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1. Overview

GSC Series MPPT-type Solar Charge Controller is specifically designed for home-use solar system, solar DC street lighting system, small-scale solar power plant system, solar DC power supply system, and other electrical premises. It employs advanced low-power consumption, high-performance micro-controller, dedicated control algorithm, tandem PWM charging circuit, 12V/24V (F1224); 24V/48V (F2448) voltage level automatic identification function which can intelligently controls solar cell to both charge the battery and supply power for DC load. It has complete protection mechanism and achieved "MPPT+SOC" double intelligent charge control. All power switching devices employ low-loss, high-efficient, long-life MOSFETs, using synchronous rectification technology, which greatly reduces the power loss of charging circuit and load output circuit and thus is a green and environmental protection smart charge controller.

2. Safety Precautions

- 1) Incorrect installation may cause damage to the product; installation should be completed by specialist.
- 2) The controller is wall-mount installed, which can take advantage of airflow's "chimney effect" for cooling the controller. The top of the controller shall not be covered by any airtight material and firmly fixed.
- 3) Select appropriate cable, recommend the standard wire that the current is not more than 5A per square millimeter, and minimize the wire length to reduce the conduction losses.
- 4) Controller must be installed inside the room where it's dry and ventilate with good heat dissipation. The product should not be used in the following environments:
 - Place of humidity, rain and sun, such as bathrooms, outdoor;
 - Place with potentially explosive gas or combustible gas;
 - Place stacked of combustibles nearby;
 - Place where children are easy to reach;
 - Place where temperature exceed the range of -20°C, +45°C;

- 5) To ensure that the battery wiring is correct, and the controller can work properly, and then connect the wires of the solar panels, pay attention to the "+", "-" pole, no reverse. If there is sunlight, the charging status LED should be on. Otherwise, need to check the connections.
- 6) When replacing the battery or turning off the battery switch, the solar cell connection and load connection have to be disconnected first. It is strictly prohibited the solar power input if the system isn't function properly.

Safety Warning:

batteries and solar cable connection short circuit may lead to ignition burns and fire hazard. Battery + (positive), - (negative) pole reversed, wrong connection or short circuit is strictly prohibited.

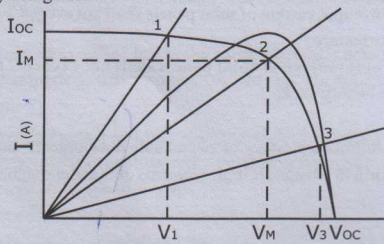
- 7) Multi-class lightning protection system consists of special lightning protection devices should be used for lightning-prone areas.
- 8) System Configuration Notes:
 - Battery voltage must be consistent with the system rated voltage, otherwise it will lead to the damage of device or battery pack;
 - Battery pack capacity (AH) must be three times larger than the maximum output current of the solar panels;
 - The maximum output current and voltage of solar panels should be less than the controller rated current and voltage;
 - The maximum output current of solar panels shall not exceed 30% of the rated capacity of the battery;
 - The open circuit voltage of solar panels shall not exceed 2 times of rated voltage of the battery pack;

(The company follows a strategy of sustainable development, and reserved the right of not inform in advance if improvements of the user manual content have been made.)

3. System Description

The Controller is specifically designed for solar DC street lights, small-scale solar power plants, DC power supply system, and other electrical premises. It employs advanced low-power consumption, high-performance micro-controller combined with intelligent digital control technology, efficient PWM charging mode, and MPPT+SOC double intelligent optimization charging control technology to supply power for DC load, which improved the photovoltaic conversion efficiency and battery charging performance. The output power of solar cell relates not only to light intensity, but also closely to the size of output current. From the I-V Characteristic Curve of Solar Cell (Feature 1), it can be found that solar cell will reach to its maximum output power in a certain output current and output voltage conditions. In order to obtain the maximum amount of energy with the current sunshine, it is necessary to take measures that can allow solar cell's output features to automatically track the surrounding climate change conditions to achieve maximum energy collection. This controller employs intelligent maximum power point tracking technology to adjust solar-cell panel working voltage, making it operate on the maximum power point of the I-V characteristic curve, thus ensuring the solar battery is always on the output power value maximum state under different environmental conditions. Compared with the normal solar charge controller, this product can increase the solar panel energy conversion efficiency (generation power) up by 20-30%.

