Solar Technology International
Without boundaries

PV Logic®

User manual

MPPT Pro Plus
Solar Charger Controller

Covering
20A charge controller STCC20M (SR-MC2420N10)
30A charge controller STCC30M (SR-MC2430N10)

Important: please read before first use.

Technical helpline
01684 774 000

SAFETY INSTRUCTIONS

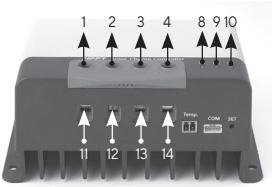
1. Please read the manual carefully before use and operate the controller only after safety operation training has been completed.
2. There are no parts inside the controller that need to be maintained or repaired. The user shall not disassemble and repair the controller.
3. Install the controller indoors to prevent exposure of components and prevent water from entering the controller.
4. Install the controller in a well-ventilated place to prevent the heat sink overheating.
5. It is recommended to install a proper fuse / circuit breaker outside the controller.
6. Be sure to disconnect the wiring of PV array and the fuse or circuit breaker near battery terminal before installation and wiring adjustment of the controller.
7. Check that all wiring is tight after installation to avoid danger of heat accumulation due to poor connections.

Warning: Safety preparations must be made. This operation may have a destructive effect.

FEATURES

- Maximum power point tracking technology (MPPT) allows the controller to track the maximum power point of solar panels even in a complex environment. Compared with the traditional MPPT tracking technology, it boasts faster response speed and higher tracking efficiency.
- The built-in MPPT algorithm can significantly increase energy efficiency of the photovoltaic system, by about 15% to 20% higher than traditional PWM charging.
- Active charging voltage regulation feature. At battery open circuit or lithium battery BMS overcharge protection, the controller battery terminal will output the rated charging voltage value.
- MPPT tracking efficiency is up to 99.9%.
- Circuit energy conversion efficiency is as high as 98%.
- Support charging procedures of various types of batteries such as lithium–, colloidal–, sealed–, vented batteries etc.
- A current-limited charging mode is available. The controller automatically reduces the charging power so that the solar panel can operate at the rated charging current.
- Support automatic identification of lead-acid battery voltage.
- In-built Bluetooth module enables viewing of operational data/status, and modification of controller parameters.
- With the built in Bluetooth function you can view the running data and status of equipment and the change of controller parameters.
- Support standard Modbus protocol to meet communication needs.
- Built-in over-temperature protection ensures that when temperature exceeds the set value, the charging current decreases linearly with the temperature, thereby avoiding high temperature damage.
- Temperature compensation and automatic adjustment of charge and discharge parameters help to improve battery life.
- Solar panel short circuit protection, battery open circuit protection and TVs lightening protection etc.

1 Solar panel interface (+)
2 Solar panel interface (-)
3 Battery interface (-)
4 Battery interface (+)
5 External temperature sampling interface
6 Communication Interface
7 Operation keys
8 PV charging indicator
9 Battery level indicator
10 Battery type indicator
11 VCC12V/20mA
12 RX
13 TX
14 GND



Model	STCC20M	STCC30M
System voltage	12V/24V Auto	
Max. PV open circuit voltage	92V(25)100V (Lowest ambient temperature)	
Rated charging current	20A	30A
Max. PV input power	260W/12V 520W/24V	400W/12V 800W/24V

MPPT TECHNOLOGY INTRODUCTIONS

The Maximum Power Point Tracking (MPPT) system is an advanced charging technology that enables the solar panel to output more energy by adjusting operating conditions of the electrical module. Due to non-linear characteristics of solar array, there is maximum energy output point (maximum power point) of an array on its curve. Traditional controller (switch charging technology and PWM charging technology) fails to maintain battery charging at this point, and therefore the maximum energy of the solar panel cannot be obtained. The solar charge controller with MPPT control technology, however, can track the array's maximum power point at all time to obtain the maximum energy to charge the battery.

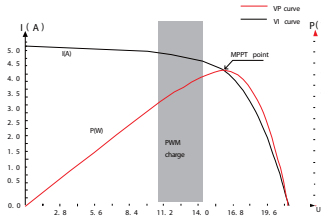
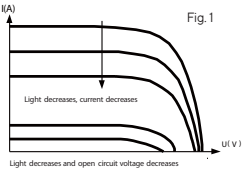
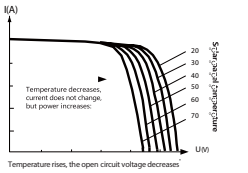


Figure 1-2 Solar panel output characteristics curve

Take a 12V system as an example. Peak voltage (Vpp) of the solar panel is about 17V, while the battery voltage is about 12V. In general, when the controller is charging the battery, the voltage of solar panel is about 12V and does not fully contribute its maximum power. But, MPPT controller can overcome this problem. It constantly adjusts the input voltage and current of the solar panel to achieve the maximum input power.



