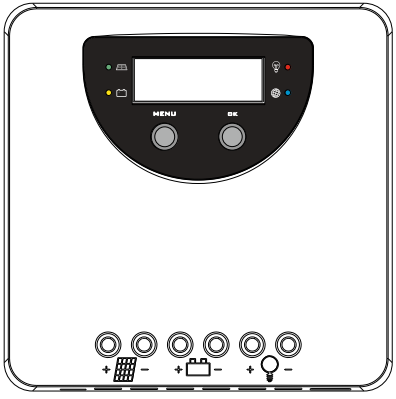
VOLTANIC

MPPT Solar Controller

12V/24V 20Ah



User Manual

CE, Rohs, ISO9001:2015

Contents

Thank you for your purchase. **Please** take time to read this manual especially the installation part on page 8. Most issues with solar systems are due to the incorrect installation & setting up of the controller. If after following this manual, you still face problems, please email us with your order number to support@voltanic.uk or head to our website www.voltanic.uk & use our livechat service.

1, Safety instructions and waiver of liability

1.1 Safety Instructions

The following symbols are used throughout this manual to indicate potentially dangerous conditions or mark important safety instructions. Please take care when meeting these symbols.

WARNING: Indicates a potentially dangerous condition. Use extreme caution when performing this task.

CAUTION: Indicates a critical procedure for safe and proper operation of the controller.

CAUTION:
1) There are no user serviceable parts inside the controller. Do not disassemble or attempt to repair the controller.
2) Keep children away from batteries and the charge controller.

1.2 Liability Exclusion

The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

2, Overview

Using advanced maximum power point tracking (MPPT) technology, Voltanic regulators efficiently track the solar panels Max Power Point at 99.9% to boost the energy yield by up to 30% more than PWM controllers helping you to charge your batteries faster. Furthermore, multi-stage charging improves your batteries lifetime.

Controller Features

• Innovative use of multiple algorithms for Max Power Point Tracking (MPPT) delivers quicker and more accurate tracking efficiency >99.9%.

• Full digital technology with high charge conversion efficiency up to 98%.

• LCD display provides a clear view of operating mode and data with real-time energy, voltage, ampere hours, temperature and more.

• Four stage battery charging process: MPPT, boost, equalization and float.

• 12/24V automatic recognition on connection.

• Multiple load control modes: Always On, Dusk to Dawn for Street Lighting, User-Defined Mode.

•Temperature compensation using the supplied remote sensor improves accuracy of charging and battery condition.

• RS-485 standard modbus protocol with RJ11 interface to maximize communication.

• Compatible with Liquid, Gel, AGM and Lithium battery systems.

Electronic Protections

• Internal power reduction function automatically protects the regulator against over-temperature.

• Automatic protection to avoid exceeding the rated charging power and current.

• Battery protection features against reverse polarity and over voltage connections.

• Deep discharge load disconnection and automatic reconnection.

2.2 What exactly is MPPT?

Let's start with the non-technical explanation. Imagine that you have a simple hosepipe. You have a steady stream of water gently pouring out and you want to maximize the power of that water so you can hit your spouse sunbathing at the other end of the garden.

How do you do it? Simple – you put your finger over the end of the hosepipe to reduce the size of the hole. If you put too much finger over the end of the hosepipe you just get a fine mist of water – i.e. very little power. If you don't put enough finger over the end of the hosepipe, the water won't go far enough. There is a "maximum" power point where you can get the water to spray a great distance without misting. The MPPT controller's job is to find that point.

Now imagine someone were to open up the tap, you may find that you have to adjust the finger to keep your jet of water from becoming a mist, and vice-versa. In the same way, the MPPT in your controller has to constantly adjust itself as the strength of the sun varies, or a cloud passes.

Technical Explanation

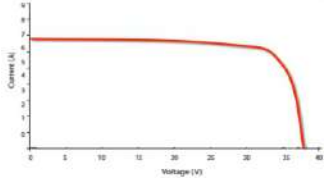
Now you may remember from high school physics that the power of an electrical device is the current multiplied by the voltage: **Power (W) = I (Current) x V (Voltage).** In our case, the electrical device is a solar panel and power is represented by watts. But power produced is not fixed. Solar panels generate different voltages depending on the conditions that the panel is exposed to. Conditions that affect the voltage in a solar panel include:

•The amount of light shining on the panel.