When controller is powered on, the system will automatically distinguish battery voltage level to ensure that the battery is on the best energy storage status, and thus extend battery using life.



Feature 1 I-V Characteristic Curve of Solar Cell

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4. Main Features

1) Voltage Automatic Identification:

12V/24V (F1224)、24V/48V (F2428) Battery voltage level automatic identification.

2) Advanced MPPT algorithm:

MPPT technology is a control method of maximum power tracking, which can adjust intelligently solar cell working point, making it operate on the maximum power point of the I-V characteristic curve, thus ensuring the solar battery is always on the output power value maximum state under different environmental conditions. Compared with the normal solar charge controller, this product can increase the solar panel energy conversion efficiency (generation power) up by 20-30%.

3) Intelligent Charging Management:

While discharge over, system will have battery equalized charged for compensation maintenance. While normally operating, the combination of constant charge (CC / CV) and float charge has been applied to fully extend the battery life, with high precision temperature compensation function to make more control accurate charge.

4) PWM Control Technology:

Employs PWM main control circuit and high-speed, low-resistance power MOSFET which make voltage loss of the charge and discharge circuit 50% lower than traditional products and improves charging efficiency by 3% -6%.

5) Synchronous Rectification:

This system uses synchronous rectification to reduce the voltage drop of the return power circuit.

6) Perfect Protection Features:

The system has overcharge, over discharge, load short circuit, overload, unique anti-reverse polarity and TVS anti-lightning protection, which improved the system's reliability and security.

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7) All-Digital Control:

Uses advanced low-power, high-performance micro-controller, adaptive intelligent control algorithm, and "MPPT + SOC" double intelligent optimum charge control.

8) Intelligent Alarm:

LED indicator and buzzer alarm (only LED) approach, intuitive display of the solar cell, battery and load status, sound-and-light alarm of possible fault state, and a timely reminder of troubleshooting according to user manual.

9) Digital Display:

Uses LCD menu to display real-time system operating parameters and working conditions, providing real-time, accurate system operation data (LCD products).

10) Online charging parameter adjustment:

Depending on the characteristics of the battery requirements, users can do online fine-tuning to its controlled charging current and voltage, which would be convenient for users to manage battery charge

11) Intelligent Communication Interface and Dry Contact Interface (Optional):

The system has RS232 interface and dry contact interface, convenient for users to do system monitor and intelligent management.

5. Specification

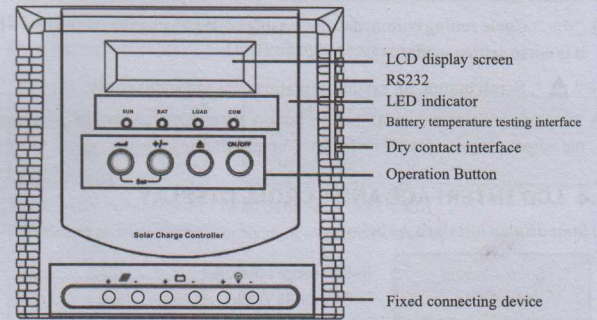
Model	F2448-10M	F1224-20M F2448-20M	F1224-30M F2448-30M	F1224-40M F2448-40M	F1224-50M F2448-50M	F1224-60M F2448-60M
System voltage	12V / 24V ; 24V/ 48V					
Rated charging current	10A	20A	30A	40A	50A	60A
Output current	10A	20A	30A	40A	50A	60A
PV panels (Imp≤rated current)	≤10A	≤20A	≤30A	≤40A	≤50A	≤60A
Battery capacity	38Ah~800Ah					
Max. efficiency	> 98%					
Max. PV Input voltage (Voc)	12V: 0-24V; 24V: 0-48V; 48V:0-95V					
PV working voltage (Vmp)	12V: 14.5V-18V; 24V: 29V-38V; 48V: 58V-72V					
Rated battery voltage	12V / 24V ; 24V / 48V					
Equalized charge voltage	14.6V / 29.2V±1% ; 29.2V/58.4V±1%					
Float charge voltage	14.4V / 28.8V±1% ; 28.8V/57.6V±1%					
Overcharge	14.7V / 29.4V ±1% ; 29.4V / 58.8V±1%					
Charging resume voltage	13.2V / 26.4V±1% ; 26.4V / 52.8V±1%					
Under voltage alarm	11.2V / 22.4V±1% ; 22.4V / 44.8V±1%					
Over discharge	10.8 V / 21.6 ±0.3V ; 21.6V / 43.2 ±0.4V					