Compared to the traditional PWM controller, the MPPT controller can provide the maximum power of the solar panel and thus can provide a larger charging current. In general, the MPPT controller can improve the energy utilisation by 15% -20% compared with the PWM controller.



In addition, due to the difference in ambient temperature and light conditions, the maximum power point often changes (see graphs Fig. 1). The MPPT controller can adjust parameters according to different conditions from time to time to keep the system near to its maximum working point. The whole process is fully automatic and does not require any adjustments by users.

CHARGING STAGE INTRODUCTIONS

As one of the charging stages, MPPT cannot be used alone. It is usually required to combine boost charge, floating charge, equalizing charge and other charging methods to complete the battery charging process. A complete charging process includes: Quick charge, holding charge and floating charge. Charging curve is shown right (Fig. 2):

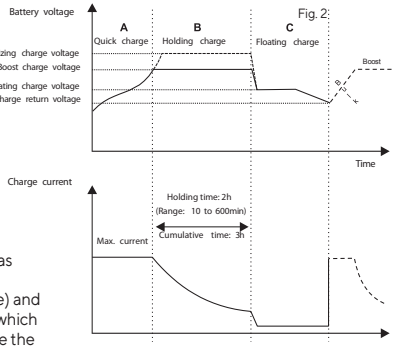


Fig. 2:

Quick charge

In quick charge stage, the battery voltage has not yet reached the set value of full charge voltage (i.e. equalising/boost charge voltage) and the controller will perform MPPT charging, which will provide maximum solar energy to charge the battery. When the battery voltage reaches the pre-set value, constant voltage charge will start.

Holding charge

When the battery voltage reaches the set value of holding voltage, the controller will perform constant voltage charging. This process will no longer include MPPT charging and the charging current will gradually decrease with time. Holding charge comes in two stages, i.e. equalising charge and boost charge. The two stages are conducted without repetition, in which equalising charge is started once every 30 days.

Boost charging

The default duration of boost charge is 2 hours. The customer can also adjust the holding time and the pre-set value of boost voltage point according to actual needs. When the duration reaches the set value, the system will switch to floating charge.

Floating charging

Floating charge is conducted following the holding charge stage, where the controller will reduce the battery voltage by reducing charge current and allow the battery voltage to remain at the floating charge set value. During the floating charge stage, the battery is charged in a very low voltage to maintain full charge state of the battery. In this stage, the load can get nearly all of the solar energy. If the load exceeds the energy that solar panel can provide, the controller will not be able to maintain the battery voltage in the floating charge stage. When the battery voltage is as low as the recovery charge set point, the system will exit floating charge stage and re-enter the fast charge stage.

Equalising charging

Equalising charge increases the battery voltage above standard voltage, causing vaporisation of battery electrolytes. If this is detected, the controller automatically controls the next stage to be equalising charge. The equalising charge will last for 120 minutes (default). The equalising charge and boost charge are not repeated in a full charge process to avoid too much gas evolution or battery overheating.

Note - When the system cannot continuously stabilise the battery voltage at a constant voltage due to influence of installation environment or load, the controller will accumulate time until the battery voltage reaches the set value. When the accumulated time reaches 3 hours, the system will automatically switch to floating charge.

Note - If the controller clock is not calibrated, the controller will perform regular equalising charge according to its internal clock.

INSTALLATION PRECAUTIONS

- When installing a vented lead-acid battery, wear protective glasses. If contact with battery acid, please rinse with clean water.
- Avoid placing metal objects near the battery to prevent battery short circuit.
- Acid and flammable gases may be generated when the battery is charged. So ensure good ventilation and keep away from sparks.
- Avoid direct sunlight and infiltration of rainwater when installing outdoors.
- Poor connection points and corroded wires may cause extreme heat and even cause fire. It is necessary to ensure that connectors are tightened and the wires preferably fixed with cable ties.
- When wiring use insulated tools and ensure that hands are dry.
- Battery terminal on the controller can be connected with either a single battery or a battery pack. Subsequent instructions in the manual are for a single battery, but it also applies to the latter.