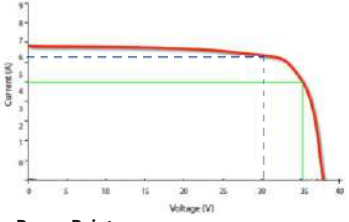
•The load that the solar panel is pushing its electricity into.

•The temperature of the panel.

As you can see, throughout the day, as the weather changes, the voltage produced by the solar panel will be constantly shifting. Remember that P (power) = I (current) x V (volts) therefore for any given voltage, the solar panel must also produce a corresponding current (measured in Amps). The amount of Amps that are produced for any given voltage is determined by a graph called an **IV curve**, which can be found on any solar panel's specification sheet and typically looks like this:



The graph above shows you what the current flow (A) through a solar panel will be for any given voltage (V). In the graph below, the jagged line shows a voltage of 30V corresponding to a Current of about 6.2A. This produces power of 186 watts (30v x 6.2a = 186w). The solid line shows a Voltage of 35V which corresponds to a current of 5A. This produces power of only 175 watts (35v x 5a = 175w). As you may have noticed, as you move along the red curve you will find one point where the Voltage multiplied by its corresponding current is higher than anywhere else on the curve. This is called the solar panel's Maximum Power Point (MPP) & is the place where we will find the most power..



Finding the Maximium Power Point

In the example above the MPP is somewhere between where the blue line touches the red line and where the green line touches it. In fact (due to calculus for the tech heads amongst you) the MPP is always on the "bendiest" part of the curve. The job of a MPPT controller is to always operate on that MPP. For the example above that would be about 33V and 6A. To do that, the MPPT forces the controller to work at 33V by varying the resistance at the controllers input using power electronics. The higher the resistance, the higher the voltage across the solar panel.

Keeping On the Maximum Power Point

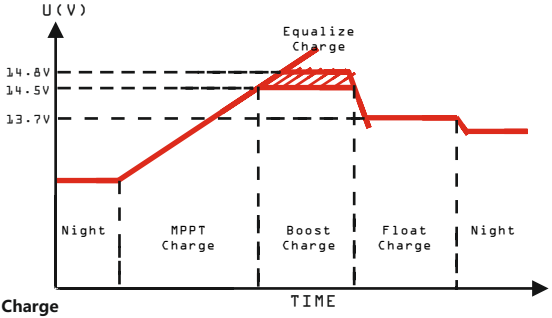
But the MPPTs job is a lot harder than finding an MPP and forcing the solar panel to stay there by creating the correct resistance at the controller input. Remember that the voltage that the solar panel would like to work at is moving all the time as the temperature and solar irradiation changes. So the MPPT has to constantly adjust its settings to keep the solar panel at its MPP. It is chasing a constantly moving target.

MPPT MAGIC

But wait, won't 33v flowing into a 12v battery damage the battery? This is where the true magic arises. Whilst PWMs simply reduce the voltage of the panel to the voltage of the battery resulting in significant power losses, MPPT controllers convert those volts into amps which then safely flow into your battery allowing you to harness 99% of the solar energy coming in versus 75% with PWM controllers. And this is the true brilliance of the MPPT controller.

2.3 MPPT—Four Charging Stages

This controller has a 4-stage battery charging algorithm for rapid, efficient, and safe battery charging.



MPPT Charge

In this stage, the battery voltage has not yet reached the boost voltage and 100% of available solar power is used to recharge the battery.

Boost Charge

When the battery has recharged to the Boost voltage setpoint, constant-voltage regulation is used to prevent heating and excessive battery gassing. The Boost stage lasts for 120 minutes and then proceeds to Float Charge mode. Whenever the controller is powered on, if it detects neither over discharged nor overvoltage, the charging will enter into the boost charging stage.

Float Charge

After the Boost Charge stage, the controller will reduce the battery voltage to the Float voltage setpoint. When the battery is fully recharged, there will be no more chemical reactions and all the charge current transmits into heat and gas at this time. Then the controller reduces the voltage to the floating stage, charging with a smaller voltage and current. It will reduce the temperature of the battery and prevent the gassing whilst also charging the battery slightly at the same time. The purpose of Float stage is to offset the power consumption caused by self consumption and small loads in the whole system, while maintaining full battery storage capacity.

In the Float stage, loads can continue to draw power from the battery. If the system load(s) exceed the solar charge current, the controller will no longer be able to maintain the battery at the Float setpoint. Should this occur & the battery voltage drops below the boost reconnect charging voltage, the controller will exit the Float stage and return to MPPT charge mode.

