MT Maximum Power Point Tracking Series

Solar charge controller

MT2410 User Manual

Mode	MT2410	
Battery voltage	12V	24V
Max. power of solar panel	130W	260W
Charge current	10A	
Discharge current	10A	
Max. solar input voltage	150V	

Dear users:

Thank you very much for choosing our products!

Please read the manual carefully before using our controllers.

Ⅰ. Feature

◆ Adopting double crest or multi crest tracing technique, used for the condition when a part of solar panel is under shadow or parts of solar panel is damage.

◆ Built-in maximum power point tracking algorithm which could promote the energy utilization efficiency of pv system. The charging efficiency is 15%~20% higher than PWM mode.

◆ It can find out the best working point of I-V curve within 1 minute. the MPPT efficiency could reach to 99.9%.

◆ Adopting advanced digital power supply techniques which makes the energy conversion efficiency reach up to 97%.

◆ Four charging stages: MPPT - equalizing charge- boosting charge- floating charge.

◆ With current-limiting charging mode. When the power of solar panel is oversized， the controller will lower charging power automatically, which enable the system to work under the rated charging current.

◆ Have the fault code indication, it helps user confirm the system fault.

◆ Various load control methods. Could recognize day and night automatically.

◆ Various system protection functions. Including over-charge, over-discharge, over-load, over-heat, battery-reverse connection and short-circuit protection etc.

Ⅱ. Using Suggestion

1. The solar panel's terminal voltage may exceed human safety voltage, please use insulating tools and ensure the hands dry.

2. Please connect wires cautiously and correctly. Although controller has reverse protection and short circuit protection, that doesn't mean it could handle all kinds of wrong, reverse connection and short circuit.

3. Please don't connect the solar panel to the controller's battery port or load port, otherwise the high voltage of the solar panel will damage the controller.

4. Please connect the battery first, then connect other equipments after the battery indicator on the controller is normally on. If connect battery reversely, the voltage of the load port will be the minus value of the battery voltage. That may damage the load equipment.

5. MPPT controller is designed according to solar panel's I-V curve, so when the controller connect the general constant voltage DC source, the controller may not work.

6. Advice is installing in the ventilated and well-cooled environment, because the controller will fever during operation.

7. Choosing the proper cable with enough capacity to avoid extra power loss in the circuit. Too much circuit loss may lead to wrong judgment.

8. Full charge is very important for the battery. The battery should be full charged at least once a month otherwise the battery will suffer permanent damage. The battery can be full charged only when the input power of the battery is more than power consumption of the load.

9. Please do not dip the controller into the corrosive liquid otherwise the controller will be damaged and release harmful gas.

10. Because the battery stores lots of energy, do not allow the battery short circuit in any case. We suggest tandem connect a fuse on the battery

11. The battery may release combustible gas, please far away from the spark.

12. Ensure the children are far away from battery ,pv and controller

Ⅲ. Front View Schematic
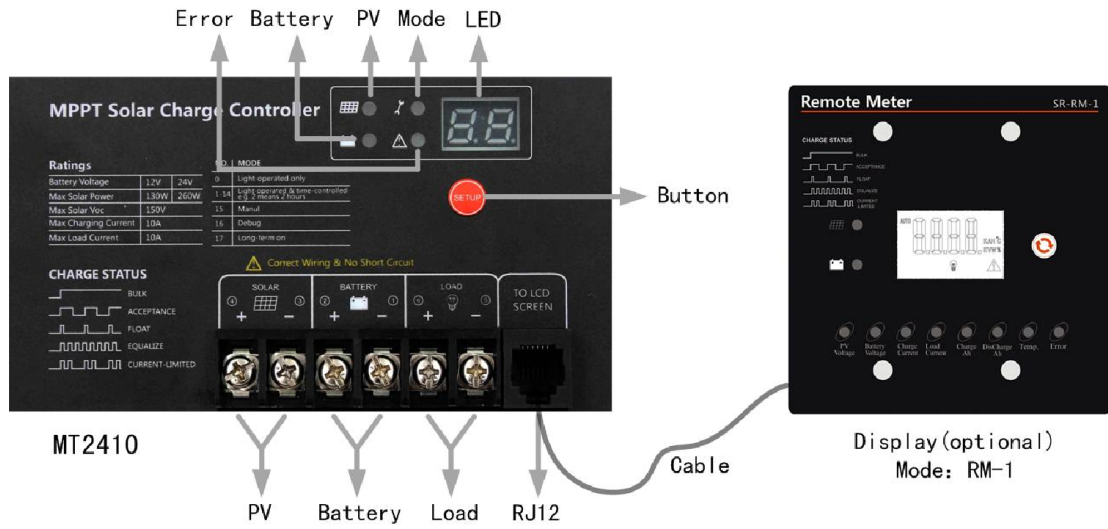
Ⅳ. Structure Drawing:

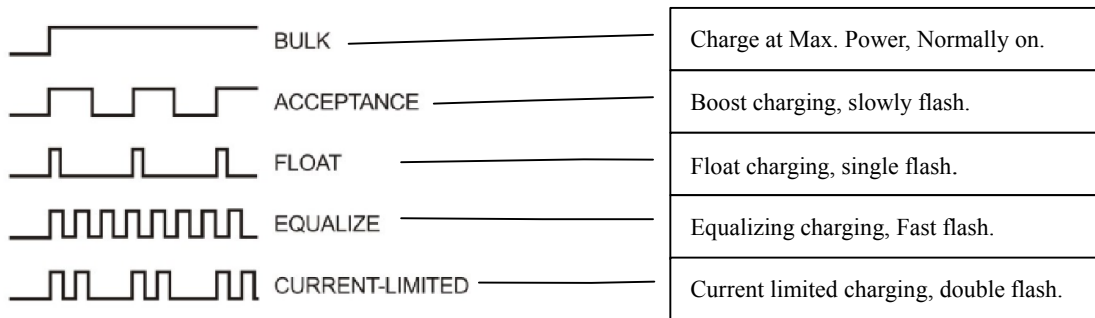Unit: mm
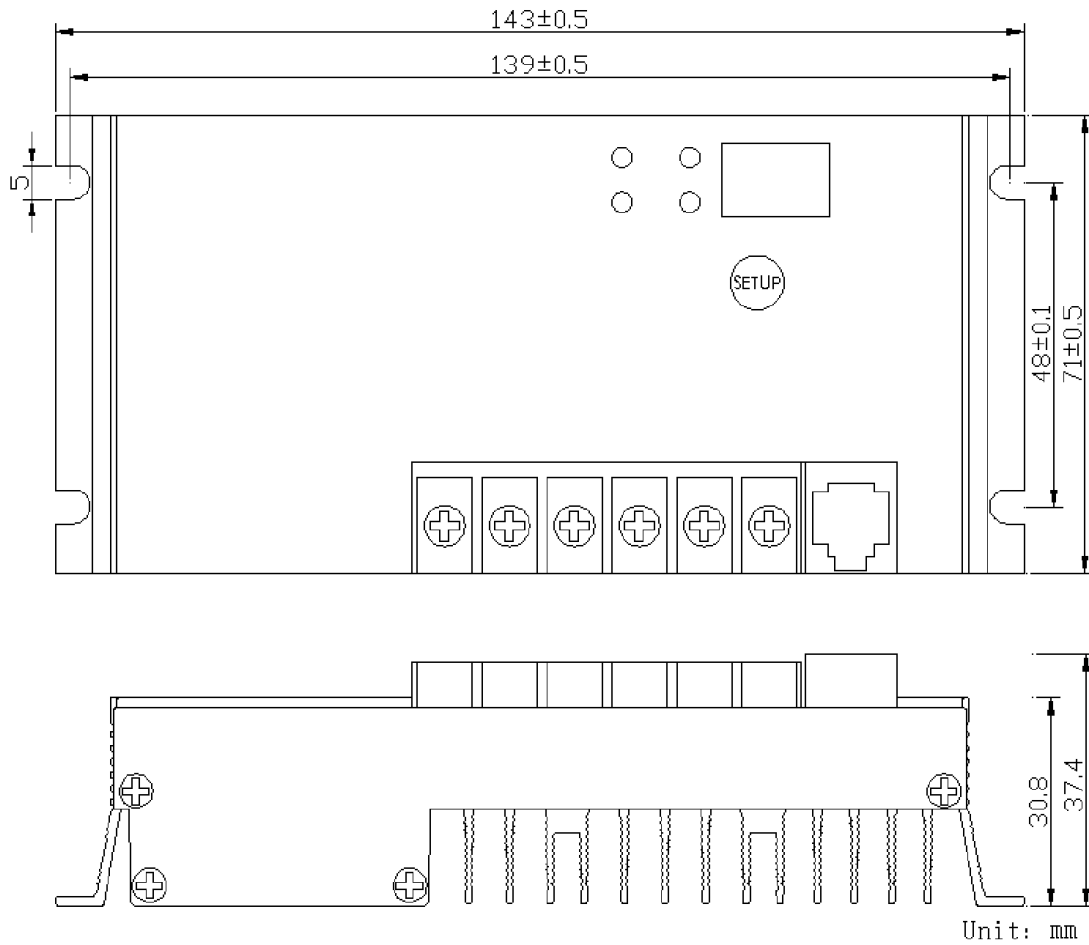
Ⅴ. Installation and Using Instruction

