Grape Solar MPPT-45

Solar charge controller

User Manual

Specification:

Model	GS-MPPT-45	GS-MPPT-60
Battery voltage	12V/24V/36V/48V	12V/24V/36V/48V
Charging current	45A	60A
Max. voltage of solar panel array	**150V**	

Dear users:

Thank you very much for choosing our products!

Please read the manual carefully before using our controllers.

Catalog

1. Safety Attention:

The input voltage is high, so please read the instructions before operation and please do not operate the controller before training.

1.  Warning: The operation is dangerous; please observe proper safety precautions before operation.
2.  Attention: The operation can damage or destroy equipment.
3.  Reminder: Suggestions and hints to the operator.

2. Features:

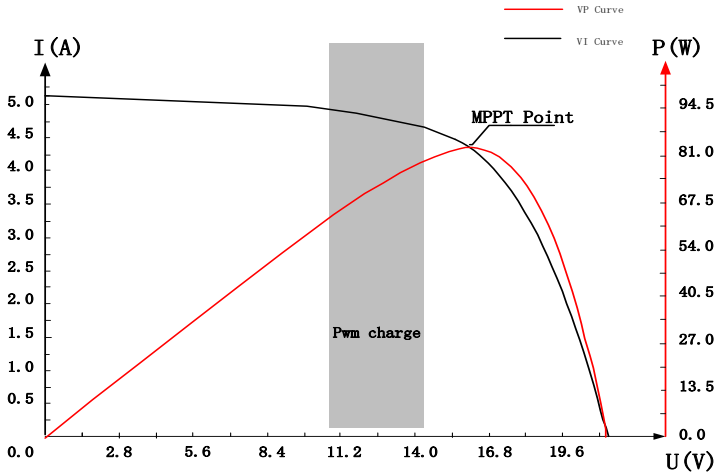
1. Can be used in all kinds of environments.
2. Double crest or multi crest tracing technique design, when the solar panel is under shadow or part of the solar panel is damaged, multi crest will turn up the voltage in the I-V curve, and the controller can still trace the Maximum Power Point.
3. Built-in maximum power point tracking algorithm which promotes energy utilization efficiency of the PV system. The charging efficiency is 15%~20% higher than PWM mode.
4. Adopting tracking algorithms to track the best working point on the I-V curve promptly and accurately within 15 seconds, the MPPT efficiency can reach 99.9%.
5. With the use of advanced digital power technology, circuit energy conversion efficiency is as high as 96%
6. Four stage charging order mode: MPPT-equalizing charging-boost charging-float charging.
7. With current-limiting charging mode, when the power of solar panel is over-sized and charging current exceeds the rated current, the controller will lower the charging power, which enables the system to work under the rated charging current.
8. The controller can network with additional controllers using the linked telecommunication cable.
9. Fault code indication helps users confirm the system fault.
10. 12V/24V/36V/48V auto identified.
11. Supports data storage, the storage span can reach 5 years.
12. Controller has built-in LCD screen monitoring, and the controller parameters are adjustable.
13. Built-in temperature sensor, when the temperature exceeds the set value, the charging current will decrease, followed by the decrease of temperature, so as to control the controller’s temperature rise.
14. Temperature compensation function adjusts the charge and discharge parameters automatically, which can improve battery service life.
15. Various system protection functions including over-charge, over-discharge, over-load, over-heat, the battery reverse connection protection and so on.
16. TVS lighting protection.

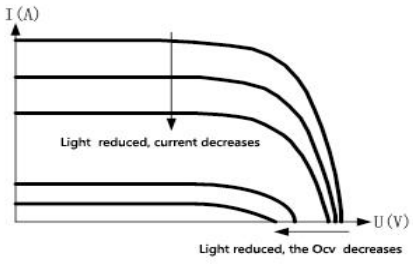
3.Charging introduction.

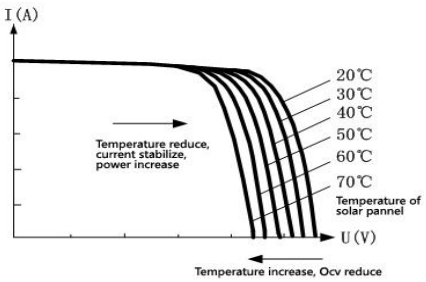
The full name of MPPT is maximum power point tracking. It is an advanced charging algorithm which can detect the real-time power of the solar panel and the maximum point of the I-V curve that make the highest battery charging efficiency. Contrasted with the traditional PWM controller, an MPPT controller can adjust the maximum power point 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 output is about 13V when a standard PWM controller is charging, while the highest voltage of the solar panel is about 17V, so it doesn't utilize the maximum power of the solar panel. MPPT controllers overcome this problem by adjusting the input current and voltage constantly to realize the largest input power.

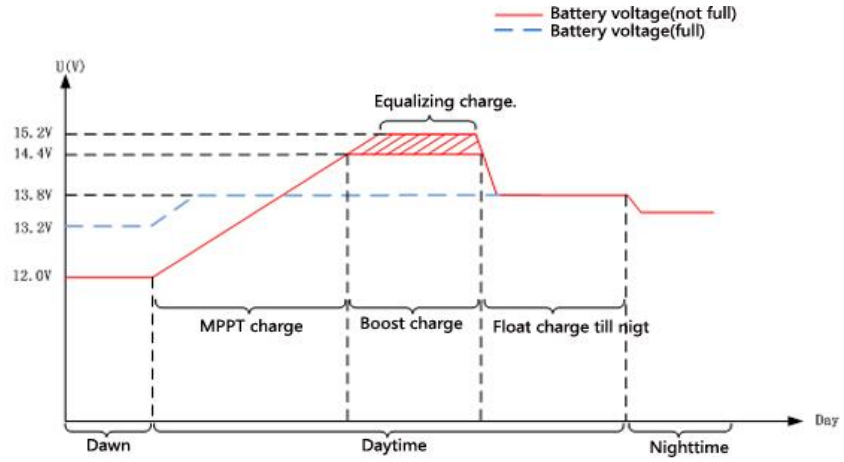
The maximum power point will change due to the surrounding temperature and sunshine condition. MPPT controllers will adjust the parameter constantly according to different conditions to make the system work with the maximum power point.