Equalize Charge

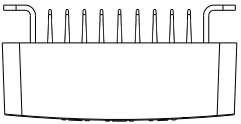
Flooded Lead Acid batteries benefit from periodic equalizing charge, which can stir the electrolyte, balance battery voltage and complete chemical reaction. Equalizing charge increases the battery voltage higher than the standard operating voltage vaporizing the sulfate crystals that build up on the plates over time. battery electrolyte. If it detects that the battery is being over discharged, the solar controller will automatically turn the battery to the equalization charging stage for 120 mins. Equalizing charge and boost charge are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

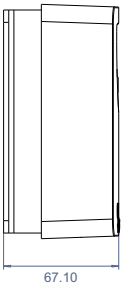
WARNING: Risk of explosion!

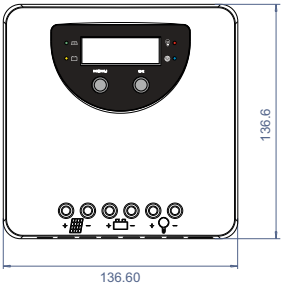
Equalizing flooded battery can produce explosive gases, so well ventilation of battery is necessary.

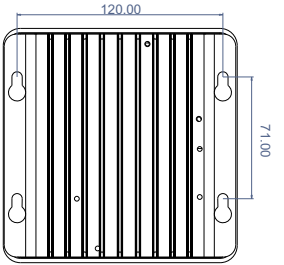
3, Dimensions

Unit:mm



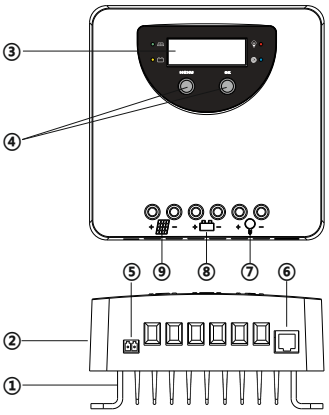






4, Structure & Accessory

4.1 Structure & Characteristics



①Heat Sink
—dissipate controller heat

②Plastic Case
—Internal protection

③LED & LCD
—Display settings and operating status, system parameters

④Key: MENU、OK
—Set and view the operating parameters

⑤Temperature Sensor Port
—Collect temperature information, for temperature compensation.

⑥RJ11 interface
—Connecting monitoring devices

⑦ Load Terminals
—Connected load.

⑧Battery Terminals
—Connect the battery.

4.2 Temperature Sensor

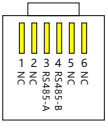
So the controller can accurately charge the battery, a temperature sensor is included. The temperature sensor is connected via interface 5. Should a sensor with a longer cable be required than this needs to be ordered separately.

If the remote temperature sensor is not connected to the controller or damaged, the default temperature for battery charging is 25 °C .

4.3 RS485

The charger is equipped with a RS485 port with RJ11 sockets, the RJ11 interface is defined as follows:

Pin No.	Definition
1	NC
2	NC
3	RS485-A
4	RS485-B
5	NC
6	NC



RJ11(6P2C) for controller

Please contact the sales for the latest version of the communication protocol.

The Rs485 interface on this charger is not galvanically isolated and can not be grounded. Do not short circuit unused pin (Note NC).

5, Installation

CAUTION: Please read all instructions and precautions in the manual before proceeding with the installation! It is recommended to remove the protective film cover from the LCD screen before operation.

5.1 Installation Notes

(1) This charge controller must only be used in PV systems by requirements given in this user manual and the specifications of other system components provided by their manufacturers. No energy source other than a PV generator may be connected to the PV charge controller referred to herein.

(2) PV-modules must always be disconnected prior to the installation and adjustments of the charge controller; Make sure the circuit breaker, fuse or disconnects of the battery terminal are turned off.

(3) Double check whether battery voltage meets the voltage range of the Charge Controller.

(4) Batteries store a large amount of energy, never short circuit a battery under any circumstances. We strongly recommend connecting a protection fuse directly to the battery terminal for protection in case of short circuiting the battery.

(5) Batteries can produce flammable gases. Avoid provoking any sparks, using fire or any exposed flame close to any batteries, ever. Make sure that the battery room is well ventilated to disperse any gases.