1. **Fix the controller:** Fix the controller onto the surface of the specific place. Keep a certain distance between the controller and fitting surface to assure heat dissipation

2. **Wire preparation:** Adopt the wire matching the current，the wire's current density should not more than 4A/mm² . Be aware of the length of wire, strip 8mm insulation of one side of the controller terminal and try to decrease the length of the connected wire so as to get a reduction in electrical loss.

3. **Connect to the battery:** connect the battery wire to the controller firstly, Pay attention to the "+" and "–", in case of reverse connection. If connected well, the indicator light will be on. Otherwise, please check the connection. If reverse connection, controller will not work but not damage the controller.

4. **Connect to the solar panel:** Pay attention to the "+" and "–", do not reverse connected. If ample sunshine, controller will show charging mode, Or should check the connection is right.　If solar panel is under the sunshine, it will produce voltage immediately. If use 24V or over, the solar panel voltage will exceed to body safety voltage, please prevent yourself from electric shock.

5. **Connect to the Load：** Connect the load to controller，make sure the current cannot over the rated current, and notice the positive and negative electrode. Prevent the system from reverse connection.

6. **Grounded connection:** If need to ground, please connect the battery "-" pole to the ground.

7. **Connect LCD display:** Connect LCD display through RJ12 interface, Mode: SR-RM-1(Optional)

Ⅵ. Working State Indication

1. Charge indication: When the solar panel output voltage reaches a certain value, charge indicator start to work. Different flash status represents different charge mode. The specific meaning of charge mode is as the table A below.

2. Battery capacity indication: When the battery is normal, the indicator is on, when it is over discharge, the indicator will slow flash, when the battery is over voltage, the indicator will fast flash.(Table B)

3. Mode indication: When the mode indicator is on, it indicates that the value on the Nixie tube is controller mode. The value will disappear if no key operation within 5s.

4. Fault indication: when the fault indicator is on, it indicates that the value on the Nixie tube is controller fault code; The value will disappear if no key operation within 5s. If fault exists, the indicator will flash.

   A.　　　**Charging Status Indication Specification:**

CHARGE STATUS

BULK	Charge at Max. Power, Normally on.
ACCEPTANCE	Boost charging, slowly flash.
FLOAT	Float charging, single flash.
EQUALIZE	Equalizing charging, Fast flash.
CURRENT-LIMITED	Current limited charging, double flash.

