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Photonic Universe Folding Solar Charging Kit

INSTRUCTION MANUAL

For models 40W, 60W, 80W, 100W, 120W and 150W



*Application: motorhomes, caravans, RVs, campervans, cars, boats, yachts
and other systems with 12V lead-acid batteries*

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1. Product overview

Thank you for purchasing the Photonic Universe folding solar charging kit. This manual offers important information and suggestions with respect to installation, use, troubleshooting and more. Please read carefully before using our product.

This kit is constructed from two identical aluminium frame solar panels, each made with tempered glass. Even though the glass is strong enough to withstand severe weather conditions including hail, it is recommended that you handle the kit with care. The glass can break from a strong impact, for example if you accidentally drop the kit and something sharp hits the glass.

The kit comes with a fold-away aluminum stand which may be erected to position the panels towards direct sunlight to maximize the energy output. When not in use or in transit, the kit can be placed into a rigid storage case made with a layer of soft material for protection.

For ease of the initial plug-and-play installation, the solar kit comes with crocodile clips for a quick connection to your battery. You can later replace these crocodile clips by ring terminals included with the kit, when you do a permanent installation or if your battery compartment does not have enough space for crocodile clips. The battery end of the cable supplied with the kit has a plug 0.5m from the crocodile clips (battery plug), and if you replace the crocodile clips by ring terminals, you will still be able to connect / disconnect the kit using this plug.

Charging of your battery will be regulated by an automatic microprocessor-based solar charge controller mounted at

the back of the solar kit. This controller measures the state of charge of your battery every second and chooses the charging parameters accordingly (voltage, current and the charging programme). The controller also provides important protection functions for your battery:

- **Overcharge** protection is one of the most important functions of the controller. When your battery is full, the controller will either switch to a trickle-charging mode when it will continue gently topping up the battery, or it will stop the charging completely.
- **Reverse current** protection, which stops the power flow from the battery into the solar panel at night.
- **Reverse polarity** protection, i.e. if you accidentally connect the kit to the battery with the wrong polarity, your system is safe.
- **Overheating** protection to switch the charging off when the controller temperature reaches a critical level.

In addition, the charge controller has a built-in temperature sensor to measure the ambient temperature. To regulate the speed of chemical reaction inside the battery, the controller will choose slightly higher charging voltage in low ambient temperatures, and lower voltage in high temperatures.

2. Installation instructions

1) Ensure that your battery is not fully discharged. The battery must generate at least 6V to start the solar charge controller (if your battery is fully discharged, the solar charge controller will not start and the kit will not be able to charge it). In such case, charge the battery first by other means for a short period of time to allow the voltage to reach 6V.

2) Initially at the connection stage, keep the solar charging kit indoors or in an area not exposed to direct sunlight. Unfold the solar panels, extend the battery leads and connect the crocodile clips to the + positive (red) and – negative (black) battery terminals on a 12V lead-acid battery.

Note: If you require a permanent connection between the controller and the battery or your battery compartment is too small for crocodile clips, please replace the crocodile clips with the ring terminals provided (or purchase 0.5m lead with a battery plug and ring terminals from Photonic Universe). To replace the crocodile clips, cut off the crocodile clips and attach the ring terminals using a crimping tool or pliers. When the ring terminals are permanently fixed to your battery, you should use the battery plug to connect and disconnect the kit.

3) Check and confirm that the solar charge controller has started and detected the battery, by switching on ‘BATT’ LED light. If there is enough light falling on the solar panels, the ‘PV’ LED will also switch on, indicating that the kit has started charging the battery.

Note: The ‘BATT’ and ‘PV’ lights might not be easily visible in bright, direct sunlight. When connecting the kit, try checking the LED status indoors or in an area without interference of bright sunlight.

4) Press the setting button on the controller until the LED stops on ‘BATT type’. Press and hold the setting button for 5 seconds until the digits start to flash. Press the setting button again to choose the battery type (see table 1 below)

and leave the chosen number flashing until it stops and the controller records the setting.

Battery type	Description	Battery charging voltage ¹	Battery setting number
Sealed	No caps on the top – not refillable	14.4V	1
Gel	Labelled as ‘Gel’ on the battery or manual	14.2V	2
Flooded	Caps on the top for refilling	14.6V	3

Table 1: Choosing the correct battery type setting

Note: this table is provided as a guidance only. Always refer to the battery user manual for the correct charging voltage for your battery, and choose the battery type accordingly.