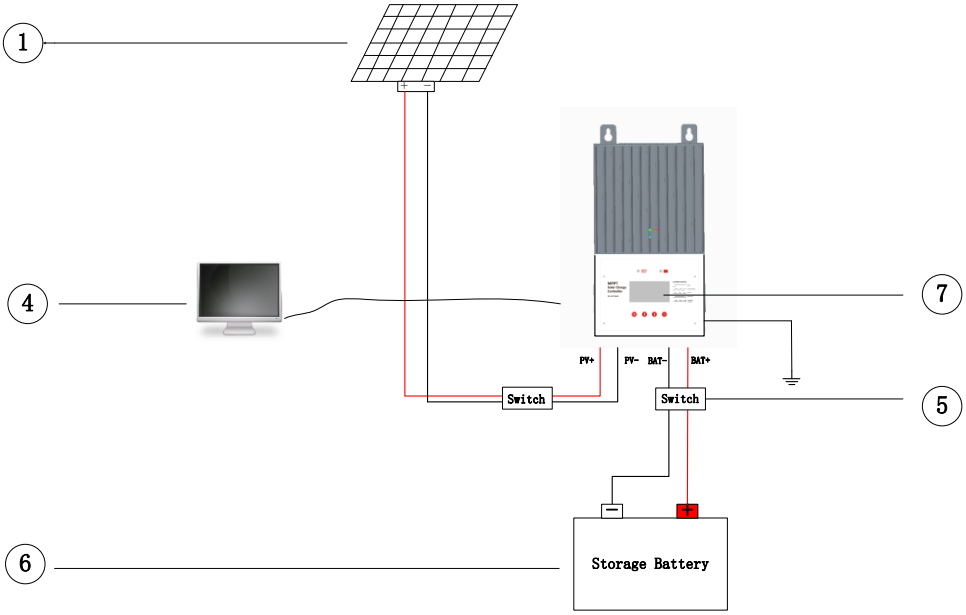


As a charging stage, MPPT charging can't work alone, it also uses boost charging, float charging and equalizing charging. When the controller works, it will identify the battery voltage, if the voltage exceeds 13.2(×2 / 24V） V , it will enter float charging directly without equalizing charging or boost charging. If the battery charging voltage is lower than 13.2V（×2 / 24V）, the charging process is: MPPT(equalizing charging)—boost charging—float charging, the equalizing charging time is 1h, boost charging time is 2h, equalizing charging interval is 30 days, the charging curve is as follows:

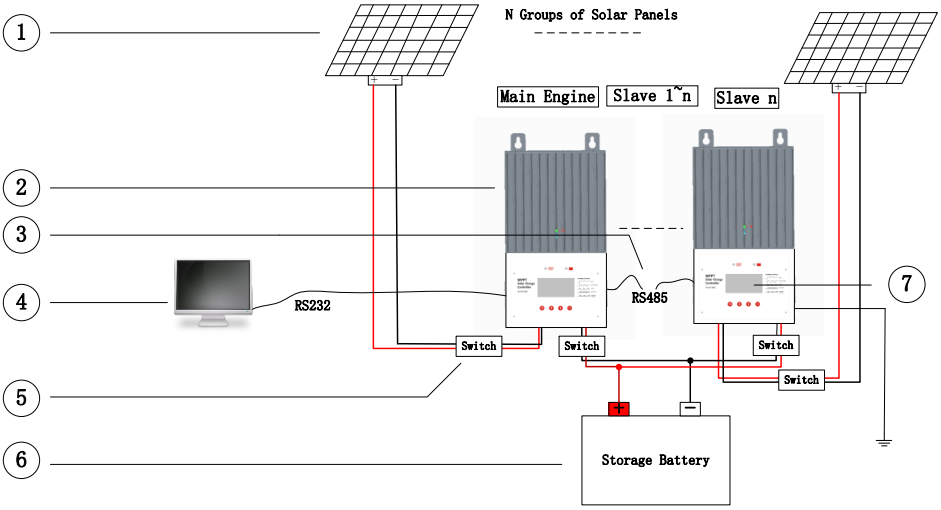


4.Connection.

1. For one machine operation:



2. For parallel operation:



1---Solar panel.

The power for battery charging.

2---Controller.

Central nervous system, which controls the overall system.

3---RS485 Telecommunication cable.

Communication line of the controller which is necessary for parallel operation.

4---Open space.

It can insure the safety of operators (the switching element is optional).

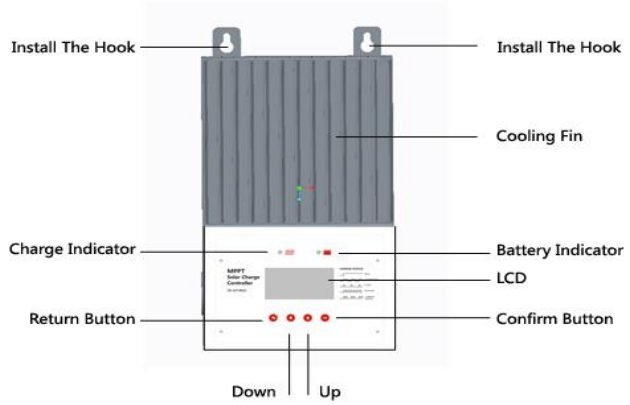
5---Battery.