Warning: Risk of explosion! Equalising vented lead-acid battery may generate explosive gases. The battery compartment must be well ventilated.

Caution: Damage of device! Equalisation can increase the battery voltage to levels that may damage sensitive DC loads. It is necessary to verify that the allowable input voltage of all system loads is greater than the equalising charge set value.

Over charge and excessive gas evolution may damage the battery plates and cause active substances on the battery plate to come off. Equalising charge may cause damage if voltage is too high or prolonged. Please carefully check the specific requirements of the battery used in the system.

- Observe the safety recommendations of the battery manufacturer.
- The system connection wires are selected according to current density not more than 4A/mm2.
- Make the controller grounded.

WIRING SPECIFICATIONS

Wiring and installation must comply with national and local electrical code requirements. PV and battery connection wires must be selected according to rated current. Refer to the following table for wiring specifications:

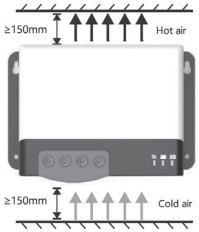
Models	PV maximum Input current	Max. wire diameter at PV end(mm^2/AWG)	Rated charge current	Battery wire diameter (mm^2/AWG)
STCC20M (MC232ON10)	20	5/10	20A	5/10
STCC30M (MC2430N10)	30	8/8	30A	8/8

INSTALLATION AND WIRING

Warning: **Danger, Explosion!** Never install the controller and a vented battery in the same enclosed space! Also do not install in an enclosed place where battery gas may collect.

Warning: Danger, High Voltage! PV arrays may generate very high open circuit voltages. Disconnect circuit breaker or fuse before wiring and take care during wiring.

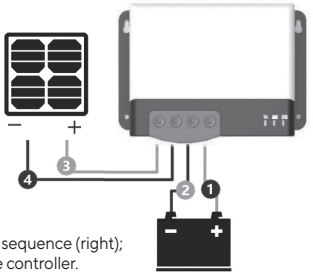
Caution: When installing the controller, ensure that there is enough air to flow through the controller's heat sink, leaving at least 150mm above and below the controller to ensure natural convection for heat dissipation. If installed in a closed box, ensure reliable heat dissipation through the box.



Step 1. Choose an installation location. Avoid installing the controller in a place free of direct sunlight, high temperature, and water, and ensure good ventilation around the controller.

Step 2. Mark the position of the mounting holes. Drill 4 holes of the appropriate size. Fix screws into the upper two mounting holes.

Step 3. Fasten the Controller. Align fixing holes of the controller with the two pre-fixed screws and hang the controller up. Fix the lower two screws.



Step 4. For installation safety, we recommend a wiring sequence (right); however, wiring in other sequence will not damage the controller.

Warning: Danger, Electric shock hazards! We strongly recommend connecting a fuse or circuit breaker to the PV array and battery terminals to prevent electric shock hazards during wiring, and make sure that fuse or circuit breaker is disconnected before wiring.

Warning: Danger, Explosion hazards! If the positive and negative terminals of battery and connecting wires are short-circuited, it may cause a fire or explosion.Connect the battery first, and then the solar panel. Please follow the **+ first** and **- next** method when wiring.

When all wires are connected firmly, check whether the wiring is correct and whether the polarity is reversed. After confirmation, connect the battery fuse or circuit breaker and observe whether the LED indicator is on. If not, disconnect the fuse or circuit breaker immediately and check whether wiring is correct.

When the battery is properly energised, connect the solar panel. If there is sufficient sunlight, the charge indicator of controller will be steady on or flash and start to charge the battery.

Warning: When the controller has stopped charging for 10 minutes, reverse polarity of the battery can damage the controller's internal components.

Note - The battery fuse must be installed as close as possible to the battery terminal. The recommended distance is no more than 150mm. The battery temperature is 25°C (fixed value) unless the controller is connected to a remote temperature sensor.

PRODUCT OPERATION AND DISPLAY

LED Indicators There are a total of three indicators on the controller.