Serial Number	Indicating Status	State of charge
☐	**Normally on.**	Charge at Max. Power.
☐	**Slow flash.** （light for 1s，off for 1s，the cycle is 2s）	Boost charging.
☐	**Single flash.** （light for 0.1s，off for 1.9s，the cycle is 2s）	Float charging.
☐	**Fast flash.** （light for 0.1s，off for 0.1s，the cycle is 0.2s）	Equalizing charge.
☐	**Double flash.** （light for 0.1s，off for 0.1s，reopen for 0.1s，reclose for 1.7s，the cycle is 2s）	Current limited charging.

B. Battery Indication Specification.

Serial Number	LED Status	Battery Status
①	**Normally on.**	The battery voltage is normal.
②	**Slow flash.** （light for 1s，off for 1s，the cycle is 2s）	The battery is over discharged.
③	**Fast flash.** （light for 0.1s，off for 0.1s，the cycle is 0.2s）	The battery is over voltage.

Ⅶ. Load Working Mode Specification:

1. Light control mode (0).

When sunset, the light intensity will fall to start point, the controller will turn on the load 5mins later after confirming the start signal. When sunrise, the light intensity ascend to close point, the controller will turn off the load.

2. Light + Time control mode (1-14):

When there has no sunlight, the light intensity will fall to start point, the controller will turn on the load 5mins later after confirming the start signal and the load will start work, the load will be turn off when the working time reach at the set value. The specific set value, please see table C.

3. Manual mode (15):

Under manual mode, user can control the load by button; no matter it is day or night. This mode applies to special load or debugging.

4. Debug mode (16):

This mode applies to debugging; the load will be shut when receiving light signal and it will be on without light signal. The debug mode is easy to examine the validity of the system.

5. Normally on mode (17):

Under this mode, the load will be normally on; this mode is fit for the load which requires 24 hours power supply.

Ⅷ. Operating Instruction

1. Mode and fault code overview:

When the system is working normally, the Nixie tube has no display, after pressing the button, the Nixie tube will be on, at the same time, the mode or fault indicator will be on. If the mode indicator is on, it indicates that the Nixie tube's displaying value is load working mode; if the fault indicator is on, it indicates that the Nixie tube displaying value is the fault code. The controller working mode and fault code is as the table C and D below.

2. Mode adjusting

When pressing the button over 3s, mode indicator start flashing, press the button again, the value of Nixie tube will be changed. According to the number displayed on Nixie tube, user can choose different working mode, please stop pressing the button when adjusting the mode you want. Wait for 10s setting mode quit automatically, or press the button over 3s, setting mode quit.

C. Mode Working Table:

Serial number	Parameter Specification
0	Light control
1	The load will be on by light control and will be off after delayingfor 1 hour
2	The load will be on by light control and will be off after delaying for 2 hours
3	The load will be on by light control and will be off after delaying for 3 hours
4	The load will be on by light control and will be off after delaying for 4 hours
5	The load will be on by light control and will be off after delaying for 5 hours
6	The load will be on by light control and will be off after delaying for 6 hours
7	The load will be on by light control and will be off after delaying for 7 hours

8	The load will be on by light control and will be off after delaying for 8 hours
9	The load will be on by light control and will be off after delaying for 9 hours
10	The load will be on by light control and will be off after delaying for 10 hours
11	The load will be on by light control and will be off after delaying for 11 hours
12	The load will be on by light control and will be off after delaying for 12 hours
13	The load will be on by light control and will be off after delaying for 13 hours
14	The load will be on by light control and will be off after delaying for 14 hours
15	Manual mode
16	Debug mode(default value)
17	Normally on mode

D. Fault code table:

Serial Number	Parameter Specification
E0	No fault, the controller is working normally.
E1	The PV input terminal is over voltage.(>150V)
E2	The power of PV is more than 140W/12V or 280W/24V.
E3	The inner temperature of controller is over value, it will decrease the power to charge.
E4	The load is short circuit.
E5	The load power is over value.
E8	There is over temperature inside the controller. Stop charging.
E9	The inner temperature sensor hasn't been connected or has been damaged.

