Photonic Universe
www.photonicuniverse.com
+44 (0) 203 150 11 11

5A 12V
solar charge controller

PU0512 series

Instruction Manual

Dear Customer,

Thank you very much for choosing our product. This manual contains important information about the installation and operations of your charge controller.

Please read this manual carefully **before installation** and pay special attention to the safety recommendations.

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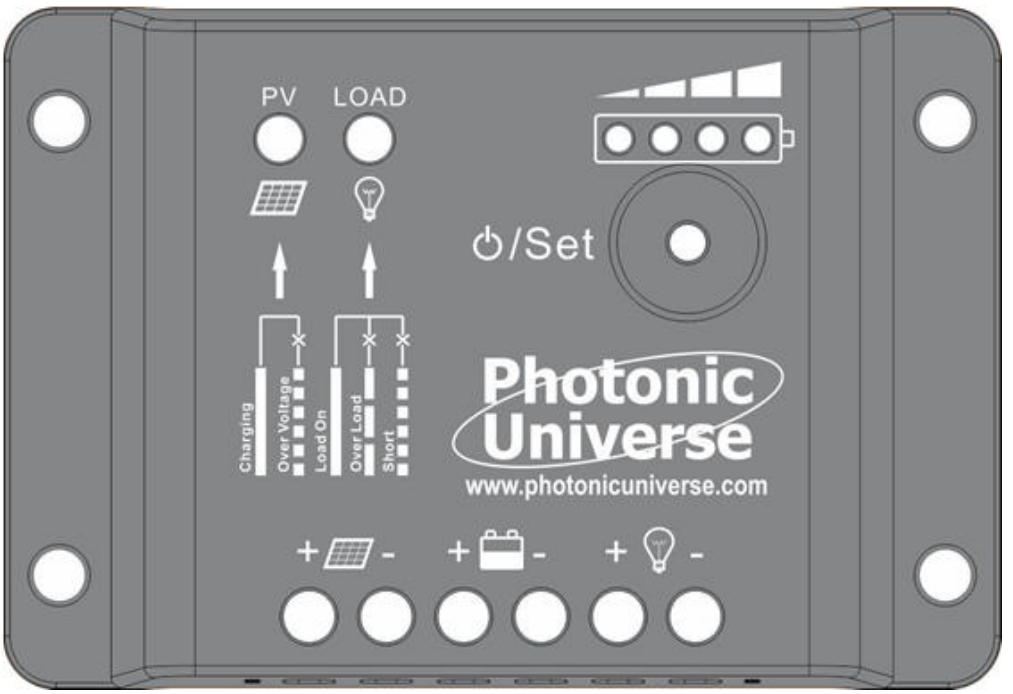
5A 12V Solar Charge Controller

PU0512 series



Nominal system and battery voltage	**12V**
Maximum solar panel input voltage	**50V**
Nominal charging / load current	**5A**

Contents

1. Important Safety Information

This manual contains important information about the safe installation and operations of the charge controller.

The following signs are used throughout this manual to indicate potentially dangerous conditions or mark important safety recommendations. Please pay special attention when you see these signs:

WARNING: Indicates potentially dangerous conditions. Extreme caution required when performing the task.

CAUTION: Indicates a critical procedure for correct installation and safe operations of the solar charge controller.

NOTE: Indicates a procedure or function that is important for the safe and proper operation of the controller.

General Safety Information

- Read the full instruction manual before installing the solar charge controller and make sure you understand all requirements, procedures and warnings.
- Make sure that this model of the solar controller is suitable for your system. In particular, it is very important that the current rating limit 5A (5 amp) of the solar controller is never exceeded by the solar panel or load.
- There are no parts serviceable by users. Do not disassemble or attempt to repair the controller.
- Install external fuses/breakers as required.
- Connect system components in the order recommended by the manual.
- When doing the installation work or any system adjustments, disconnect all components from the solar controller in the order reverse to connection.
- Do not allow any contact with water, oil or grease.
- Confirm that power connections are tightened, secure, and properly insulated if applicable.
- The controller is suitable for solar panels only. Do not use it with any other source of energy such as wind turbine or mains charger.

2. General Information

2.1 Product Overview

Thank you for choosing our 5A 12V solar charge controller *PU0512 series*. This controller uses *Pulse Width Modulation (PWM)* technology which can increase the lifespan of your battery and improve performance of the solar system. *PWM* technology can also recover some lost battery capacity. Other features of this solar charge controller include:

- Advanced 4-stage *PWM* charging controlled by a microprocessor
- Use of MOSFET electronic switch (no mechanical switches)
- LED indicators to show charging and load status, as well as the state of charge of the battery.
- Automatic temperature compensation (adjustment of charging parameters depending on the room temperature for more efficient charging)
- Electronic protection: over charging, over discharging, overload, short circuit, reverse current (from the battery back to the solar panel at night)
- Reverse polarity protection for the battery.

This controller is designed for off-grid solar systems, such as solar lighting systems, or for charging 12V batteries in motorhomes, caravans, campers, boats, and remote locations.
This solar charge controller has the full set of self-diagnostic and electronic protection functions; these prevent damage from installation mistakes or system faults.
The unit protects the battery from overcharging by the solar module and over discharging by the load. The charging process is optimised for maximum charge acceptance and long battery lifespan.