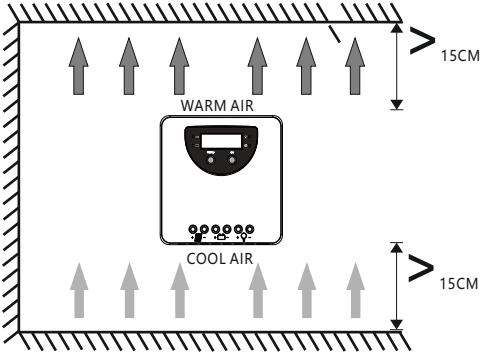
(6) Only use insulated tools and avoid placing (any) metal objects near/close to batteries.

(7) Be extremely cautious when working with batteries. Wear eye protection at all times. Have fresh water available to immediately wash and clean any contact with battery acid. Get immediate medical aid in case of any hazard that may occur. Never install/handle batteries alone.

5.2 Mounting Location Requirements

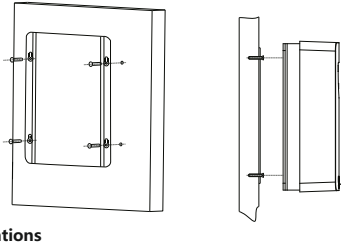
Do not subject the PV charge controller to direct sunlight or any other heat sources. Protect the PV charge controller from any dust, dirt and moisture. Mount it flat to a vertical wall. Must be a non-flammable material. Maintain a minimum clearance of 15 cm below and around the controller to ensure unhindered air circulation. Mount the PV charge controller close to the battery.

Mark the position of the PV charge controller fastening holes on the wall, drill 4 holes and insert dowels, fasten the PV charge controller to the wall with the cable openings facing downwards.



5.3 Fix the controller

Drill 4 mounting holes in the wall according to "installation position" and fix the four screws(M5) , then aim the controller's fixing holes at the screws and mount the controller on.



5.4 Wiring Specifications

Wiring and installation methods must comply with national and local electrical code/specifications.

The wiring specifications of the PV system battery must be selected according to rated currents. Please check following table for wiring specifications:

Model	Rated charging current	Rated discharging current	Solar wire diameter (mm^2/AWG)	Battery wire diameter (mm^2/AWG)	Load wire diameter (mm^2/AWG)
12V/24V 20AH	20A	20A	6/10	6/10	6/10

The indicated cable/wire sizes are for reference only. If longer runs between the PV array and the controller or between the controller and the battery are required, then larger capacity cables must be used to reduce voltage drop and improve system performance.

5.5 Connection

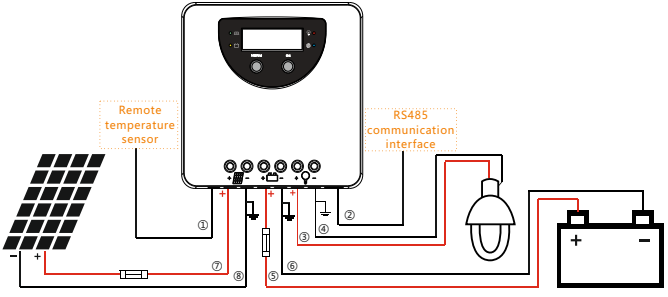
WARNING: The PV-module/array can produce open-circuit voltages in excess of 100 Vdc when exposed to sunlight. It is recommended to cover PV-modules from any incident light during installation

WARNING: Risk of explosion! In case the battery's positive and negative terminals or leads get ever in touch, i.e. short-circuited, a fire or explosion hazard might get triggered. Always pay maximum attention when handling batteries and related circuits.

CAUTION: 1. When the controller is not connected with the external temperature sensor, the internal temperature of the battery is 25 ℃.

2.If a power inverter is used the system, directly connect the inverter to the battery. Do not connect it to the controller's load terminals.

We strongly recommend connecting a fuse directly to the battery terminal to protect from any short circuit in the battery circuit. Never touch uninsulated cables (ends), only use electric insulated tools, and make sure that the wire thickness is adequate for the PV module operating currents. Connections must always be conducted in the sequence as described below.



Step 1: Connect accessories

(1) Connect the remote temperature sensor cable to the interface and place the other end close to the battery.

(2) If available, connect the accessories for RS485 or IoT communication.

Step 2: Connect loads (lamp symbol)

(3) Connect positive load cable to positive load terminal

(4) Connect negative load cable to negative load terminal

To avoid the presence of any tension on the cable/wires, please connect these first to the load before connecting them to the charge controller.

Step 3: Connect the battery (battery symbol)

For 12V systems, make sure the battery voltage is between 5 and 15.0 Vdc voltage range; for 24V systems, between 20 - 31 Vdc

(5) Connect the positive battery cable to positive battery terminal

(6) Connect the negative battery cable to negative battery terminal

CONTINUES ON FOLLOWING PAGE

Step 4: Connect the solar panel(s)

PERFORM THE FOLLOWING CHECKS:

A) When connecting the PV-Module make sure to cover it from incident sun light.