① ② ③	1. PV array indication	Indicate current charging mode of controller
	2. Battery indication	Indicate current state of battery
	3. Battery type indication	Indicate current battery type

1. PV ARRAY INDICATOR

No	Charge status	Indicator state	Charge state
1	Bulk	Steady on	MPPT charging
2	Acceptance	Slow flashing	Boost charging
3	Float	Single flashing	Floating charging
4	Equalise	Quick flashing	Equalising charging
5	Current - limited	Double flashing	Current - limited charging
6		Off	No charging

2. BATTERY INDICATOR

Colour	Indicator status	Battery status
Green	Steady on	Full charge
Yellow	Steady on	Voltage normal
Red	Steady on	Voltage below under-voltage
	Quick flash	Over-voltage or over temperature

3. BATTERY TYPE INDICATOR

Colour	Battery status
Green	Sealed lead-acid battery
Yellow	Colloidal lead-acid battery
Red	Venated lead-acid battery
Blue	Lithium iron phosphate battery 12V
Purple	Lithium iron phosphate battery 24V
White	Custom

KEYS OPERATION

There is a key on the controller, which is used in conjunction with the battery type indicator for selection of battery type. The specific operation mode is as follows:

In the current operating state, press and hold the key for 8 seconds. The battery type indicator (the colour displayed is that of the previously saved battery type) starts to flash (the controller turns off charging and other works and enters idle state).

At this point, each time the key is pressed, the battery type indicator changes a colour which corresponds to a battery type. After the battery type is selected, press and hold the key for 8 seconds again or maintain no operation for 15 seconds. Then, the controller will automatically save the currently set battery type and enter the normal operating mode. In addition, press and hold the key for 20 seconds, and the controller will restore the factory default parameters.

PRODUCT PROTECTION

Waterproofing protection Rating: IP32

Input power limited protection When the power of solar panel is higher than the rated value, the controller will limit the power of solar panel within the rated power range to prevent damage by over current, and the controller enter the current-limiting charge.

Battery reverse polarity protection If the battery polarity is reversed, the system will not work but it will not burn out the controller.

PV input end voltage is too high If the voltage at the PV array input end is too high, the controller will automatically shut off the PV input.

PV input end short circuit protection If the voltage at the PV array input end is short circuited, the controller will turn off charging; after short circuit is removed, charging will automatically recover.

PV input reverse polarity protection Reversed polarity of PV array will not damage the controller. Normal operation will continue after wiring error is corrected.

Night reverse charging protection Prevent battery discharge through the solar panel at night.

Over-temperature protection When temperature of the controller exceeds the set value, it will reduce charging power or stop charging.

TVS lightning protection.

SYSTEM MAINTENANCE

- To maintain the best long-term performance for controller, it is recommended to conduct inspections twice a year.
- Make sure the airflow around the controller is not obstructed and remove any dirt or debris from the heat sink.
- Check if the insulation layers of all exposed wires are damaged due to sun exposure, friction with other objects nearby, dry rot, destruction of insects or rodents, etc. If so, it is necessary to repair or replace the wire.
- Verify if indicators are consistent with the device operations. Correct any malfunctions or error indications if necessary.
- Check all wiring terminals for corrosion, insulation damage, signs of high temperature or burning/discoloration. Tighten terminal screws.
- Check for dirt, insects nesting and corrosion and clean as required.
- If the lightning arrester has failed, replace it to protect controller and other devices from being damaged by lightning. Correct any malfunctions or error indications if necessary.

Warning: Danger, electric shock hazards! Make sure that all power supplies to the controller have been disconnected before checks or operations as above.

COMPARISON OF PARAMETERS

If a user-defined battery is used, the default voltage parameters of the system are the same as those of the sealed lead-acid battery: Overvoltage disconnection voltage> charge limit voltage ≥ equalizing charge voltage ≥ boost charge voltage ≥ floating charge voltage> boost charge recovery voltage; Overvoltage disconnection voltage> Overvoltage disconnection recovery voltage;

COMPARISON OF PARAMETERS OF VARIOUS TYPES OF BATTERY

Set voltage battery type	Sealed lead-acid	Colloidal lead-acid	Vented lead-acid	Lithium	User defined
Overvoltage disconnection voltage	16.0V	16.0V	16.0V	——	9 – 17V
Equalizingcharge voltage	14.6V	——	14.8V	——	9 – 17V
Boost chargevoltage	14.4V	14.2V	14.6V	14.4V	9 – 17V
Floating chargevoltage	13.8V	13.8V	13.8V	——	9 – 17V
Boost chargerecovery voltage	13.2V	13.2V	13.2V	——	9 – 17V
Equalizing chargeduration	120 min.	——	120 min.	——	0 – 600 min.
Equalizing charge interval	30 days	0 days	30 days	——	0 – 250 days (0 indicates turning off equalising charge function)
Boost charge duration	120 min.	120 min.	120 min.	——	10 – 600 min.

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