Note: do not change other settings on the controller such as ‘Mode’ and ‘Timer’ as they relate to the load output of the controller only, which is not used in your solar kit. The load output is a pair of unconnected load cables at the right side of the controller, designed to power small 12V loads within 10A by timer, with the automatic load cut off function when the battery is low. If you are interested to learn more about the load output of the controller, see Appendix of this user manual.

5) Place the kit outside in a sunlit area, with no obstructions or shading on the panels. To maximize the output, adjust the position of the kit regularly to track the movement of the sun throughout the day.

¹ At temperature 25°C

Note: Placing the kit indoors next to a window will reduce the output considerably, and is not recommended.

6) If your area has a high risk of theft, you can chain the kit using the holes in the aluminium frame at the back.

3. Solar charge controller operations

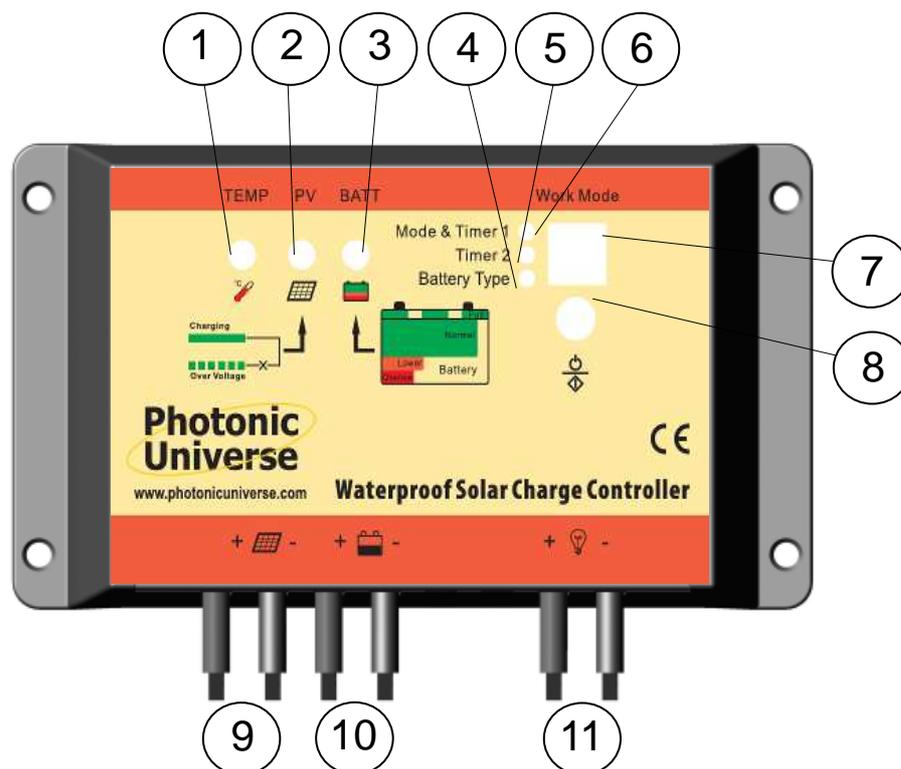


Figure 1: 10A waterproof solar charge controller operations

1. Temperature sensor
Measures ambient temperature and automatically adjusts charging voltage depending on the temperature.
2. Charging status LED indicator
Shows whether charging is on or off and also indicates when the battery voltage is abnormally high.
3. Battery status LED indicator
Shows state of charge of the battery.
4. Battery type setting indicator
Indicator will be on when you select the battery type.

5. Timer 2 setting indicator
Indicator will be on when you set timer 2 for load (not used in your kit).
6. Mode and Timer 1 setting indicator
Indicator will be on when you set timer 1 for load (not used in your kit).
7. LED digital display
For battery type selection.
8. Setting button
Sets battery type and load work mode.
9. Solar module cables
Connecting the solar panels
10. Battery cables
Connecting to a battery or battery bank
11. Load cables
Connecting loads (not used in your kit).

LED indicator	LED colour and frequency	Meaning
Charging status (PV)	Constant green	Solar panel is charging the battery
	Flashing green	Over-voltage in the system
Battery status (BATT)	Constant green	Normal operations (battery is ready)
	Flashing green	Battery is fully charged
	Constant orange	Under-voltage, battery requires charging
	Constant red	Battery is over discharged
Digital display	Flashing red ' H '	Controller overheating protection

Table 2: LED indications and meaning

Note: Please refer to the next section for troubleshooting or Appendix for help with the ‘Mode’ and ‘Timer’ indicators relating to load.