B) Double check the max volts produced by the PV-Module/s does not exceed 95V (check solar panel technical data sheet). Once completed:

(7) Connect the positive PV cable to positive PV terminal

(8) Connect the negative PV cable to negative PV terminal

Step 5: Choose correct battery type

(9) Go to the Battery Configuration section on page 15 & follow the guide to choose the your correct battery type. **We recommend to use the controllers default settings.**

Step 6: Final Checks

(10) Tighten all cables connected to the controller. If there are any error messages or if the LCD display is off, troubleshoot using the troubleshooting section on page 16.

5.6 Grounding

Be aware that the negative terminals of controller are interconnected and therefore bear the same electrical potential. If any grounding is required, always do this on the negative wires/terminals.

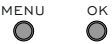
CAUTION: For common-negative systems, such as motorhome, it is recommended to use a common-negative controller; but if in a common-negative system, some common-positive equipment is used, and the positive pole is grounded, the controller may get damaged.

6, Operation

6.1 LED indicator

LED	Status	Function
Green (PV Panel)	On	Solar panel is connected, no charged.
	Fast flash(0.1/0.1s)	MPPT charging
	Flash(0.5/0.5s)	Equal or Boost Charging
	Slow flash(0.5/2s)	Float Charging
Yellow (Battery)	On	Battery is normal.
	Off	Over voltage protection
	Fast flash(0.1/0.1s)	Low voltage protection
	Slow flash(0.5/2s)	Battery voltage is low.
Red (Load)	On	Load is on.
	Off	Load is off.
	Fast flash(0.1/0.1s)	Short circuit or over current protection
	Slow flash(0.5/2s)	Over temperature protection
Blue (Communication)	Off	No communication
	Fast flash(0.1/0.1s)	Normal communication

6.2 Key function



Mode	Operating
Browse interface	Short press **OK.**
Static display	Press the **MENU** and **OK** key at the same time for 1s, the LCD screen will lock the interface. Press the **MENU** and **OK** key again for 1s, the LCD interface will unlock and start scrolling.
Setting parameter	Press the **MENU** key for 1s to enter the setting mode when the icon ⚙ appears on the display interface, and exit automatically after 30s or press the **MENU.**
Load On/Off	When the controller is working in street lamp mode, press the **MENU** key for 3s to turn on the load, press the **MENU** key again or 1min later the load will be turned off.

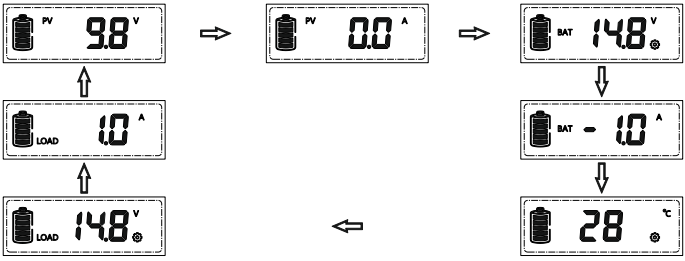
6.3 LCD Display

6.3.1 Status Description

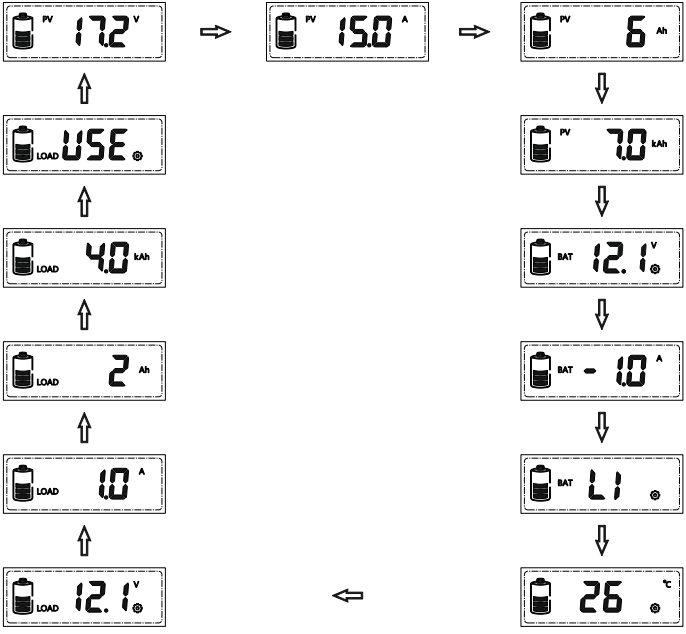
Item	Icon	Status
PV array	⇨	Charging
	PV 7.2 V	PV voltage
	PV 3.0 A	PV current
	PV 6 Ah	PV ampere hours of the day
	PV 8.0 kAh	The total charge ampere hours of the solar panel
Battery		Battery capacity
	BAT 12.3 V	Battery voltage (Set Charging target voltage for lithium battery)
	BAT 10 A	Battery current
	BAT GEL	Battery type(Programmable)
	26 ℃	Temperature
Load	LOAD 12.1 V	Load voltage(Set low voltage protection voltage)
	LOAD 1.0 A	Load current
	LOAD 3 Ah	Load ampere hours of the day
	LOAD 6.0 kAh	The total discharge ampere hours of the load
	LOAD USE	Load mode(Programmable)