Although the controller is easy to operate and use, please take your time to read this manual carefully and become familiar with it. This will help you to install the product safely and make full use of all the functions and improve the performance of your solar PV system.

2.2 Product Features

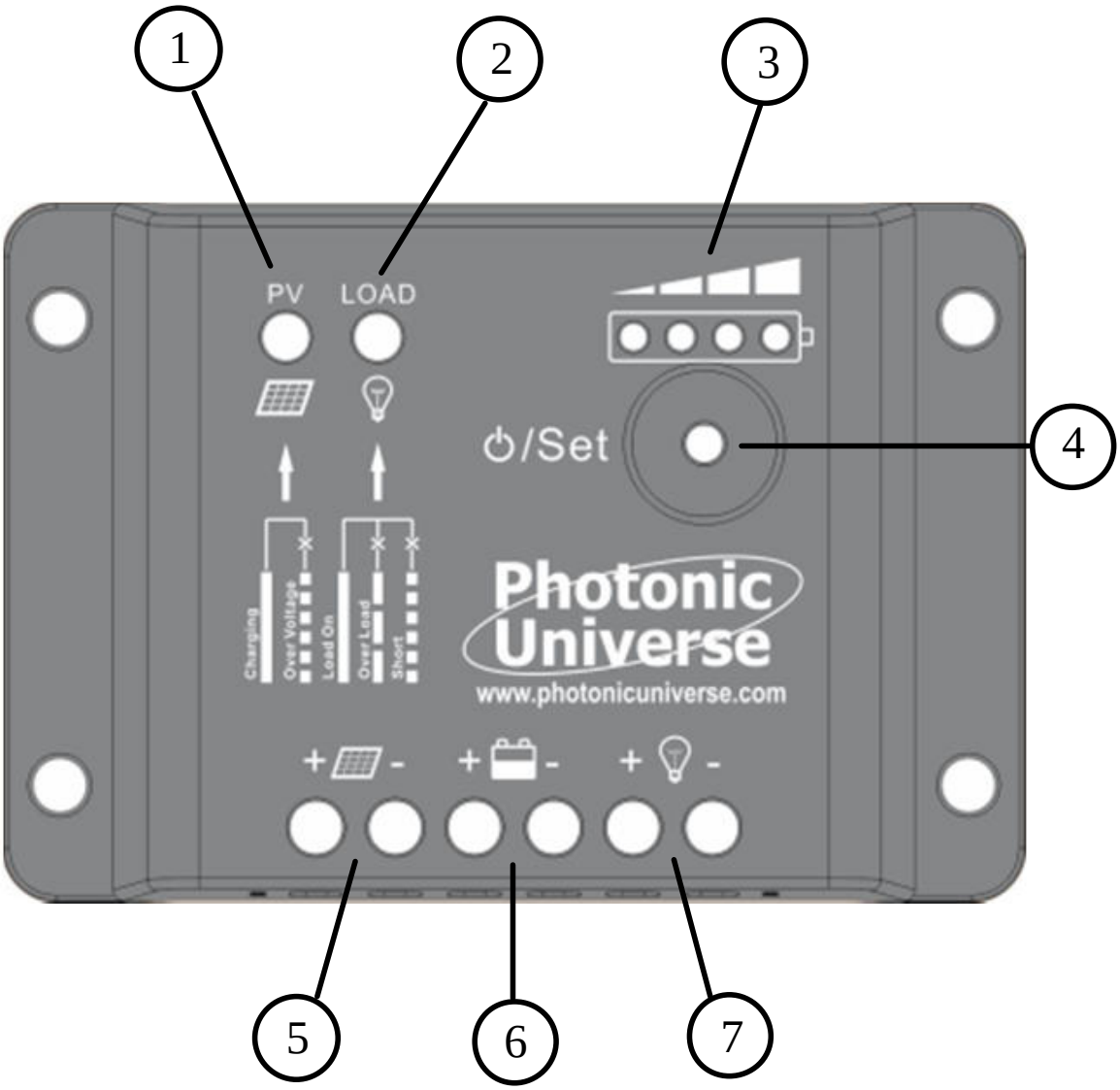


Figure 2-1 Key features

1. Charging status LED indicator

An LED indicator that shows the charging status and also indicates when the battery voltage is higher than the over voltage disconnect point.

2. Load status LED indicator

Displays the status of load (power at load terminals).

3. Battery voltage LED indicators

Four LED indicators showing the state of charge of the battery.

4. Settings button

Used to switch the load On/Off and select the battery type.

5. Solar Module Terminals

Positive and negative terminals for connecting a solar panel.

6. Battery Terminals

Positive and negative terminals for connecting a 12V battery.

7. Load Terminals

Positive and negative terminals for connecting a 12V load.

3. Installation Instructions

3.1 General Installation Notes

- Read through the entire installation section first before beginning the installation.
- Be very careful when working with batteries. Wear eye protection. Have fresh water available to wash with immediately and clean any contact with battery acid.

- Use insulated tools and avoid placing metal objects near batteries.
- Batteries might produce some explosive gases during charging. Make sure there is sufficient ventilation in the work area.
- Do not install the controller in direct sunlight or possible contact with water.
- Loose power connections and/or corroded wires may result in resistive connections that melt wire insulation, burn surrounding materials, or even cause fire. Ensure tight connections and use cable clamps to secure cables and prevent them from unnecessary movement.
- Use this controller with Gel, Sealed or Flooded lead acid batteries only.
- Select an appropriate type of cable according to the power rating of your system / length of cable required.

NOTE: This controller can be used with a 12V battery or 12V battery bank (several similar 12V batteries connected in parallel + to +, - to -). This manual always refers to a single 12V battery, but it is implied that a battery can be a bank of several batteries.

3.2 Mounting

NOTE: When mounting the controller, ensure enough room for air to flow through the controller heat sink. There should be at least 6 inches (150 mm) of clearance above and below the controller to allow air flow for cooling.

WARNING: Risk of explosion! Never install the controller in a closed place with flooded batteries! Do not install the controller in any closed area where battery gases can accumulate.

Step 1: Choose mounting location

Locate the controller on a vertical surface protected from direct sunlight, high temperature and water. Ensure there is adequate ventilation.

Step 2: Check for clearance

Place the controller in the location where it will be mounted. Verify that there is sufficient room to run wires and clearance above and below the controller for air flow.

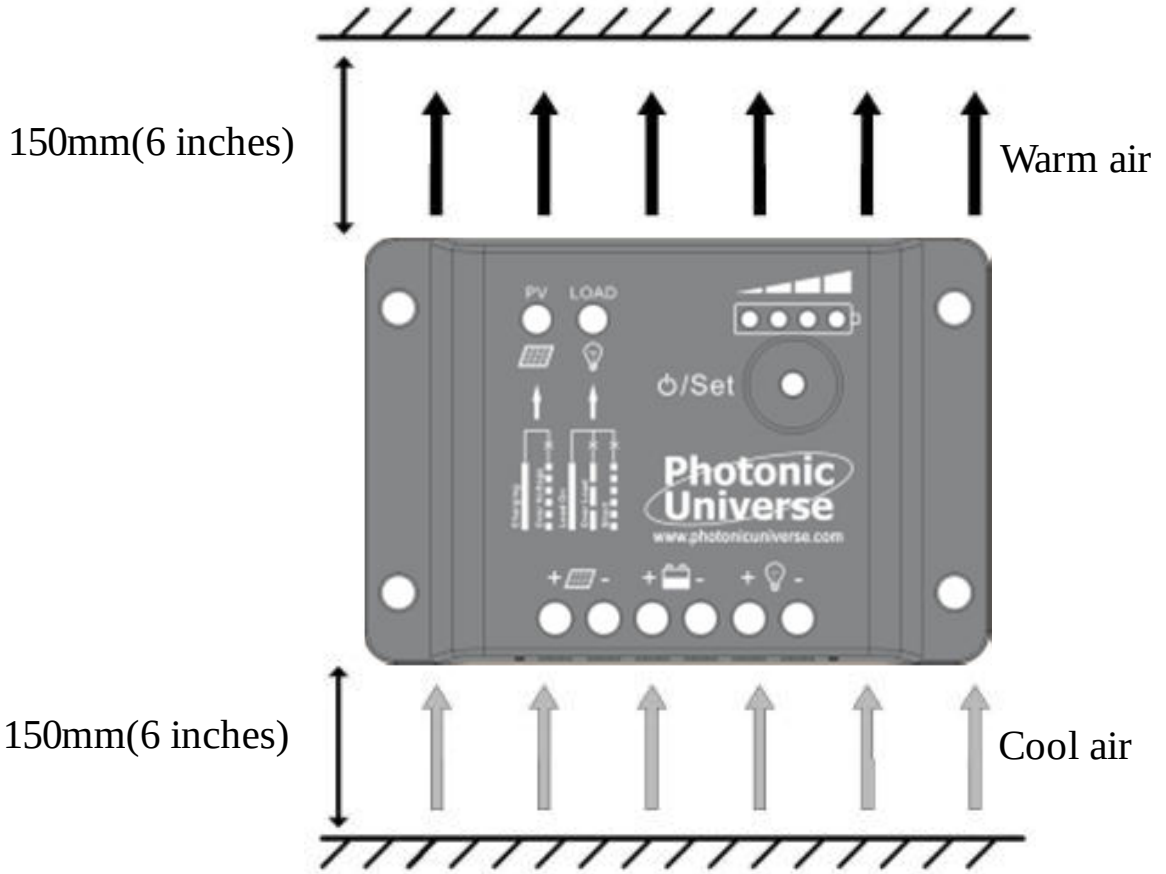


Figure 3-1 Mounting and cooling

Step 3: Mark holes

Use a pencil or pen to mark four (4) mounting hole locations on the mounting surface.

Step 4: Drill holes

Remove the controller and drill holes in the marked locations.

Step 5: Secure controller

Place the controller on the surface and align the mounting holes with the drilled holes in step 4. Secure the controller in place using suitable screws.

3.3 Wiring

NOTE: A recommended connection order has been provided on page 12 for maximum safety of installation and operations

NOTE: The controller is a common positive ground controller. If your system (e.g. vehicle or boat) is a negative ground system, you can still use the controller, but you SHOULD NOT use any earthing of the solar panel cables or load cables.

CAUTION: Do not connect any loads with surge power exceeding the current rating of the controller 5A (5 amp). Do not connect any power inverters to the load output of the controller.

CAUTION: For mobile applications, make sure you secure all wiring. Use cable clamps to prevent cables from unnecessary movement. Unsecured cables create loose and resistive connections which might lead

to excessive heating and/or fire.

WARNING: Risk of explosion or fire! Never short circuit battery positive (+) and negative (-) or cables.

Make sure the battery voltage is greater than 6V

Before you connect the battery, make sure that the battery voltage is greater than 6V to start up the controller. If the battery is fully discharged and produces less than 6V, the controller will not switch on and charge it – please charge it by other means first.

The loads that can be connected to load terminals of the controller are 12V DC loads which can be normally connected to 12V battery (such as 12V lights, fan, radio etc). The controller will power these loads at the same voltage as produced by the connected battery.

NOTE: Make sure the combined current of all loads connected to the controller load terminals is less than the rated current 5A. If loads require higher current, connect them directly to the battery.

Step 1: Wiring

The recommended connection order has been provided in Figure 3-2. Make sure the positive and negative polarity connection is correct and all terminals are tightened.

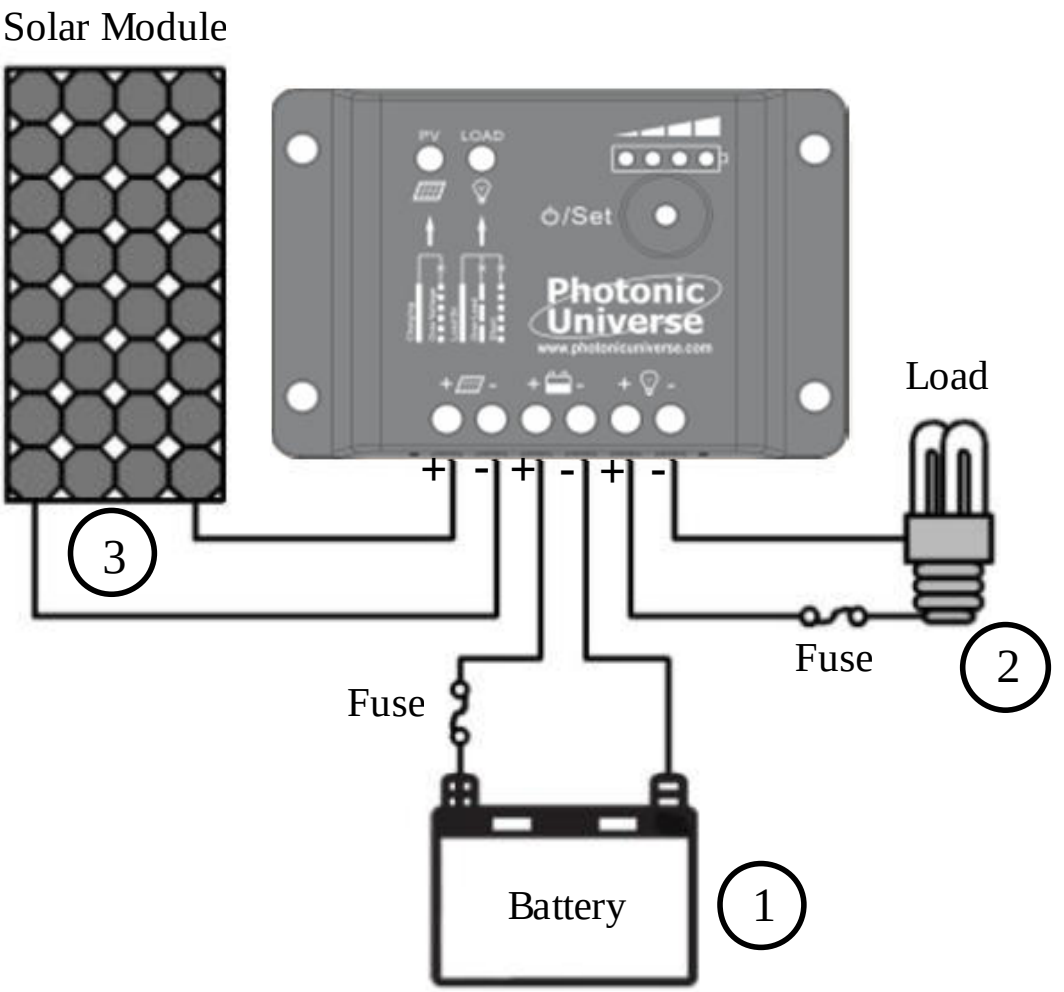


Figure 3-2 System wiring review

NOTE: Load terminals are not "dump load". It is not necessary to use load terminals if your system is intended to charge the battery only, or if you connect loads to the battery directly.

Fuse rating should be chosen according to the maximum charging current and load current. Please do not use fuses higher than 10A.

Step 2: Check power LED

When the battery power is applied and the controller starts up, the battery LED indicators will be on. If the controller does not start up (LEDs are not lit) or LEDs show an error (flashing), please refer to section 5 for troubleshooting.

4. Operation

4.1 Battery Charging Information

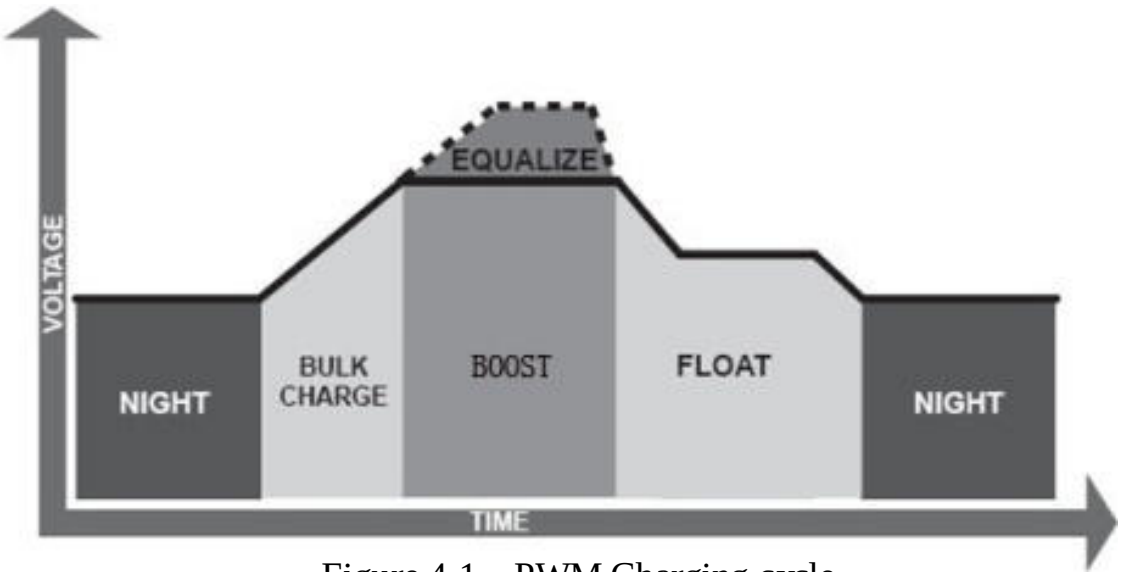


Figure 4-1 PWM Charging cycle

- **Bulk charge**

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

charge the battery.

- **Boost charge**

When the battery has been charged up to the Boost voltage set point, constant-current regulation is used to prevent heating and excessive battery gassing. The Boost stage lasts 120 minutes and then changes to Float Charge.

- **Float charge**

When the battery is fully charged during the Boost stage, the controller reduces the battery voltage to Float voltage set point. When the battery is fully charged, there will be no more chemical reactions and all the charge current transmits into heat and gas from this point on. The controller still charges the battery using lower voltage and current. This reduces the temperature of the battery and prevents gassing, whilst also charging the battery slightly at the same time.

The purpose of the Float stage is to offset power consumption caused by self-consumption and small loads in the system (LEDs) while maintaining full battery storage capacity.

During the Float stage, loads can continue drawing power from the battery. If the system load(s) current exceeds the solar charge current, the controller will no longer be able to maintain the battery at the Float set point. Should the battery voltage

remain below the Boost set point, the controller will exit the Float stage and return to Bulk charge.

- **Equalise charge**

WARNING: Risk of explosion!

Equalising a flooded battery can produce explosive gases. Good ventilation around the battery is essential.

CAUTION: Equipment damage!

Equalisation may increase battery voltage to the level damaging to sensitive DC loads. Ensure that all loads have input voltages greater than the equalise charging voltage.

CAUTION: Equipment damage!

Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Equalising charge may cause damage if it is too high or lasts too long. Please carefully review the specific requirements of the battery used in the system.

Certain types of batteries benefit from periodic equalising

charge, which can stir the electrolyte, balance the battery voltage and complete the chemical reaction. Equalising charge increases the battery voltage to the level higher than the standard voltage, which gasifies the battery electrolyte.

If the battery is being over discharged, the solar controller will automatically turn to equalising charging stage, and this stage will remain for 120 minutes. Equalising charge and boost charge are not carried out constantly in a full charge process to avoid too much gassing or battery overheating.

4.2 LED Indicators

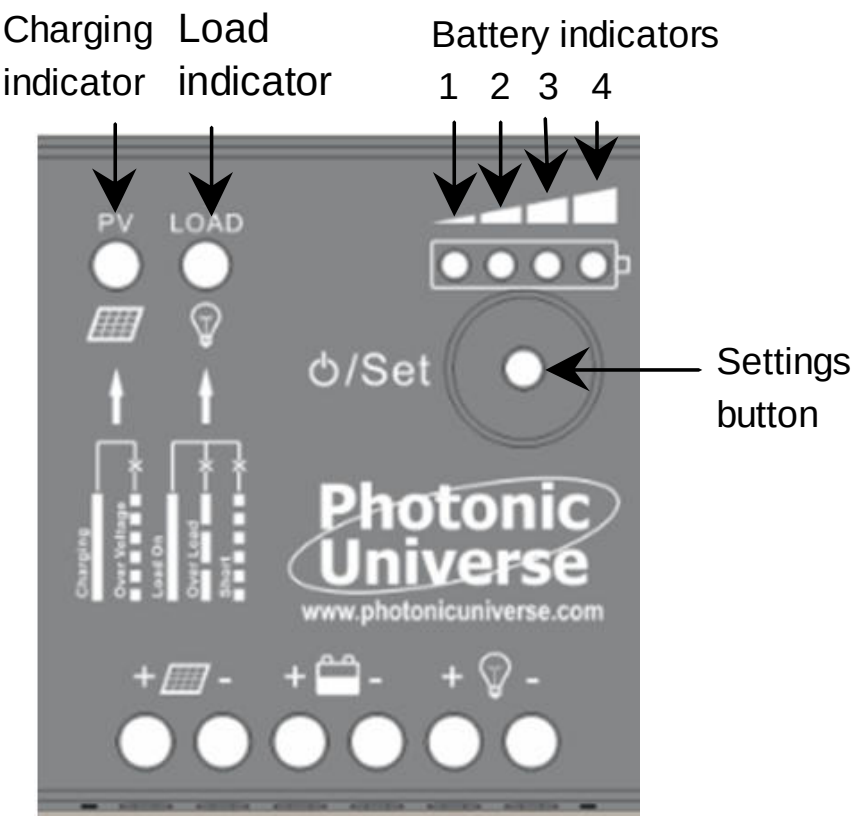


Figure 4-2 LED indicators

- **Charging status indicator**

LED (*ON*) – sunlight is available for battery charging

LED (*FAST FLASHING*) – system over-voltage

Please refer to section 5.2 for troubleshooting.

Charging status LED indicator Table 4-1

Indicator	Charging Status
On Continuous	Charging
Fast Flashing	Battery over voltage

- **Battery status indicator**

LED 1 (*SLOWLY FLASHING*) - battery under voltage

LED 1 (*FAST FLASHING*) - battery is over-discharged

Table 4-2 shows approximate battery voltages for each LED (if needed please refer to section 5.2 for troubleshooting).

Battery LED indicator Table 4-2

LED 1	LED 2	LED 3	LED 4	Battery Status
Slowly Flashing	×	×	×	Under-voltage
Fast Flashing	×	×	×	Over-discharged
Approximate voltage for each battery LED (charging)				
○	○	×	×	＞12.8V
○	○	○	×	＞13.4V

○	○	○	○	＞14.1V
Approximate voltage for each battery LED (discharging)				
○	○	○	×	＜13.4V
○	○	×	×	＜12.8V
○	×	×	×	＜12.4V

“○” LED indicator on “×” LED indicator off

NOTE: operation of the four LED battery lights is based on the battery voltage measured by the controller. While voltage is a good estimate for the battery capacity, it is important to remember that these LED lights do not represent the exact capacity. Battery voltage may vary with the temperature and charge / discharge cycles and it will affect the number of LED battery lights illuminated.

- **Load status indicator:**

Load indicator is ON when there is power at load output terminals. When the load current is 1.25 times of rated current (5A) for 60 seconds, or 1.5 times of rated current for 5 seconds (overload), the load indicator will start flashing slowly. When the controller detects short circuit of the load, the indicator will start flashing fast. Please refer to section 5.2 for troubleshooting.

Load status LED indicator Table 4-3

Indicator	Load Status
On Continuous	On
Off	Off
Slowly Flashing	Overload
Fast Flashing	Short Circuit

4.3 Setting Operation

- **Load work mode setting**

When the controller is powered on, the settings button can be used to switch load output On/Off. Press the button once to switch the load On/Off.

- **Battery type setting**

Press and hold the settings button for more than 5 seconds, and battery indicators LED 1, LED 2, LED 3 will start flashing. Press the setting button again to choose Sealed, Gel, or Flooded battery type. To select the correct battery type, illuminate the corresponding LED(s) (see Table 4-4) and then wait – the indicator will stop flashing after a few seconds and record the setting.

Battery type selection Table 4-4

LED 1	LED 2	LED 3	Battery type
○	×	×	Sealed lead acid battery
○	○	×	Gel battery
○	○	○	Flooded battery

"○" LED indicator on "×" LED indicator off

NOTE: If you are not sure which battery type you have, please refer to your battery manual for charging voltage and specifications, or confirm with the battery manufacturer or distributor.

5. Protection, Troubleshooting and Maintenance

5.1 Protection

- **Load Overload**

If the load current exceeds the maximum load current 5A (5 amp), the controller will disconnect the load. Overloading must be removed by disconnecting the load or pressing the settings button.

- **Load Short Circuit**

Fully protected against load wiring short-circuit. After one

automatic load reconnect attempt, the fault must be cleared by rewiring or pressing the settings button.

- **Battery Reverse Polarity**

As the controller is fully protected against battery reverse polarity, there will not be any damage to the controller as a result. In any case, correct the wiring mistake to resume normal operations.

- **Damaged Local Temperature Sensor**

If the temperature sensor is damaged or short-circuited, the controller will assume the default temperature 25 ºC for charging or discharging the battery.

- **High Voltage Transients**

Solar input is protected against high voltage transients. In lightning prone areas, additional external suppression is recommended.

5.2 Troubleshooting

Troubleshooting Table 5-1

Faults	Possible reasons	Troubleshooting
Four battery LEDs are flashing fast	Battery connection problem / battery disconnected	Disconnect the system and reconnect in the right order (battery first), and check the lights after battery connection
Charging LED is off, even in sunny conditions	Solar panel / battery connection problem	Check that solar and battery connections are correct (incl. polarity), tight and secure.
Charging LED is flashing fast	Battery voltage is higher than over voltage disconnect voltage (OVD)	Disconnect the solar panel. Check whether the battery voltage is too high.
Battery LED 1 indicator is flashing slowly	Battery under voltage	Without any load connected, LED status will return to ON automatically when the battery is charged.
Battery LED 1 indicator is	Battery over-discharged	Load output will switch off automatically. LED

flashing fast		status will return to ON when the battery gets charged.
Load LED indicator is flashing slowly	Overload	Reduce the load and press the settings button. The controller will resume in 3 seconds.
Load LED indicator is flashing fast	Short circuit	When the first short-circuit occurs, the controller will automatically resume after 10 sec.; if a second short-circuit occurs, press the settings button and the controller will resume after 3 sec.

NOTE: If no LED indicators are lit, measure the battery voltage with a multimeter. Min. 6V is required to start the controller.

NOTE: If the charging status LED is not lit with normal connection, measure the input voltage of the solar panel with a multimeter. 14V minimum is required for battery charging.

5.3 Maintenance

The following inspections and maintenance tasks are recommended at least twice every year for the best controller performance.

- Check that the controller is securely mounted in a clean and dry environment.
- Check that the air flow and ventilation around the controller is not blocked. Clear all dirt or fragments from the heat sink.
- Check all the wires to make sure insulation is not damaged due to constant exposure to sunlight, frictional wear, dryness, insects and pests etc. Maintain or replace the wires if necessary.
- Tighten all the terminals. Inspect for loose, broken, or burnt wire connections.
- Check and confirm that LED indicators are consistent with what you expect according to this manual. Pay attention to any troubleshooting or error indication. Take necessary corrective actions.
- Confirm that all the terminals have no signs of corrosion, insulation damage, high temperature or burnt /

discoloured signs; and tighten terminal screws to the suggested torque.

- Inspect for dirt, insects and corrosion, and if found clear up.
- Check all fuses and fuse holders; make sure they are in a good condition.

CAUTION: Danger - electric shock!
Make sure that the power is OFF when carrying out the above tasks.

6. Warranty

PU0512 Photonic Universe 5A 12V solar charge controller is guaranteed to be free from defects for a period of ONE year from the date of shipment. We will either repair or replace any defective products at our discretion.

- **Claim procedure**

Before requesting warranty service, check this operation manual, including the Troubleshooting section, to be certain that there is a problem with the solar controller. Notify us about the defects by email / phone. If the problem cannot be solved remotely by

our technical team, return the product to us with shipping charges prepaid. Provide proof of date and place of purchase with your item.

To obtain rapid service under this warranty, your information should include a detailed description of the failure, solar module and battery types, connection scheme, as well as load information (types, current, usage). This information is critical to help process your warranty claim.

This warranty does not apply in the following conditions:

1. Damage by accident, negligence, abuse or improper use.
2. Solar or load current exceeding the rating of product (5A).
3. Unauthorised product modification or attempted repair.
4. Damage occurred as a result of contact with water.
5. Damage occurred in transit or during shipping.
6. Mechanical damage.
7. Damage as a result of natural disasters, lightning, extreme weather conditions.

7. Technical specifications

Electrical Parameters Table 7-1

Description	Parameter
Nominal System Voltage	12V
Maximum Battery Voltage	16V
Rated Charging / Load Current	5A
Charge Circuit Voltage Drop	≤0.26V
Discharge Circuit Voltage Drop	≤0.15V
Self-consumption	≤6mA

Temperature Compensation Coefficient Table7-2

Description	Parameter
Temperature Compensation Coefficient (TEMPCO)*	-30mV/ºC/12V（25ºC ref）

***Compensation of equalize, boost, float and low voltage disconnect voltage**

Battery Voltage Parameters (temperature at 25℃) Table 7-3

Charging Parameters			
Battery charging settings	**Gel**	**Sealed**	**Flooded**
Over Voltage Disconnect Voltage	16V	16V	16V
Charging Limit Voltage	15.5V	15.5V	15.5V
Over Voltage Reconnect Voltage	15V	15V	15V
Equalize Charging Voltage	-------	14.6V	14.8V
Boost Charging Voltage	14.2V	14.4V	14.6V
Float Charging Voltage	13.8V	13.8V	13.8V
Boost Reconnect Charging Voltage	13.2V	13.2V	13.2V
Low Voltage Reconnect Voltage	12.6V	12.6V	12.6V

Under Voltage Warning Reconnect Voltage	12.2V	12.2V	12.2V
Under Voltage Warning Voltage	12V	12V	12V
Low Voltage Disconnect Voltage	11.1V	11.1V	11.1V
Discharging Limit Voltage	10.8V	10.8V	10.8V
Equalize Duration	-------	2 hours	2 hours
Boost Duration	2 hours	2 hours	2 hours

Environmental parameters Table 7-4

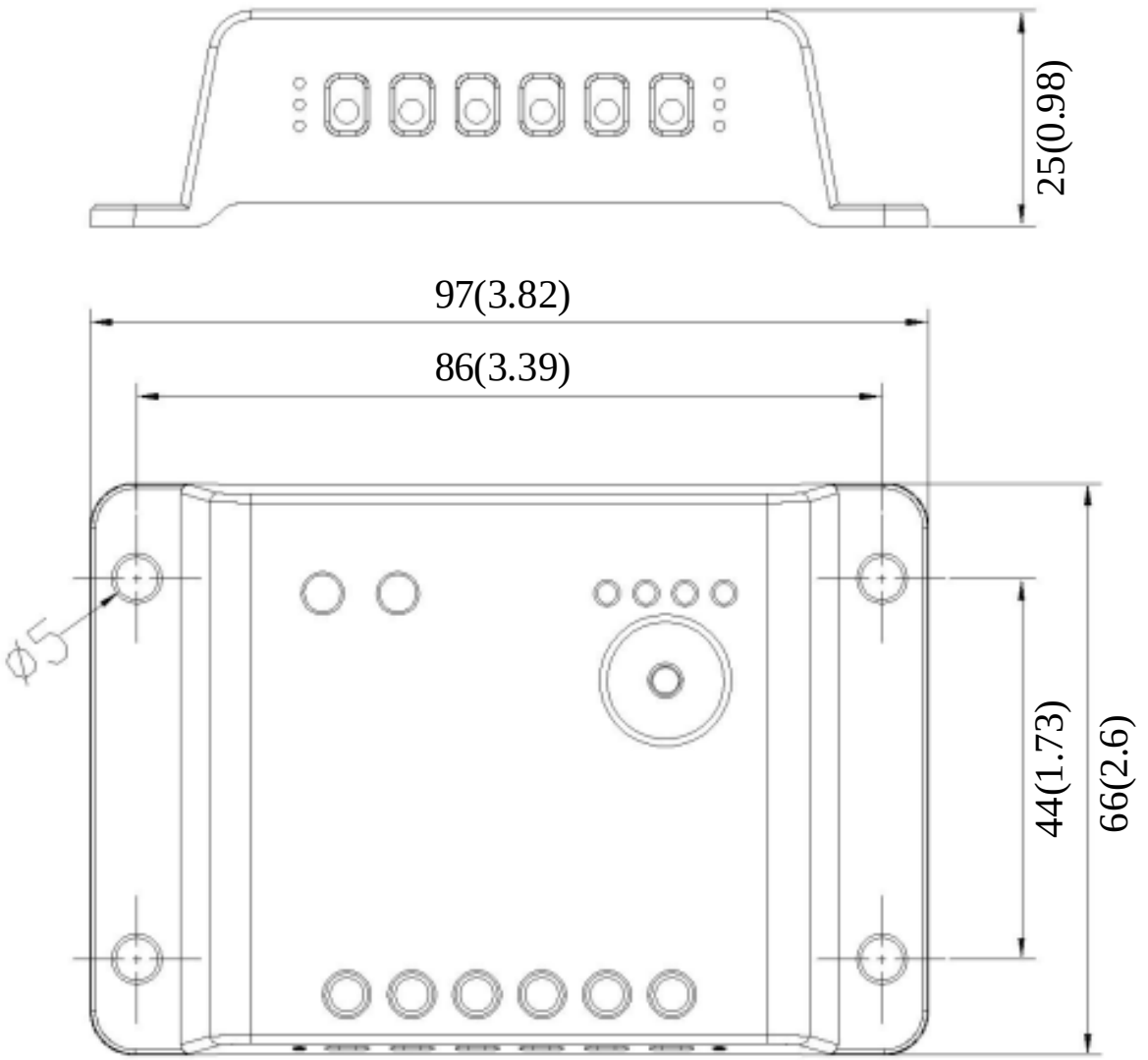
Environmental parameters	**Parameter**
Working temperature	-35℃ to +55℃
Storage temperature	-35℃ to +80℃
Humidity	10%-90% NC
Enclosure	IP30

Mechanical Parameters Table 7-5

Mechanical Parameter	**Parameter**
Overall dimension	97(3.82) x 66(2.6) x 25(0.98) mm (in.)

Mounting dimension	86(3.39) x 44(1.73) mm (in.)
Mounting hole size	Φ5
Terminals	2.5mm^2
Net weight	0.05kg

Mm (inches)



Dimensions

We reserve the right to change this manual at our discretion.

Please look for updated versions on our website

www.PhotonicUniverse.com

Photonic Universe Ltd

E-mail: info@photonicuniverse.com

Web: www.PhotonicUniverse.com

Tel.: +44 (0) 20 3150 11 11

Fax: +44 (0) 20 3150 12 12