Attention: if no key operation within 5s, the Nixie tube will be shut; or if there are some faults, the fault indicator will flash all the time until the fault has been removed.

Ⅸ: Faults And Solutions.

| Faults	Solutions
Fault code E1	The input voltage of PV terminal is over value, please check if the PV parameter is matched, charging will be recovered if the voltage become lower.
Fault code E2	The power of PV input terminal is over value, check if the PV power parameter is matched.
Fault code E3	The inner temperature of the controller is over value, please keep cool and ventilated.
Fault code E4.	The load is short circuit, after the fault been debugged; it will recover at the next day or after long pressing the key
Fault code E5	The load power exceeds rated power, please reduce the electric equipment, it will recover at the next day or after long pressing the key.
Fault code E8	The controller is inner overheated, this situation is more serious than E3; it will recover when the temperature becomes lower.
Fault code E9.	The inside temperature sensor is unconnected or damaged; the inside over temperature protection will not work, if it effect to normally use, please find after-sale service.
The battery indicator fast flash, no output.	The battery voltage is over value, please check if the connection is reliable or if the voltage is over value.
The battery indicator slow flash, no output.	The battery is over discharge, it will recover when battery is fully charged.
Other faults	Please check if the wiring is reliable. Meanwhile the controller is damaged.

X. Parameters

Parameters	Value	
Model	MT2410	
System voltage	12V	24V
Max. input power of solar panel	130W	260W
Transfer efficiency	≤96%	≤97%
Rated charge/ discharge current	10A	
No load loss	＜15mA	
Max. input voltage of solar panel	＜150V	
MPPT tracing efficiency	＞99%	
Over voltage protection	16.5V	33.0V
Limited charge voltage	15.5V	31.0V
Equalizing charge voltage	15.2V	30.4V
Equalizing charge interval	30 days	
Boosting charge voltage	14.4V	28.8V
Floating charge voltage	13.8V	27.6V
Over-discharge recover voltage	12.5V	25.0V
Over discharge voltage	11.0V	22.0V
Boosting charge time	2 hours	
Equalizing charge time	1 hour	
Over temperature protection	Yes	
Light-operated voltage (on)	5V	
Light-operated voltage (off)	6V	
Light-operated delay time	5min	
Working temperature	-35℃～+65℃;	
Weight	430g	
Altitude	≤3000m	
Dimension	143*71*37.4 (mm)	
Installation dimension	139*48(mm)	
Overload protection	Load current≥1.25 times rated current, cut off the load within 10 seconds; Load current≥1.5 times rated current, cut off the load within 5 seconds	
Protections	1.Reverse connection. 2.Inner over temperature. 3.The voltage of PV input terminal is over value. 4.Over load 5.Reverse charging protection at night. 6. TVS lightning protection 7. Waterproof: IP 64	

XI: Typical Efficiency Diagram.