PV array charge ampere hours and load ampere hours are off after power failure

6.3.2 The interface automatically cycles in the displayed sequence



6.3.3 Press OK to browse the interface



6.3.4 Fault indication

Status	Icon	Description
Short circuit	E1	Load off, fault icon display,the LCD screen displays E1.
Over current	E2	Load off, fault icon display,the LCD screen displays E2.
Low voltage	E3	Load off, battery level shows empty, fault icon display, battery frame flashes, the LCD screen displays E3.
Over voltage	E4	The charge and discharge are off, battery level shows full, fault icon display, battery flashes, the LCD screen displays E4.
Over temperature	E5 °C	The charge and discharge are off, fault icon display, icon ℃ flashing, the LCD screen displays E5.
Controller does not correctly identify system voltage	PV BAT. LOAD 88.8 VA/℃ kAh (h•W)	Controller does not correctly identify system voltage.

6.4 Parameters setting

When the icon ⚙ appears in the display interface, it means that the parameters can be set. Press the **MENU** key for 1s, then icon ⚙ flashes, press **OK** to change the parameter.

6.4.1 Charging target voltage(Lithium)

If the battery type is set to lithium battery, the LCD display interface is shown in the left figure. Long press the **MENU** key for second, the settings icon will begin flashing and you will be able to set the charging target voltage of lithium battery.

Charging target voltage setting range: **10.0 ~ 32.0V (default: 14.4V)**

The controller automatically calculates the charging recovery voltage according to the charging target voltage . The charging recovery voltage is approximate 0.97 * Charging target voltage. **For non lithium battery types, this setting cannot be changed.**

6.4.2 Low voltage protection and recovery voltage

When the LCD shows as displayed at left, press the MENU key for 1s, the ⚙ icon flashes, now you can set the controller 's low voltage protection voltage.

LITHIUM: For lithium batterys, the low voltage protection voltage setting range is as follow: **9.0 ~ 30.0V (default: 10.6V).**
The controller automatically calculates the low voltage recovery at approximate 1.11 * low voltage protection voltage.

NON-LITHIUM: For non lithium batterys, the low voltage protection mode of the controller is divided into battery voltage control and capacity control.

① Battery voltage control setting range : **10.8~11.8V (default:11.2V)**
21.6~23.6V (default:22.4V)
The default low voltage recovery voltage of the controller is 0.8V higher than the low voltage protection voltage. If you want to reduce the low voltage recovery voltage, please reduce the lowvoltage protection voltage first.

② Battery capacity control:

Display	Low voltage protection range	Low voltage reconnect
S-1	11.0~11.6V	12.4V
S-2	11.1~11.7V	12.5V
S-3	11.2~11.8V	12.6V
S-4	11.4~11.9V	12.7V
S-5	11.6~12.0V	12.8V

6.5 Setting Battery Type

When the LCD shows as displayed on left, press the **MENU** key for 1s, the icon flashes, you can then set the battery type.

Display	Battery type
GEL	GEL(Default)
LIQ	Liquid
AG-	AGM
LI	Lithium

1.Charging Voltage Parameters(Liquid, GEL, AGM)

When choosing the Liquid, GEL or AGM battery type, the parameters of boost, equalization and float charge voltage can be set on the display or via RS485. The range of parameters is in the table below. [NOTE: The following voltage parameters are 25℃/12V system parameters. For 24V systems, multiply by 2.]