A battery pack which is composed of batteries in series, parallel, or a combination.

6---LCD display.

The LCD can display the system status, parameters, records and the set value. (You can just choose one communication way: PC or LCD).

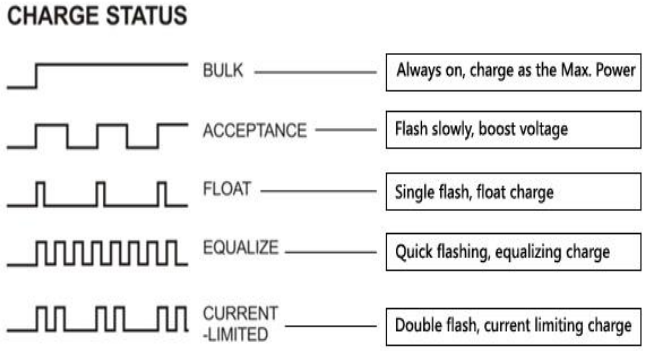
5. Panel introduction.



A. Fix the hooks.

Used for the installation of the controller.

B. Charging indication.



Serial number	Status	Charging stage

1	**Normally on.**	Charging at Max. Power.
2	**Slow flash.** （light for 1s，off for 1s，the cycle is 2s）	Boost charging.
3	**Single flash.** （light for 0.1s，off for 1.9s，the cycle is 2s）	Float charging.
4	**Fast flash.** （light for 0.1s，off for 0.1s，the cycle is 0.2s）	Equalizing charge.
5	**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.
6	Off	Night

C. Battery indication.

Indication	Battery status
Normally on	The voltage is normal.
Slow flash （light for 1s ，off for 1s , the span is 2s ）	It is over discharge.
Fast flash. （light for 0.1s，off for 0.1s，the cycle is 0.2s）	It is over voltage.

D. Cooling fin.

This provides heat dissipation for the controller. The cooling fin will be hot when the controller runs, please do not touch the face of the controller.

E. LCD display and keys operation.

The display section has a two-stage menu, main menu and side menu, the main menu has three items, each item has its side menu, the second side menu is the parameter setting menu and the others are parameter viewing menus. It has 4 independent function keys, from left to right is: “  ”“  ”“  ”“  ”key, the function of “  ”key, is to return to previous menu or return to last status, the function of “  ”“  ”key, is to select or set parameters, the function of “  ”key is to enter into next menu, or enter into parameter setting or confirm the parameters.

F. Homepage menu comparison table

Menu table-1		
Serial number	Name	LCD display content
1	System status	System Data

2	System configuration	System Configuration
3	Product info	Product Info

System Data" is the menu to examine the system status and display status items；"System Configuration" is the menu to set the system running parameters', and "Product Info" is the menu to examine equipment information.

G. System submenu comparison table.

Serial number	name	LCD display	Parameter sample
1	charging stage	Chg-stag:	IDLE
2	battery voltage	U-bat:	55.5V
3	solar panel voltage	U-pv:	100.5v
4	charging current	I-chg:	30.9A
5	load status	Load：	ON
6	discharging current	I-load:	0.0A
7	battery capacity(SoC)	Soc:	100%
8	temperature	Temp:	25°C
9	charging power	P-chg:	900W
10	discharging power	P-load:	1.25kw
11	the max voltage	Vmax:	60.9V
12	the min voltage	Vmin:	52.8V
13	charging capacity(AH)	C-chg:	999AH
14	discharging capacity(AH)	C-load:	0AH
15	charging capacity(WH)	E-chg:	999WH
16	discharging capacity(WH)	E-load:	0WH
17	running days	Rundays:	100D
18	over-discharge times	LVD-CNT:	10
19	full charge times	FUL-CNT:	100
20	fault code	Fault:	1

The submenu of the system can check the current running parameters such as battery voltage, charge-discharge current, fault code and so on, helping with system maintenance.

H. . System configuration submenu comparison table

Serial number	Name	LCD display	Parameter range
1	over voltage discharge	OVD：	16V
2	charging limited voltage	CLV：	15.5V
3	equalizing charge voltage	ECV:	15.2V
4	boost charge voltage	BCV:	14.4V

5	float charge voltage	FCV:	13.8V
6	boost return voltage	BCV-R:	12.6V
7	low voltage reconnect	LVR:	12.6V
8	under voltage warning	UVW:	12V
9	low voltage disconnect	LDV:	11V
10	equalizing charge duration	EQV-T:	120Min
11	boost charge duration	BST-T:	120Min
12	equaling charge interval	EQV-Inv:	30D
13	temperature compensation coefficient	TEMP-Com:	-3mv/℃2V
14	load mode	L-Mode:	0～17
15	light control voltage	L-CON-V:	5V
16	controller address	Address:	1～16

The configurable items and configuring range of system configuration submenu are as the above table, please operate cautiously when setting the parameters to insure the proper operation of the system.

I. Product info submenu comparison table

Serial number	name	Item	Parameter sample
1	model	Model:	MT4845
2	hardware version number	HW-ver:	01.01.01
3	software version number	SW-ver:	01.01.01
4	series number	Serial:	9999999

Product info submenu, which displays the model, hardware version, software version and serial number.