1. Solar panel power & efficiency curve (12V system)

Solar Panel Power VS Efficiency (12V System)
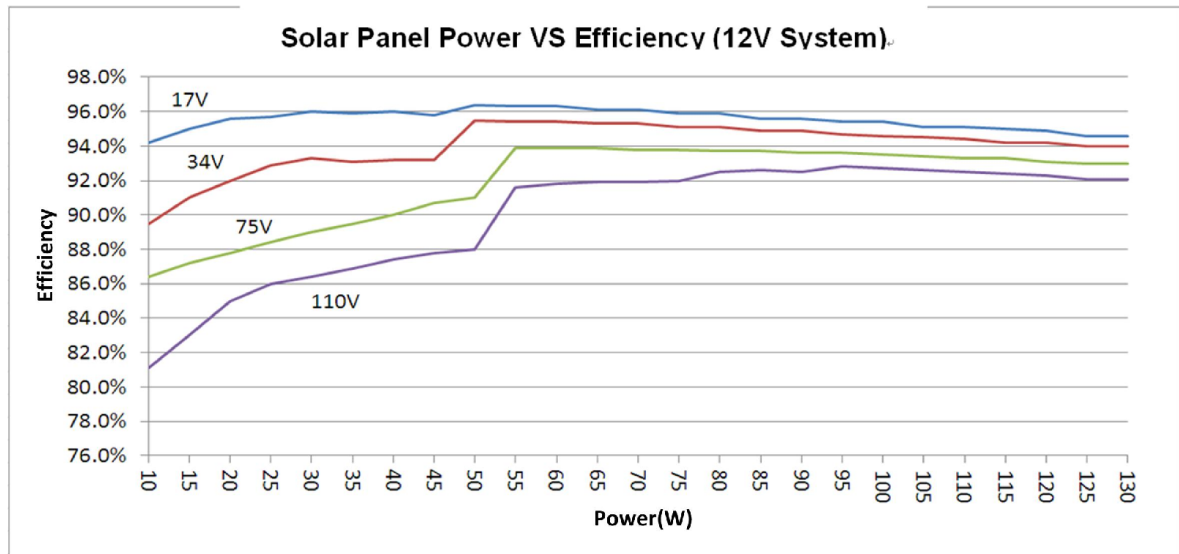
2. Solar panel power & efficiency curve (24V system)
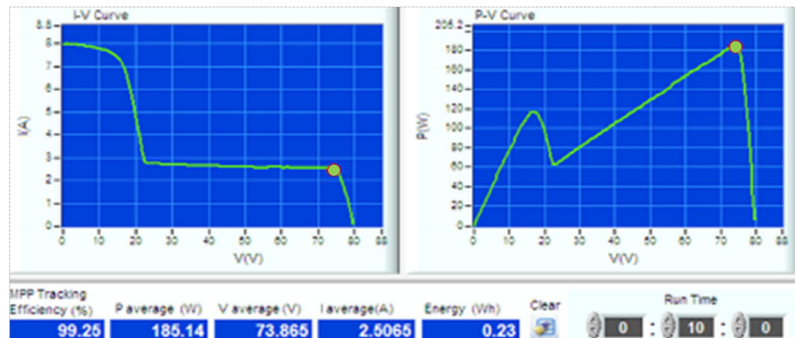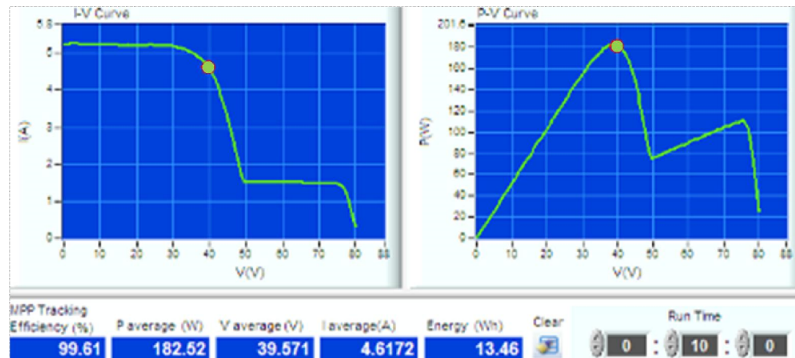