Over discharge resume starting voltage	13.2 V / 26.4 ±0.3V ; 26.4 V / 52.8 ±0.4V
Discharge circuit drop voltage	< 5 % system rated voltage
Overload, short circuit	125% (60s) / 150% (10s) / short circuit shut down automatically,
PV anti-reverse polarity protection	yes
Display	LCD + LED
Alarm mode	Sound(optional), light alarm
Control mode	Switch control / PWM
Communication interface(optional)	RS232 / dry contact
Battery temperature compensation	(optional)
Working temperature	-20°C to +45°C
Relative humidity	0-95% (Non-condensing)
Storage temperature	-25°C to +85°C
Storage humidity	≤85%
Installation method	Hanging vertical installation
Dimension	164×168×55 mm

Notes:"M" means with MPPT function

6. Control panel manual

6.1 Control panel display and operation instruction



Caution:

terminal S, the functional option interface, which is on right side of controller, can not be connected without requirement.

6.2 LED Display instruction

SUN: On, PV input in normal mode; Flash, PV overvoltage; Red light on, PV polar reversed.

BAT: Green light on, battery input in normal mode; Green light flashes (1time/1s), battery over discharged; Yellow light on, (1time/1s) charging over current.

FAULT: long bright, output short circuit, over current protection .Flash, charging over current.

LOAD: On, output in normal mode; flash, output overload.

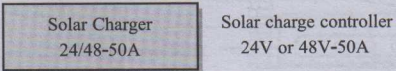
COM: Communication indicators, flash when communications with outer system interface RS232.

6.3 Button function instruction

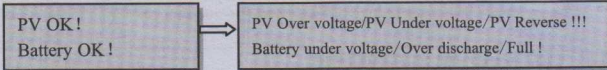
- 1) “**↵**” and “**+/-**” (SET) : Setting button, enter system parameter settings after pressing these two simultaneously for 3s.
- 2) “**↵**”: Enter button, for enter or exit (be ineffective when it is not in setting mode).
- 3) “**+/-**”: Cycle setting button, data increasing or decreasing (be ineffective when it is not in setting mode)
- 4) “**▲**”: Scroll button, for system operating data and status check
- 5) “ON/OFF”: System manual ‘on/off’ button. Press “ON” and hold for 3s, launch the output, Press and hold for 3s again, output shutting down

6.4 LCD INTERFACE AND SCROLL DISPLAY

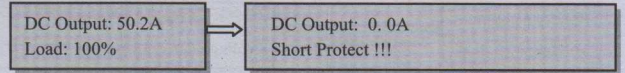
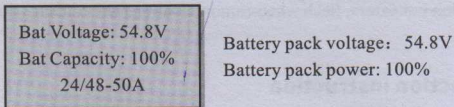
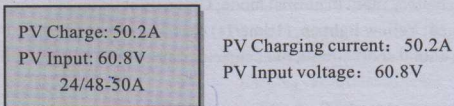
1) Start display interface ,as below;



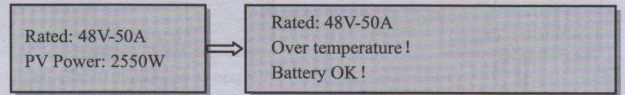
2) Press “**▲**” button, the display as shown below(the right one is the content of display in specific condition for the system):



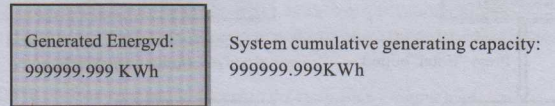
PV input information: normal / overvoltage / low voltage / reverse polarity
 Battery voltage: Normal / low voltage / Over discharge / Fault



DC output current: 50.2A /0.0A
 Output overload capacity: 100%; Output short circuit