6. Instructions.

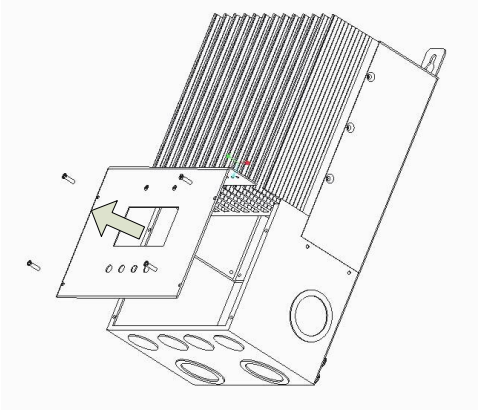
1. The controller will identify the battery voltage automatically. Please connect the battery first and ensure the connection is reliable. If you need parallel operation, please connect the slave engine to the battery first, otherwise it will identify the system voltage incorrectly.
2. This MPPT controller generally functions best with an input voltage at least six volts above battery voltage, higher than what is normally found in most "12-volt" panels when applied to a 12 volt battery system. This controller functions best with series strings of two to five "12 volt" panels, or one to three "24 volt" panels. Grape Solar does not recommend the use of this controller with a single "12 volt" panel.
3. Install in a cool, well-ventilated environment to prevent the controller from overheating during operation..
4. The controller will detect the surrounding temperature to compensate the battery charging voltage, so ensure the controller and battery is in the same environment.
5. Choosing the proper cable with enough capacity to avoid voltage drop of over 3% in the circuit. Too much voltage drop can affect or disable system performance.
6. Full charge is very important for the battery. The battery should be full charged at least once a month or the battery will suffer permanent damage. The battery can be fully charged only when the input power of the solar array is more than the power consumption of the load.
7. Please do not dip the controller into the corrosive battery liquid, or the controller will be damaged and release harmful gas.
8. The solar panel's terminal voltage may exceed human safety voltage when connecting a 24V system, when this is done, please use insulating tools and ensure your hands are dry.
9. Because the battery stores lots of energy, do not allow the battery to short circuit in any case. We suggest tandem connecting a fuse on the battery.
10. Vented batteries may release combustible gas, do not create sparks or use open flame in the vicinity of a vented battery.
11. Ensure children are kept far away from the battery and controller
12. Please follow the battery manufacturer's safety suggestions.

7. Networking introduction.

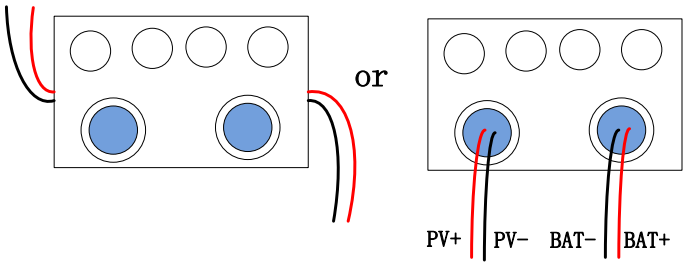
The controller supports parallel operation, before working, please set different addresses for each controller; the controller's factory default is "slave engine", and it can be customized into "main engine". For more details, please check the RM-2 parts specification.

8. Installation instructions.

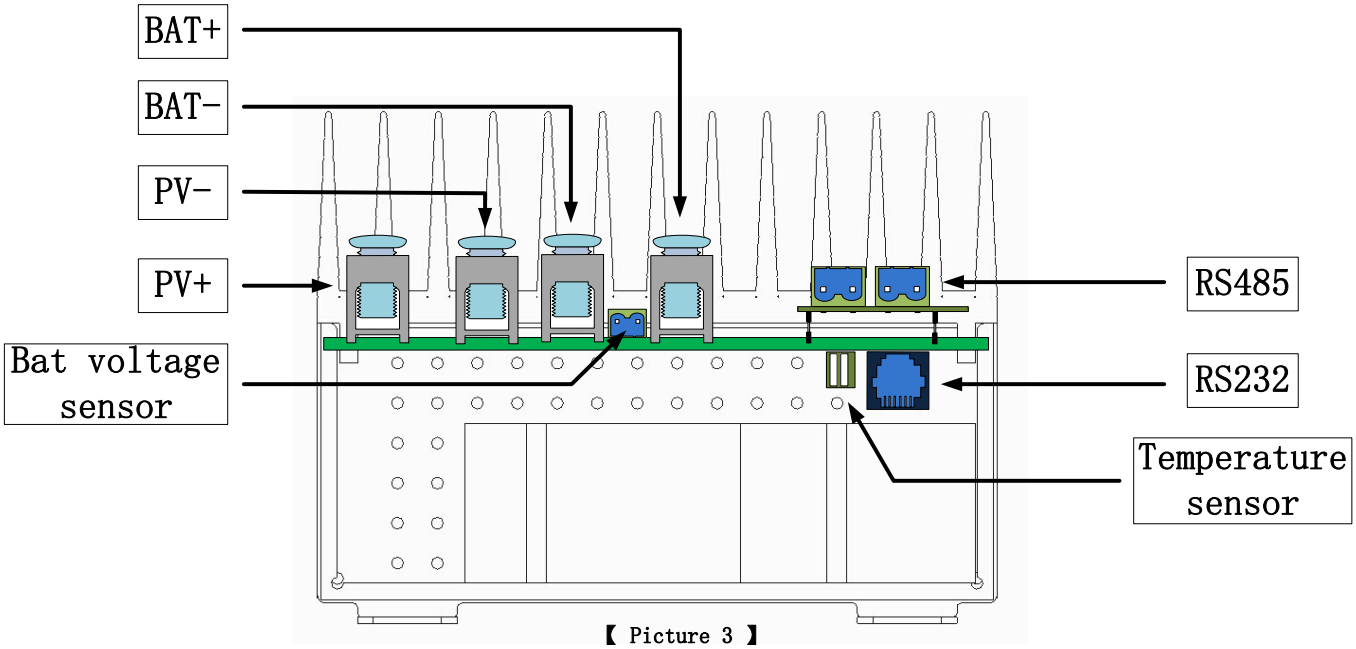
1. Loosen the four screws and open the panel (picture 1).
2. Please take away the baffles of the front or side wiring holes, take out the plastic cable pass-throughs, and install them in the wiring holes.
3. Use suitable cable for the PV and battery connections. (picture 2).
4. Attach the bare wire cable ends to the appropriate terminals inside the unit. (picture 3).
5. Close the panel after connecting the LCD and telecommunication cable (if parallel operation is needed), and then tighten the screws(picture 4). Connect temperature cable from negative battery terminal to the temperature sensor (Bat voltage sensor is not used)
6. Fix the controller to the desired install location.



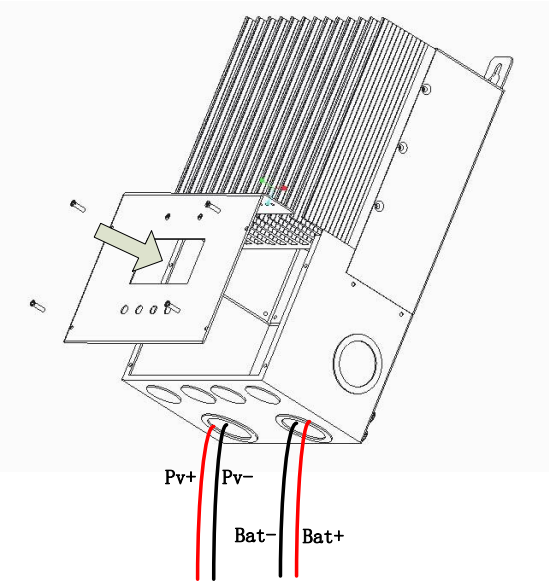
【 Picture 1 】



【 Picture 2 】



【 Picture 3 】



【 Picture 4 】

7. Power on.

Battery short circuit is prohibited; do not touch the solar panel or the bare port of battery wiring.

Choose the cable, do not exceed the current density of 4A/1mm, please make sure the wiring is correct.

Do not reverse connect the wire, leave an air switch between battery and controller or between solar panel and controller, open the battery air switch after completion of above job, and then open the solar panel air switch; The installation site is suggested to be aeration-drying; start the slave first, if it is main engine, please set it as slave. Ensure that the system is run by one main engine and start it in the end.

9. Environmental requirements.

1. Working ambient temperature range: -35℃~ +45℃
2. Storage temperature range: -45℃~ +80℃
3. Humidity range: 10% ~ 90% without moisture condensation.
4. Protection level: IP32.

Do not use under flammable and explosive condition, never put the controller in moist, rainy, dusty, corrosion or electromagnetic interference condition.

Self-maintenance is prohibited.

10. Protections.

1. **Waterproof protection**

Waterproof degree:： IP32.

2. **Input power limit protection**

When the PV power exceeds the rated power, controller will limit the PV power under the value of rated power so as to prevent the controller from being damaged, the controller will charge by limited current.

3. **Battery reverse connection protection**

Battery reverse connection will not damage the controller but the system will stop working.

4. **The voltage of PV input terminal is over value**

When the voltage of PV input terminal is over value, controller will shut the PV input automatically.

5. **Short circuit protection of PV input terminal**

Load short circuit will not damage the controller but controller will stop output.

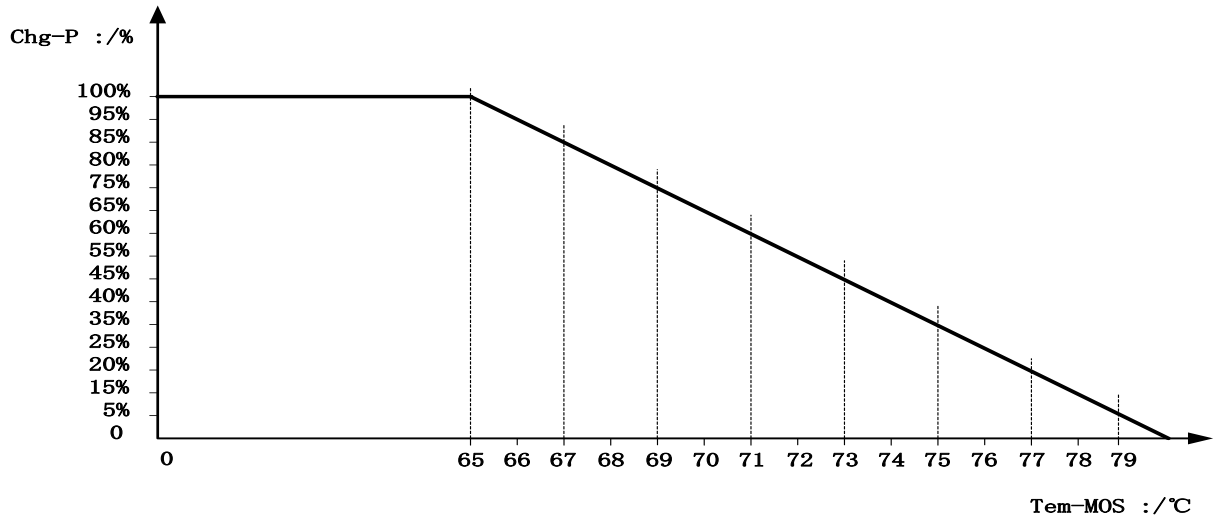
6. **Reverse charge protection at night.**

Prevent the battery from discharge at night.

7. **TVS lightning protection**

8. **Over temperature protection**

When inside temperature of the controller is over value, the controller will lower charging power or stop charging.



11.Fault code.

Fault code	Indication
BAT_LDV	Battery is over discharge
BAT_OVD	The system is over voltage
OVRTMP1	The controller inside is over temperature

OVETMP2	The outside controller is over temperature
P_OVRCRT	The solar panel is over current
P_SHTCRT	The solar panel is short circuit
P_OVP	The solar panel is over voltage
P_SHADOW	The solar panel is shaded
P_EDDY	Reverse current in solar panel
P_WK_OVP	Tracing working voltage exceeds 48V/140V;36V/120V 24V/110V;12V/100V
BAT_SNSR	Fault sampling of outer battery
ERR_485	Abnormal communication of RS485

12. Parameters.

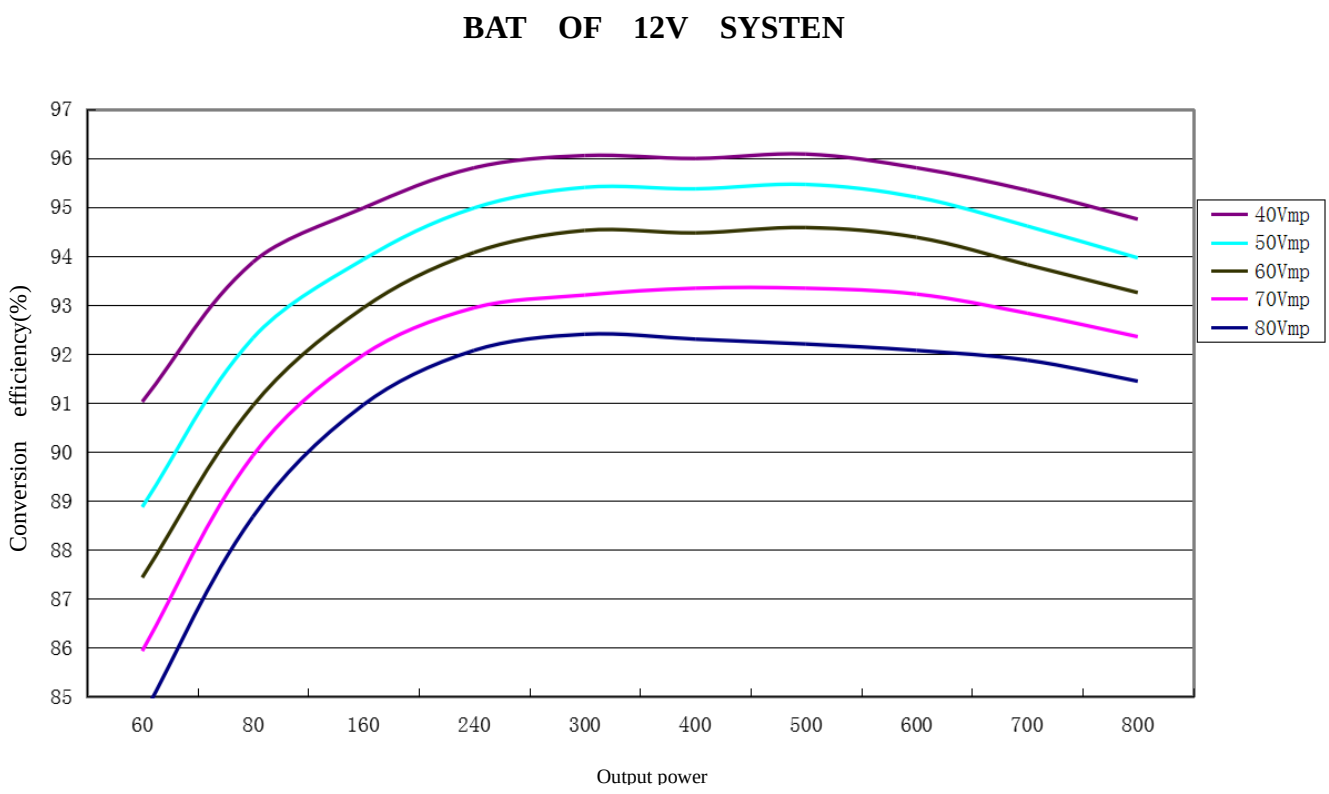
Marks: n represents ×2/24V; ×3/36V; ×4/48V.

Parameters	Value		Adjustable	Default value
Model	60	45		
System voltage	12V/24V/36V/48V Auto			
No-load loss	0.7 W～1.5W			
Max. Input voltage	100V(12Vsystem) 110V(24Vsystem) 120V(36Vsystem) 140V(48Vsystem)			
Rated charging current	60A	45A		
Max. Input power	800W/12V 1600W/24V 2400W/36V 3200W/48V	600W/12V 1200W/24V 1800W/36V 2400W/48V		
Transfer efficiency	≤96%			
MPPT tracing efficiency	＞99%			

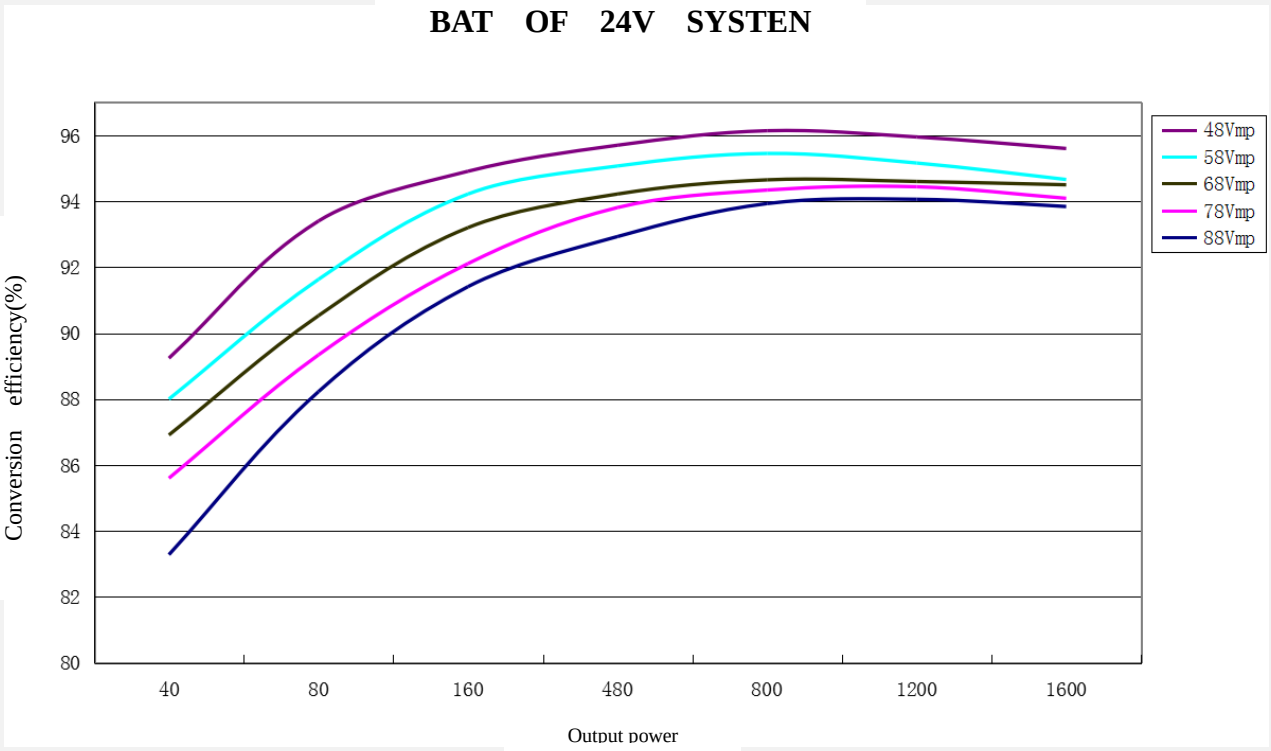
Over voltage protection	9.0V～17.0V；×nV	√	16.0V
Limited charge voltage	9.0V～17.0V；×nV	√	15.5V
Equalizing charge voltage	9.0～17.0V；×nV（25℃）	√	15.2V
Equalizing charge interval	0～255day（0 means close the function）	√	30day
Boost charge voltage	9.0V～17.0V；×nV（25℃）	√	14.4V
Boost charge return voltage	9.0V～17.0V；×nV（25℃）	√	13.2V
Float charge voltage	9.0V～17.0V；×nV（25℃）	√	13.8V
Over discharge return voltage	9.0V ～ 17.0V；×nV	√	12.6V
Over discharge voltage	9.0V ～ 17.0V；×nV	√	11.0V
Boost charge time	10～600Min	√	120 Min
Equalizing charge time	0～600Min	√	120 Min
Temperature compensation	0～-5（00 means close the compensation function）	√	-3.0
Over temperature protection	YES		
Light controlled open voltage	4～40V		
Light controlled delay time	5min		
Device address	1 ～ 16	√	2(slave)
Working temperature	-35° ～ +45℃		
Protection level	IP32		
Weight	4.8 Kg	4.2 Kg	
Max. Wiring dimension	25 mm^2		
Altitude	≤ 3000 m		
Product dimension	318.7*170*128（mm）	286.7*170*128（mm）	

13. Conversion efficiency

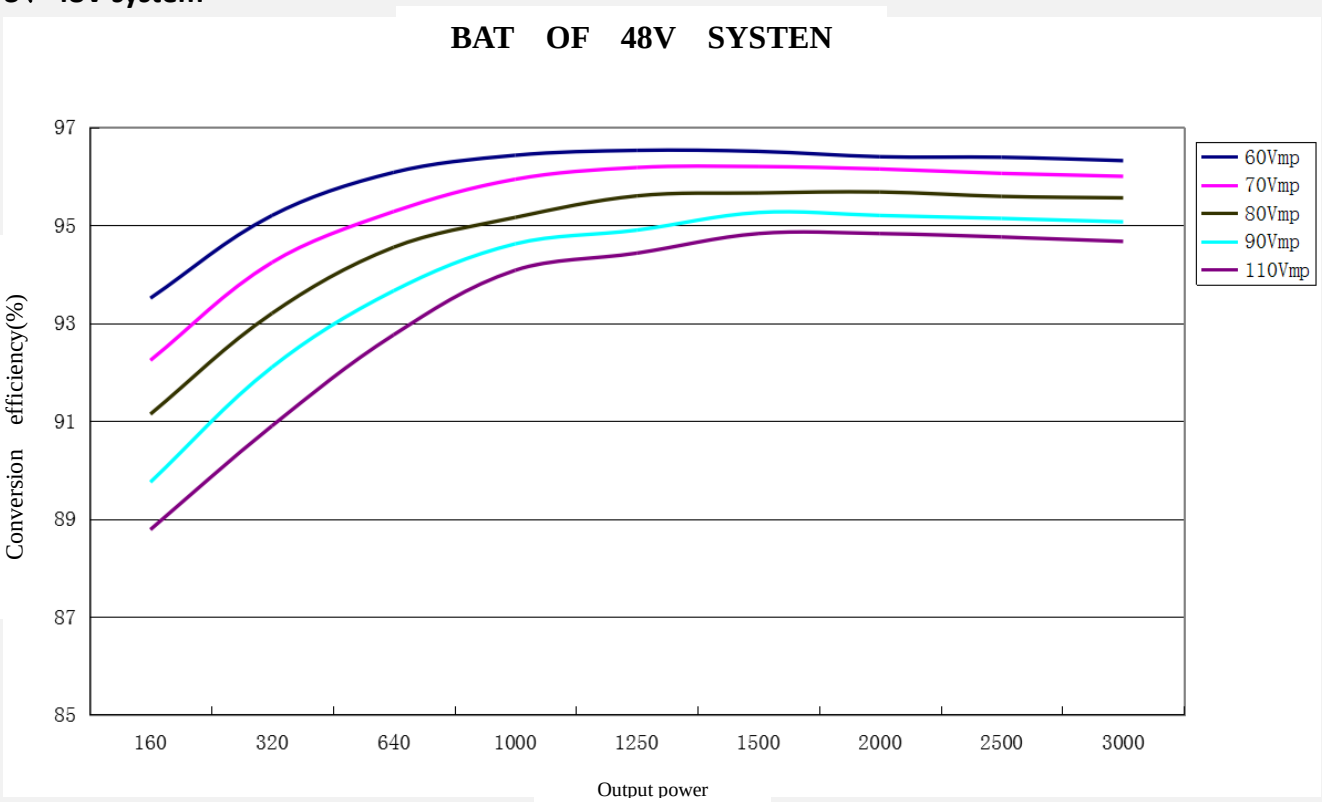
1、12V system



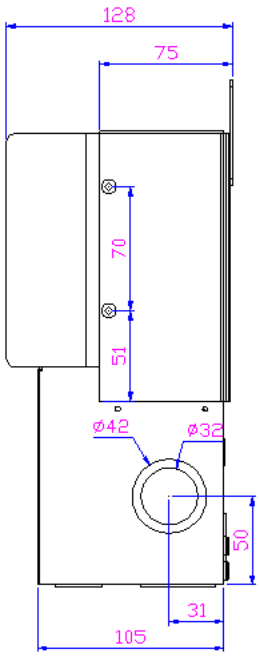
2、24V system



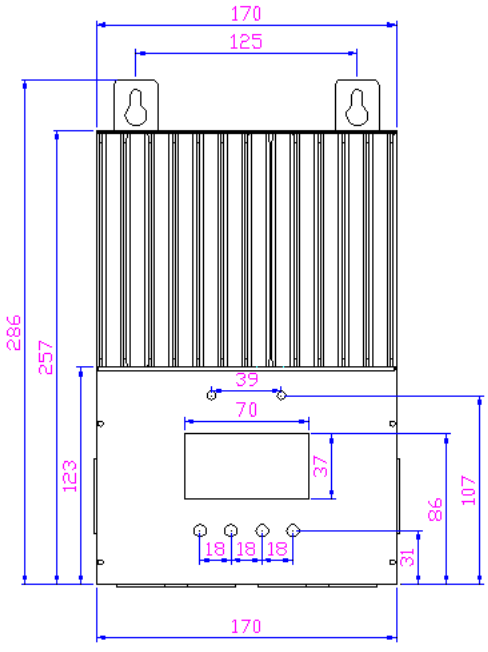
3、48V system



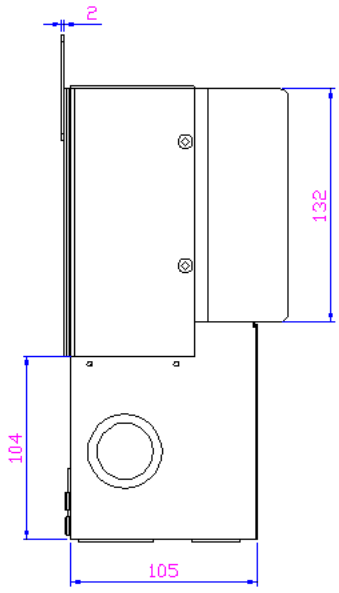
Dimension of MPPT-45 (in mm)



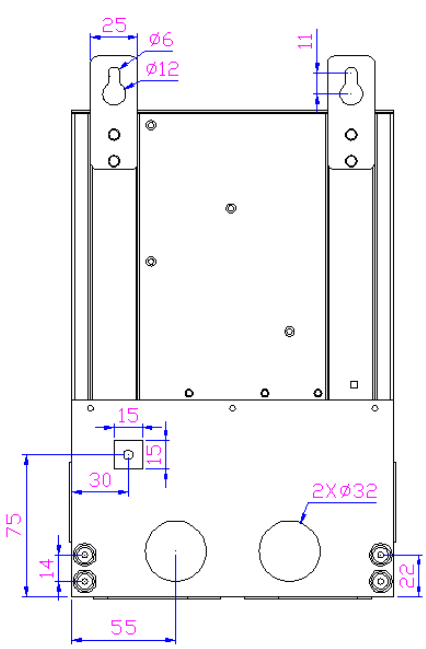
Left side view



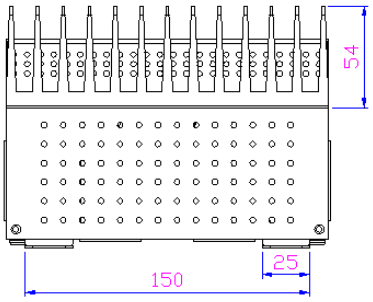
planform



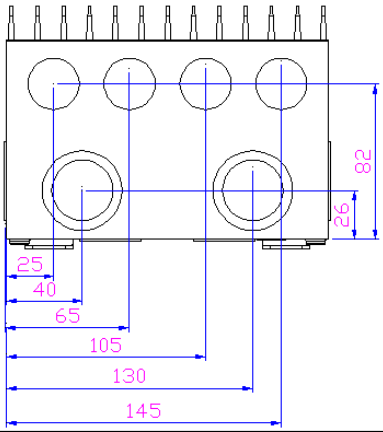
Right side view



Button view



Upware viwe



Front view