Solar Panel Power VS Efficiency (24V System)
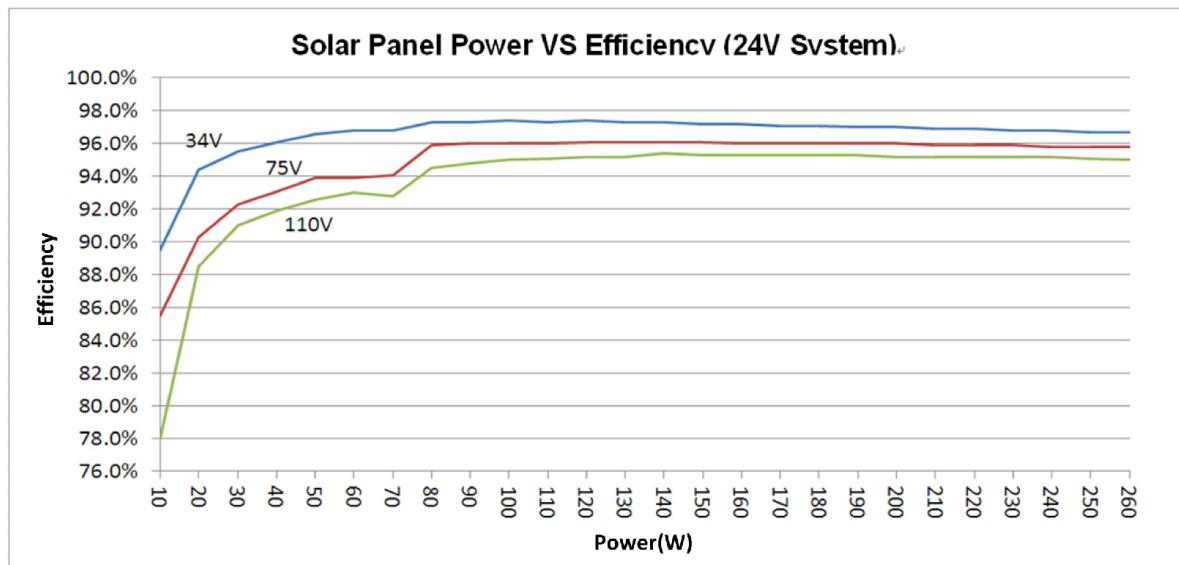
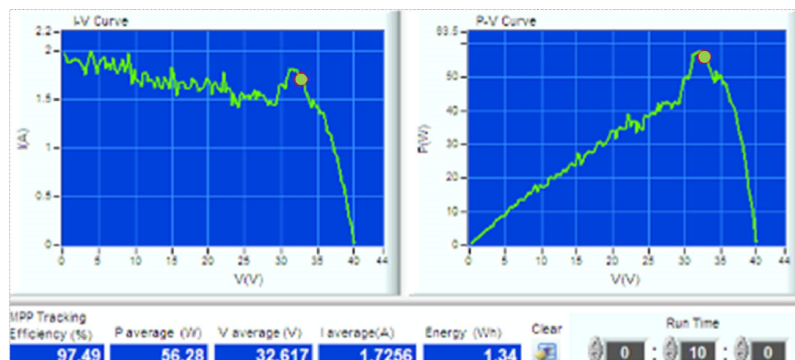# 4. The MPPT tracing efficiency test (under the shaded condition).

①There's shadow in the middle of PV module, the tracing efficiency is 99.25%.
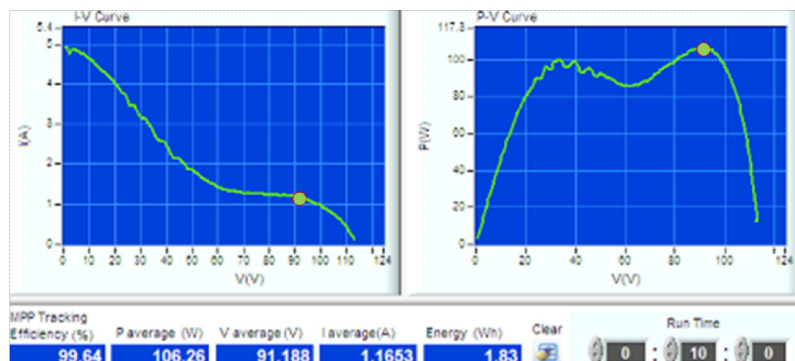

MPP Tracking Efficiency (%)	P average (W)	V average (V)	I average(A)	Energy (Wh)
99.25	185.14	73.865	2.5065	0.23

②There's shadow at the top left corner of PV module, the tracing efficiency is 99.61%.

MPP Tracking Efficiency (%)	P average (W)	V average (V)	I average(A)	Energy (Wh)
99.61	182.52	39.571	4.6172	13.46

③Simulate tree shade covered PV module, the tracing efficiency is 97.49%.