Charging stage	Boost	Equalization	Float
Charging Voltage Range	14.0 - 14.8V	14.0 - 15.0V	13.0 - 14.5V
Default charging voltage	14.5V	14.8V	13.7V

2.Charging Voltage Parameters(Lithium)

When choosing lithium battery type, the Charging target and recovery voltage of lithium battery can be set manually (see section 6.4.1 for details) or via Rs485.

Charging target voltage setting range: **10.0~32.0V (default:14.4V)**

Charging recovery voltage setting range: **9.2~31.8V (default:14.0V)**

Note:

(Overcharge Recovery Voltage+1.5V)≥Lithium Overcharge Protection Voltage≥ (Overcharge Recovery Voltage+0.2V)

Parameter setting out of range is not supported.

Warning: The required accuracy of BMS shall be at least 0.2V. If tolerance is larger than 0.2V, manufacturer will not assume any liability for any consequent system malfunction.

6.6 Load mode

When the LCD shows as displayed at left, press the **MENU** key for 1s, the icon flashes, you can then set the load mode.

Display	Load mode
0	Always on Mode: The load output is always switched on.
1	Dusk to Dawn Mode: The load output is switched on between sunset and sunrise.
2 3 4 5 6 7 8 9	Evening Mode: The load output will be switched on for 2~9hours after sunset.
USE	Manual Mode: The load output can be switched on and off manually by pressing **MENU** shortly.

1. Always on Mode

When the controller is set to always On mode, no matter the charging or discharging state, the load is always powered on (except when in protection state).

2. Street Lamp Function

When the load is set to Dusk to Dawn or Evening mode, the Day/Night threshold voltage and the Day/Night delay time can be set manually or via Rs485 devices and the load can be turned on or off by the test function during the day charging process.

2.1 Day/Night threshold voltage

The controller recognizes day and night based on the solar array open circuit voltage.

This day/night threshold voltage can be modified according to local light conditions and the solar array used.

Day/Night threshold setting range: 3V - 10V (Default: 8V)

2.2 Day/Night delay time

In the evening, when the solar array open circuit voltage reaches the setting day/night detect voltage, you can adjust the day/night delay time to make the load turn on a little bit later.

Day/Night delay time setting range: 0 - 30min (Default: 0min)

2.3 Test Function

When the controller is working in Dusk to Dawn or Evening mode, press the **MENU** key for 3s to turn on the load. Press the **MENU** key again or the load turns off automatically after 1 minute.

If the controller is operating in **a**lways on mode, the test function does not work.

3.User-defined Mode

①If the load mode is selected "**USE**", then you can switch on and off the load output manually by pressing **MENU** shortly.

②The default switching state of the load in manual mode can be changed manually or via Rs485. At the same time, the output to the load can be turned on or off.

1.If the controller turns off the load due to low voltage protection, over-current protection, short-circuit protection or over temperature protection, the load will turn on automatically when the controller recovers from protection state.
2.Please note: Pushing the MENU button can still activate the function of the key, even during the above protection states.

7, Troubleshooting, Protections and maintenance

7.1 Trouble shooting

Faults	Reason	Troubleshooting
	Short Circuit	①Clear short circuit fault ②Restart the controller or press the key to restore the load output
	Over Current	①Reduce electrical equipment; ②Restart the controller or press the key to clear the fault load and restore the output
	Battery voltage is too low	Load will be reconnected when battery is recharged.
	Battery voltage is too high	Check if other sources overcharge the battery or battery parameter is set correctly. If not, controller is damaged.
	Battery voltage is abnormal at start-up	Charge or discharge the battery so that the battery voltage is within the normal operating range(5.0~15.0V or 20~31V).
	Over temperature	After the temperature decreases, the controller will work normally.

7 ■ 2 Protection

Protection	Description
PV Over Current	The controller will limit charging power to the rated level. Over-sized PV array's will not be able to operate at the maximum power point.
PV Short Circuit	When PV short circuit occurs, the controller will stop charging. Remove it to resume normal operation. When the PV isn't charging, the controller will not be damaged if short-circuit occurs. **Warning: The controller may be damaged if short-circuit occurs during charging.**
PV Reverse Polarity	Full protection against PV reverse polarity. No damage will occur to the controller. Correct the connection to resume normal operation.
Battery Reverse Polarity	Full protection against battery reverse polarity. No damage will occur to the controller. Correct the connection to resume normal operation.
Battery Over voltage	Should there be extra energy sources to charge the battery, when the battery voltage exceeds 15.8V / 31.3V(Overcharge protection voltage of lithium battery equals charging target voltage plus 0.2V), the controller will stop charging to protect the battery from overcharging damage.
Battery Over discharge	When the battery voltage drops to the low voltage disconnect setting, the controller will stop discharging to protect the battery from over discharge.
Load Over Current Protection	If the load current exceeds the maximum load current rating by 1.25x, the controller will automatically cut off the output. If the load reconnects to the output automatically 10 times, it needs to be cleared by pressing the test key, restarting the controller or switching from Night to the Day.
Load Short Circuit Protection	When the load output of the controller is short circuited, the controller will automatically cut off the output. If the load reconnects the output automatically 10 times, it needs to be cleared by pressing the test key, restarting the controller or switching from Night to the Day.
Over Temperature Protection	The controller detects the internal temperature through internal sensor, when the temperature exceeds the setting value, the charging current will decrease. The controller stops working when the internal temperature exceeds 75℃ and resumes work when the internal temperature is below 65℃.
Damaged Remote Temperature Sensor	When the external temperature sensor is damaged or not connected, the controller will charge at 25 ℃ by default to prevent overcharge from damaging the battery.

7.3 Maintenance

For best system performance, the following inspections and maintenance tasks are recommended to be carried out for at least two times a year.

- Make sure there is air-flow around the controller. Clear up any dirt and fragments on radiator.
- Check all the naked wires to make sure insulation is not damaged. Repair or replace some wires if necessary.
- Tighten all terminal screws to the indicated torque; Inspect for loose, broken, or burnt cable/wire connections.
- Check and confirm that LCD works as required. Pay attention to any troubleshooting or error indication. Take corrective action if necessary.
- Make sure all system components are effectively and tightly connected to ground.
- Check all terminals for any corrosion signs, damaged insulation, increased temperature .
- Check for any dirt, nesting insects and any corrosion signs. Implement corrective actions as early as possible.

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

8, Technical Data

	Model	12V / 24V 20AH MPPT
Battery Parameters	Max Charging Current	20A
	System Voltage	12V / 24V automatic recognition
	MPPT Charging Voltage	before boost or equalization charging stage
	Boost Voltage	14.0V-14.8V / 28.0V-29.6V @25℃ (default: 14.5V / 29.0V)
	Equalization Voltage	14.0V-15.0V / 28.0V-30.0V @25℃ (default: 14.8V / 29.6V)
	Float Voltage	13.0V-14.5V / 26.0V-29.0V @25℃ (default: 13.7V / 27.4V)
	Low Volt. Disconnect	10.8V-11.8V / 21.6V-23.6V (default: 11.2V / 22.4V)
	Reconnect Voltage	11.4V-12.8V / 22.8V-25.6V (default: 12.0V / 24.0V)
	Overcharge Protect	15.8V / 31.3V
	Max volt on Bat. terminal	35V
	Temp. Compensation	-4.17mV/K per cell (Boost, Equalization), -3.33mV/K per cell (Float)
	Charging target voltage	10.0V-32.0V (Lithium, default: 14.4V)
	Charging recovery voltage	9.2V - 31.8V (Lithium, default: 14.0V)
	Low voltage disconnect	9.0V - 30.0V (Lithium, default: 10.6V)
	Low voltage reconnect	9.6V - 31.0V (Lithium, default: 12.0V)
	Battery Type	Gel, AGM, Liquid, Lithium (default: Gel)
Panel Parameters	Max volt on PV terminal *1	95V
	Max input power	260/520W
	Day/Night threshold	3.0V-10.0V / 6.0V-20.0V (default: 8V/16V)
	MPPT tracking range	(Battery Voltage + 1.0V) ~Voc*0.9 *2
Load	Output Current	20A
	Load mode	Always on, Street lamp, User-defined Mode (default: Always on)
System Parameters	MPPT tracking efficiency	>99.9%
	MPPT charge conversion	98.0%
	Dimensions	136.6*136.6*67.1mm
	Weight	830g
	Self consumption	≤12mA
	Communication	RS485(RJ11 interface)
	Optional	IoT,BLE(Internal/External)
	Grounding	Common Negative
	Power terminals	6AWG(16mm²)
	Ambient temperature	-20 ~ +55℃
	Storage temperature	-25 ~ +80℃
	Ambient humidity	0 ~ 100%RH
	Protection degree	IP32
	Max Altitude	4000m

9.Conversion Efficiency Curves

Test conditions: Illumination intensity: 1000W/m² Temperature: 25℃