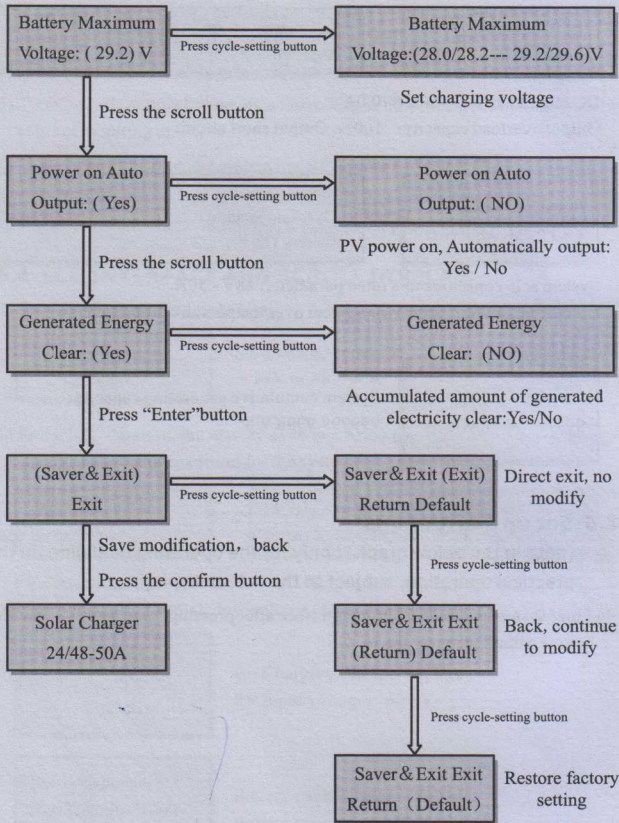
System self-consciousness rated parameter: 48V - 50A
 PV current power: 2550W or System over temperature protection



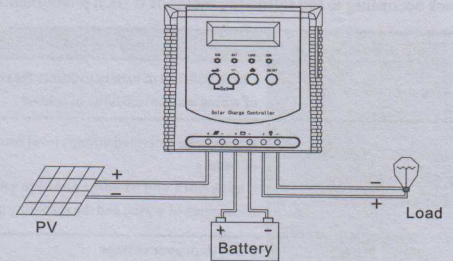
6.5 Set up instructions

(data in the below graph is only for the operating guideline, in the practical operation, subject to the actual display):

- 1) Enter system parameter setting interface after pressing “**↵**” and “**+/-**” (setting bottom)simultaneously for 3s.



7. Production installation



- 1) According to the system requirements, you should first install battery “+/-” pole and DC air switch (the switch current specification should be chosen 1.3-2 times of the rated current)connection ,then connect the serial cables between battery pack ,and make sure the wiring is correct.
- 2) Put the load connection access to the controller’s output load
- 3) Put the solar panel connection access to the controller’s solar battery, when solar battery is more than one pack, it’s suggested to use array combiner

Caution:

The “+/-” pole of the solar cell ,batteries and load should be corresponding to those of controller PV output, battery input and load, reversed connection is not allowed, otherwise may lead to the damage of the product.

8. Operating Instructions

- 1) Manual switch on/off: Press and hold 3s “on/off”bottom on the panel to turn on the output, repeat it, then turn off the output.
- 2) The system factory default setting is to switch on automatically when PV has power; this is the so-called unattended function, if no need, please enter system setting to deactivate such function.

9. Common Faults and Treatments

Please check according to the following methods if such phenomenon occurs:

Fault Indication	Resolving Method
All indicators are off	Check both end of battery to ensure the correctness of wiring and the reliability of contact
When is sunlight shooting the solar panels directly, charging indicator off	Ensure solar cell rated voltage level matches that of battery Check both end of solar panel to ensure the correctness of wiring and the reliability of contact
SUN: Flash	PV system over voltage
BAT: Yellow light Flash	Battery open circuit or low voltage, check the reliability of PV input connection; or controller damaged
FAULT: Long on	Output short -circuit, please check output circuit, press "on" button after removed all loads, controller will be back to normal output after 30s.
FAULT: Flash (1 time/1s)	Please Check if the PV panel configuration exceeds system's ratings. Remove the redundant PV panels
LOAD: Flash (1 time/1s)	Load power exceed the rated one, reduce the No. of electrical-consuming equipment, press load switch button, controller output will recover the output after 30s.