MPP Tracking Efficiency (%)	P average (W)	V average (V)	I average(A)	Energy (Wh)
97.49	56.28	32.617	1.7256	1.34

④There's wide-range shadow covered PV module, the tracing efficiency is 99.64%.

| MPP Tracking Efficiency (%)	P average (W)	V average (V)	I average(A)	Energy (Wh)
99.64	106.26	91.188	1.1653	1.83

XII. MPPT Charging Algorithm Instruction

The full name of the MPPT is maximum power point tracking. It is an advanced charging way which could detect the real-time power of the solar panel and the maximum power point of the I-V curve that makes the highest battery charging efficiency. Contrast with the traditional PWM controller, MPPT controller could play a maximum power of the solar panel so that a larger charging current could be supplied. Generally speaking, the MPPT controller's energy utilization efficiency is 15%~20% higher than PWM controller.

The voltage of the solar panel is about 12V when General controller is charging while the highest voltage of the solar panel is about 17V, so it doesn't play the largest power of the solar panel. MPPT controller overcome this problem by adjusting the input current and voltage constantly to realize the largest input power.

Meanwhile, the maximum power point will change due to the surrounding temperature and sunshine condition. MPPT controller will adjust the parameter constantly according to different conditions to make the system working in the largest power point.

Current

Working point of the general controller

Maximum power point

12.0V   17.5V   22.0   Voltage
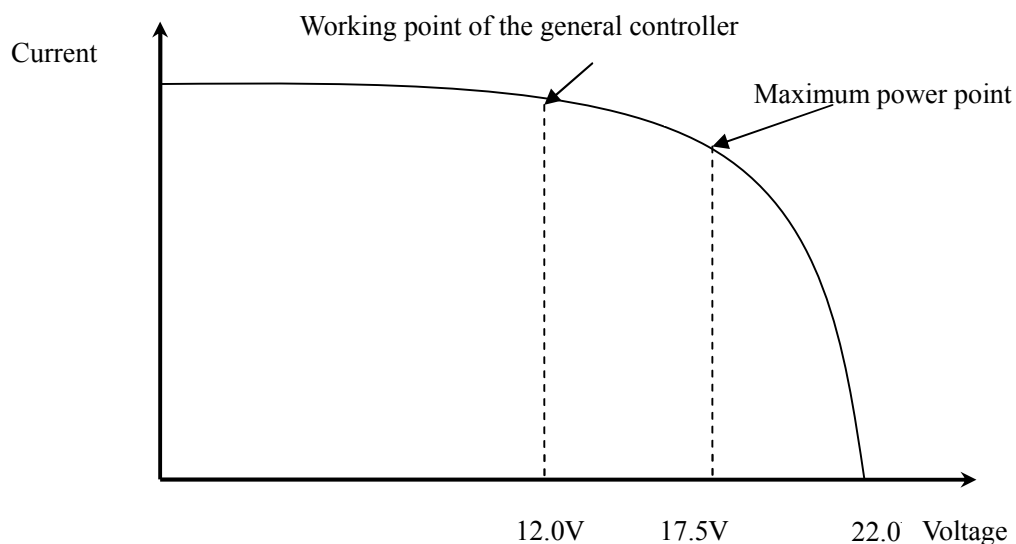
As a charging stage, MPPT can't be used alone. It must be combined with ascending charge, floating charge, equalizing charge to complete the battery charge.

The controller will judge the battery voltage before working. If the battery

voltage is higher than 13.2V(*2/24V), the controller will judge the battery working as full charge state, then the controller will enter into floating charge stage, except equalizing charge or charge hint.

When the battery's initial charging voltage is under13.2V (*2/24V), the charging process is: MPPT-equalizing charge-boost voltage charge-floating charge.

The span of equalizing charge is 1 hour, ascending charge is 2 hour, and equalizing charge interval is 30 days. Charging curve is as below: