temperature  | 100  | Trigger over-voltage protection |
| 002  | PV over-voltage      | 020  | Internal over-temperature | 200  | Command mode                    |
| 004  | Overcharging         | 040  | PV under-voltage          | 400  | Battery system unrecognized     |
| 008  | Over-discharging     | 080  | Battery under-voltage     |      |                                 |

Table 1

## System Voltage and Battery Types

1) The controller identifies the system voltage according to the battery voltage at start-up. And the controller will re-identify the system voltage when power-off and restart. Please ensure the system voltage displayed in controller is consistent with the actual voltage. Otherwise, need to recheck the battery pack voltage.

**Note:** Please refer to Table 9 for the battery detailed system identification voltage.

2) The controller has set 3 kinds of conventional battery charging parameters (Table 2). To charge other types of batteries, please select "USE", then set up by PC software or APP. The controller can identify 12V/24V ONLY. To charge lithium battery, please select "Lit", then set up on the controller.

| Battery type  | Constant voltage = C * N (V)  | Floating voltage = F * N (V) | 1. C = Constant charging parameter. (9 ≤ F < C ≤ 15)<br>2. F = Floating charging parameter. (9 ≤ F < C ≤ 15)<br>3. N = Series number of battery. (1 ≤ N ≤ 2)<br>[e.g. N=2, battery system is 24V]<br>4. <b>Example:</b> If battery system is 24V, then N=2; If battery pack's saturation voltage is 28.4V, then C=28.4/N=14.2V. |
|---------------|---|------------------------------|---|
| Flooded (FLD) | 14.6 * N  | 13.8 * N                     |   |
| Sealed (SEL)  | 14.4 * N  | 13.8 * N                     |   |
| Gel (GEL)     | 14.2 * N  | 13.8 * N                     |   |
| User (USE)    | C * N   | F * N                        |   |
| Li-ion (Lit)  | According to the specifications of the selected lithium batteries, charging and protection parameters can be set through the controller.<br><b>Example:</b> Step 1: Enter the setup mode.<br>Step 2: Set the battery type to "Lit".<br>Step 3: Set the parameters of S05-S10.<br>Step 4: Save the setting parameters and exit.<br><b>Note:</b> Please refer to Table 7. |                              |   |

**Cell Specification**

Nominal Voltage: 3.7V

Charge Voltage: 4.2V

Cut-off Voltage: 2.7V

6 cells in series

**Reference Settings**

S06: 22.2V

Nominal Voltage

S05: 25.2V

Charge Voltage

S07: 16.2V

Under-volt protection

Table 2

## Working status instruction

User can identify the controller current working status according to the flash rule of the light. (When the screen is off.)

| Indicator Light                         | Instruction     |
|---|-----------------|
| The first light is always on (A)        | Standby         |
| All lights flashing (ABCD)              | Error warning   |
| Three lights turn on sequentially (ABC) | Charging        |
| The fourth light is always on (D)       | Load indicators |

Table 3 (Tip: A/B/C/D comes from Figure 1)

## 1. Characteristics

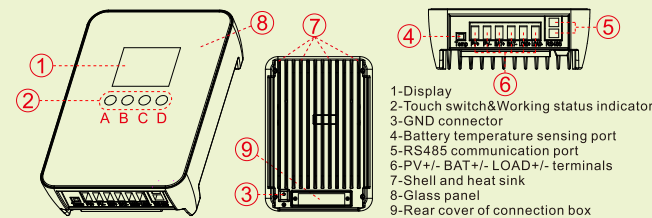


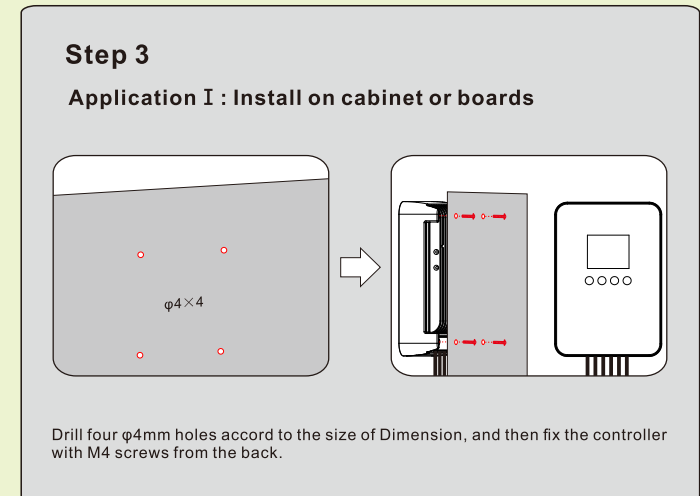
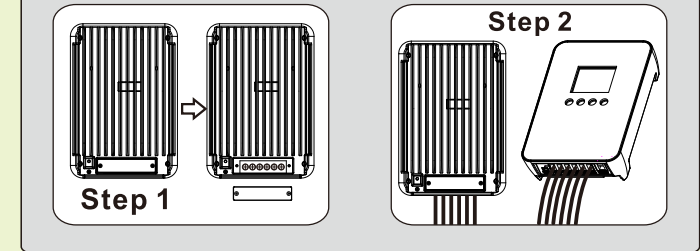
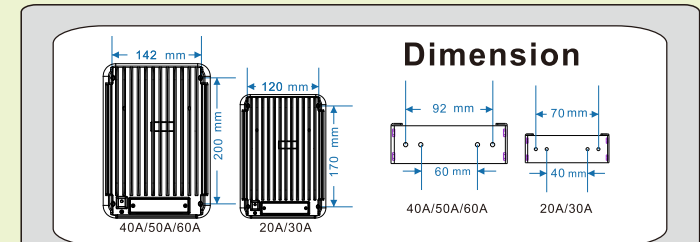
Figure 1

## 2. Product List

|                                  | Description                        | Quantity |
|----------------------------------|------------------------------------|----------|
| Product                          | MPPT controller                    | 1 unit   |
|                                  | Mounting backboard                 | 1 pcs    |
| Installation accessories package | Temperature sensing cable          | 1 pcs    |
|                                  | M4 screws (for mounting backboard) | 2 pcs    |
|                                  | M4 screw (for controller)          | 4 pcs    |
|                                  | Plastic expansion particles        | 2 pcs    |
|                                  | User manual                        | 1 pcs    |
| Information pack                 | Operational instructions           | 1 pcs    |
|                                  | RS485-USB cable                    | 1 pcs    |
| Optional                         | External WIFI communication module | 1 unit   |

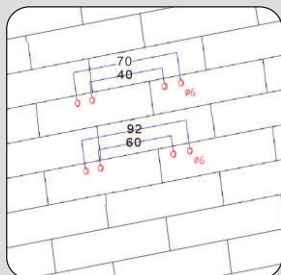
Table 4 (If there are any parts missing, please contact dealer.)

## 3. Installation Instructions

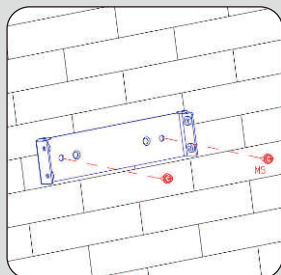


Drill four φ4mm holes according to the size of Dimension, and then fix the controller with M4 screws from the back.

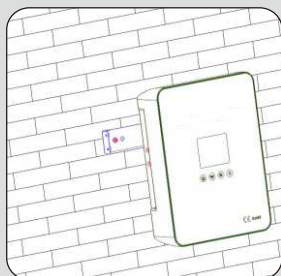
## Application II: Mounting installation



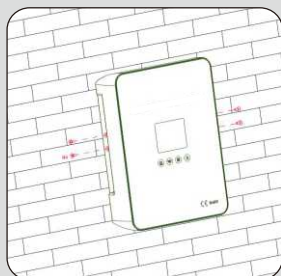
1. Measure and mark the distance on the wall, drill  $\phi 6\text{mm}$  holes and insert plastic expansion particles and tighten.



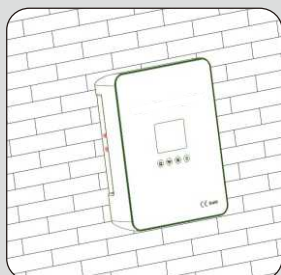
2. Align the holes of mounting backboard to the holes in the wall, fix it with M5 screws.



3. Hang the controller to the mounting backboard accordingly.



4. Tighten and fix the controller to the mounting backboard with M4 screws.



5. Well-installed.

### Remark:

- Above steps of mounting backboard are suitable for general wall installation. If installed on wooden wall, use self-tapping screws to fix it directly.
- Be cautious to the controller installation position, keep 20cm space up and down for good ventilation and heat dissipation.
- The ambient temperature of installation position must be within  $-20^{\circ}\text{C}\sim+50^{\circ}\text{C}$ , otherwise, the controller may not work properly.

## 4. Serial connection(string) of solar panels

The Table 5 is the number(N) of solar panels in series, for reference only.

| System Voltage | Voc * N = PV <sub>input</sub> < DC100V |      |         |      |         |      |         |      |         |      |         |      |
|----------------|--|------|---------|------|---------|------|---------|------|---------|------|---------|------|
|                | Voc<23V                                |      | Voc<31V |      | Voc<34V |      | Voc<38V |      | Voc<46V |      | Voc<62V |      |
|                | Max.                                   | Best | Max.    | Best | Max.    | Best | Max.    | Best | Max.    | Best | Max.    | Best |
| 12V            | 4                                      | 2    | 3       | 1    | 2       | 1    | 2       | 1    | 2       | 1    | 1       | 1    |
| 24V            | 4                                      | 3    | 3       | 2    | 2       | 2    | 2       | 2    | 2       | 2    | 1       | 1    |

Table 5

## 5. DC Load Output Voltage and Max. Discharge Current

The controller has DC LOAD output function, and its output voltage range is the same as battery pack. For example, if the battery's voltage is 25.2V, the instant DC output voltage is 25.2V, too.

It can supply power to DC LOAD continuously if the DC LOAD's current is within the rated range. When the DC LOAD's working current is 100%-120% of rated current for 5 mins, DC LOAD will be OFF. As soon as DC LOAD's working current is over 120% of rated current, the DC LOAD will be OFF immediately.

To restart DC LOAD, user should set Load Type to "ON" or "USE" manually through controller/APP/PC.

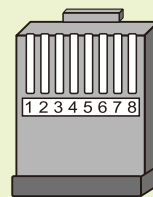
## 6. Communication port description

The communication port of the controller is compatible with RS485-USB communication cable for real-time monitoring by PC software and Wi-Fi module to have remote cloud monitoring by APP.

The communication port is a standard 8 pin RJ45 interface, and the pins are defined as follows(Table 6):

| PIN | Function          |
|-----|-------------------|
| 1   | RS485-A           |
| 2   | RS485-B           |
| 3   | Dry contact       |
| 4   | Dry contact       |
| 5   | GND               |
| 6   | GND               |
| 7   | +5V(Non-Isolated) |
| 8   | +5V(Non-Isolated) |

Table 6



(Figure 2)

(Note: The pin definition is applicable to our related products ONLY!)

When the Load output is off due to the triggering protection mechanism, the dry contact output interface will be ON (low impedance). Otherwise, it is OFF (high impedance).

The controller has dual RS485 communication ports. It can be used for communication and parallel connection.

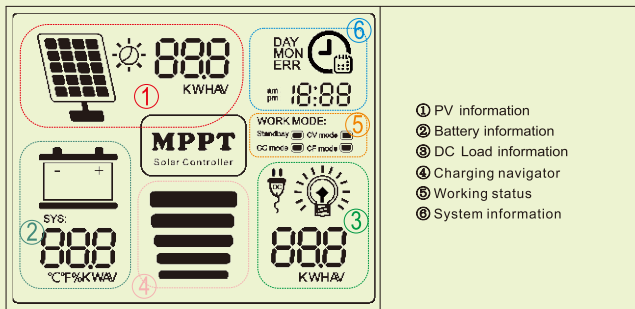
If need to monitor multiple controllers centrally, please set the device address order (1~254) of the controllers accordingly. For example, 5 controllers in parallel connection and monitor centrally, set controllers' address order as 1, 2, 3, 4, 5.

If want to monitor the multiple controllers in Master-Slave communication, set the host controller address to 255. For example, 5 controllers in parallel connection, just need to set the MASTER(host) controller address order as 255.

Tip: For more information, please refer to the official website document.

## 7. Operation

### 7.1 LCD display area description



- PV information
- Battery information
- DC Load information
- Charging navigator
- Working status
- System information

### 7.2 Button Operation: (Four buttons: PV, BAT/up, DC/down, S)

| Button     | Accessible information   | In setup mode function   |
|------------|--|--|
| <b>PV</b>  | PV voltage/PV current/<br>PV power/PV total energy   |  |
| <b>BAT</b> | Bat voltage/Bat current/Bat power/Bat percentage/<br>Bat temp/Bat type/Device address  | Go up/increase   |
| <b>DC</b>  | Load voltage/Load current/Load power/<br>Load total energy/Load working mode   | Go down/decrease   |
| Button     | Operational instructions   | Setup items  |
| <b>S</b>   | <ul style="list-style-type: none"> <li>Long touch 3S to enter or exit setup mode</li> <li>Touch the button:                             <ul style="list-style-type: none"> <li>-&gt; Selection of settable parameters S01~S14.</li> <li>-&gt; Save parameters before exit</li> </ul> </li> </ul> | S01 Bat-Type->USER/SEL/FLD/GEL/LIT<br>S02 Device address<br>S03 Load mode->ON/OFF/USER<br>S04 Bat-temp->°C/°F<br>S05 Charge-Volt->9~30V<br>S06 Nominal-Volt->8.5~29V<br>S07 Under-volt protection voltage<br>S08 Under-volt recovery voltage<br>S09 Over-volt protection voltage<br>S10 Over-volt recovery voltage<br>S11~S12 Realtime set<br>S13~S14 Date set |

Table 7

## 8. Common fault and trouble shooting.

| Common Problems  | Possible Reasons   | Solution  |
|--|--|---|
| Controller cannot start up, screen can not be on.            | Battery positive and negative reverse connected.                                       | Check the wiring, reconnect in right order.   |
| Controller not charging, PV voltage undetectable.            | PV Input positive and negative reverse connected.                                      | Check the wiring, reconnect in right order.   |
| Switching from Standby and CC modes in circular manner.      | Number of solar panels is too less in series and PV voltage is low.                    | PV Vmpp voltage must be greater than Vbat. Please refer to the proposed series-parallel scheme(Table 5) |
|  | It may occur in cloudy weather or in early morning and at dusk.                        | Normal phenomenon.  |
|  | Unreasonable configuration of solar panels.  | Based on sufficient power, please refer to the proposed series-parallel scheme(Table 5)                 |
| Controller is on and PV voltage is normal, but not charging. | The controller can not recognize battery system voltage (The "System" in LCD flashes). | Check whether the battery voltage in LCD is in the range of controller system recognition.              |
| The battery is in a low energy or empty for a long time.     | Solar panels quantity are too less to generate enough energy.                          | Increase solar panels quantity.   |
|  | Battery capacity is too small to Store enough energy.                                  | Increase battery capacity.  |

Table 8

## 9. Parameters

| Product Category                  | Model                              | EM2420  | EM2430      | EM2440                     | EM2450     | EM2460     |
|-----------------------------------|------------------------------------|---|-------------|----------------------------|------------|------------|
|                                   |                                    | MPPT efficiency   | ≥ 99.5%     |                            |            |            |
|                                   | Standby consumption                | 0.5W~1.2W   |             |                            |            |            |
|                                   | Heat-dissipating method            | Natural-Cooling   |             |                            |            |            |
| Battery system voltage range      | 12V system                         | 9VDC~15VDC(Lead acid)   |             |                            |            |            |
|                                   | 24V system                         | 18VDC~30VDC(Lead acid)  |             |                            |            |            |
|                                   | Li-Ion                             | 8VDC~30VDC(Default), ≤30VDC(Optional activation function)   |             |                            |            |            |
| Input Characteristics             | Max. PV input voltage(Voc)         | 100VDC(Default), DC 150V(Optional for SMXXXX)   |             |                            |            |            |
|                                   | Min. Vmpp Voltage                  | Battery voltage + 2V  |             |                            |            |            |
|                                   | Start-up charging voltage          | Battery voltage + 3V  |             |                            |            |            |
|                                   | Low input voltage protection       | Battery voltage + 2V  |             |                            |            |            |
| Rated PV Power                    | Over voltage protection / Recovery | 100VDC/95VDC(Default), 150VDC/145VDC(Optional)  |             |                            |            |            |
|                                   | 12V system                         | 260W  | 390W        | 520W                       | 650W       | 780W       |
|                                   | 24V system                         | 520W  | 780W        | 1040W                      | 1300W      | 1560W      |
|                                   | Li-Ion                             | 252W~504W   | 378W~756W   | 504W~1008W                 | 630W~1260W | 756W~1512W |
| Charge Characteristics            | Activation for lithium battery     | Optional  |             |                            |            |            |
|                                   | Battery types(Default Gel battery) | Sealed(SEL), Gel(GEL), Flooded(FLD), User-defined(USE), Li-Ion(LIT)   |             |                            |            |            |
|                                   | Rated charge current               | 20A   | 30A         | 40A                        | 50A        | 60A        |
|                                   | Temperature compensation           | -3mV/°C/2V (default)  |             |                            |            |            |
| Output voltage stability accuracy | Charge method                      | 3-stages: CC(Constant Current), CV(Constant Voltage), CF(Floating Charge)   |             |                            |            |            |
|                                   | Output voltage stability accuracy  | ± 0.2V  |             |                            |            |            |
|                                   | Load voltage                       | Same as battery voltage.  |             |                            |            |            |
| LOAD Characteristics              | Rated load current                 | 20A   |             | 30A                        |            |            |
|                                   | Load control mode                  | On/Off mode, PV voltage control mode, Dual-time control mode, PV + Time control mode  |             |                            |            |            |
|                                   | Low voltage protection             | 10.5V (default), 11V (restored), settable   |             |                            |            |            |
|                                   | Setting method                     | PC software / APP / Controller  |             |                            |            |            |
| Display & Communication           | Display                            | High-definition LCD segment code backlight display  |             |                            |            |            |
|                                   | Communication                      | Dual RJ45 port/ RS485 protocol / PC (via RS485-USB Cable) & APP (via Wi-Fi module) / Centralized monitoring (via parallel connection and RS485-USB cable) |             |                            |            |            |
| Other Parameters                  | Protection                         | Input & output over-volt / low-voltage protection, reverse polarity protection, over-heating protection, battery shedding protection etc.                 |             |                            |            |            |
|                                   | Operating ambient temperature      | -20°C ~ +50°C   |             |                            |            |            |
|                                   | Storage temperature                | -40°C ~ +75°C   |             |                            |            |            |
|                                   | IP(Ingress protection)             | IP43  |             |                            |            |            |
|                                   | Noise                              | ≤10dB   |             |                            |            |            |
|                                   | Altitude                           | 0~3000m   |             |                            |            |            |
|                                   | Max. Wiring size                   | 28mm <sup>2</sup>   |             |                            |            |            |
| Recommended breaker               | ≥ 40A                              | ≥ 63A   | ≥ 63A       | ≥ 100A                     | ≥ 100A     |            |
| N. weight (kg) / G. weight (kg)   | 1.65 / 1.98                        |   | 2.35 / 2.78 |                            |            |            |
| Product size / Packing size(mm)   | 220×148×58.5 / 289×212×105         |   |             | 245×170×63.5 / 334×225×123 |            |            |

Table 9