4. Troubleshooting

Trouble / indication	Possible cause	Suggested solution
Both the battery and charging LED indicators are off	Battery is over discharged	Measure the battery voltage and if it is 6V or lower, charge it by other means first.
	Battery connection problem	Examine all the cables and terminals to make sure that the battery is properly connected. Measure the voltage at the input battery cables of the controller for confirmation.
	Fuse is blown	Check the fuse and replace it if needed (the fuse is located in a fuse holder near the crocodile clips).
	Incorrect connection polarity	Check that the battery is connected to the solar charging kit with the right polarity. Trace polarity from the battery terminals to the controller terminals.
	Bright conditions	Check LED lights indoors or in a darker place, as lights might not be visible very well in bright sunlight conditions.
Battery LED indicator is on, but the charging LED is off	PV array disconnected or wrong polarity	Check that all the connections are secure and clean, and the polarity of the solar panel connection to the controller is right.
	Lack of sunlight	Place the panels in direct, unobstructed sunlight. Check the LED lights indoors.
Charging LED indicator is flashing green	High battery voltage	Check the battery voltage by a digital multimeter. Disconnect the charging kit from your battery.
Battery LED indicator is constant orange	Low battery voltage	The battery LED indicator will return to green automatically when the battery receives some charge.
Digital display shows “H” (flashing)	Temperature too high	If the heat sink of the controller exceeds 85°C, the controller will automatically cut the input and output circuits. When the temperature falls below 75°C, the controller will resume working.

Table 3: Troubleshooting

5. Frequently asked questions (FAQ)

Q. What type of batteries can be used with this kit?

A. Any 12V lead acid battery: sealed, AGM, gel or flooded (typically used in caravans, motorhomes and boats). The battery cannot be too small: you need to make sure that it can receive the maximum current from the solar panel. We recommend the following as a guide:

Power rating of the solar kit	40W	60W	80W	100W	120W	150W
Minimum battery capacity	20Ah	30Ah	40Ah	50Ah	60Ah	70Ah

Table 4: Minimum recommended battery capacity

You might be able to use a smaller battery if it can accept high current and faster charging. Please check the battery specifications in relation to the maximum current it can receive and compare it to the maximum current stated on your solar charging kit.

There's no upper limit of the maximum battery capacity. Your battery can be as large as you want, though you have to remember that the charging time will increase proportionally to the increase in battery capacity.

Q. My battery is AGM sealed type. Which battery type should I set on the solar charge controller?

A. You need to check the user manual or specifications for your battery and find the recommended charging voltage for it. Then choose the battery type on the controller with the closest charging voltage for your battery (gel 14.2V, sealed 14.4V, flooded 14.6V, at 25°C). In most cases AGM battery will require the sealed battery type on the controller.

Q. Can this kit charge a 24V battery?

A. No, this kit is designed to charge a 12V battery. Technically it's possible to re-wire the solar panels to work in 24V mode but this should only be done by an appropriately qualified person.

Note: unauthorised modification to 24V will void the warranty.

Q. Can the kit charge two or more 12V batteries connected in parallel (“+” to “+”, “-” to “-”)?

A. Yes, it's possible if the batteries are the same type, capacity and are always used together wired in parallel as a single 12V battery bank.

Q. Is there any risk that the solar kit will over charge my battery?

A. One of the main protection functions of the solar charge controller is to ensure that your battery is not over charged.

Q. Can I extend the battery leads?

A. Yes, it's possible – please choose cable with the same cross section for extension.



Photonic Universe offers 5m cables with battery plugs for extension - please check our website for more info: www.photonicuniverse.com

Q. Can the kit be connected to my battery through a cigarette lighter or another connector?

A. You can use any type of connector between the kit and the battery, but you need to make sure that the connector is wired directly to your battery and it's suitable for the maximum current of the kit (see specs).

Q. Can rain damage the solar kit?

A. It won't damage the kit as the panels and controller are fully waterproof, but we recommend wiping and drying the kit after rain to avoid rust on fittings (latches and hinges), or using some lubricant on them.

6. Maintenance

It is recommended to perform the following tasks (with the power disconnected) at least twice a year to keep the kit in top working condition:

- Clean the solar panel glass using a regular household glass cleaner, then wipe and dry the kit. Use a suitable lubricant on fittings (latches and hinges) to avoid rust on them after a rain or due to high humidity.
- Check all the wires to make sure insulation is not damaged for serious solarisation, frictional wear, dryness, insects or vermin etc. Maintain or replace wires if necessary.
- Check and confirm that the LED digital display is consistent and functioning. Pay attention to any error messages and take the necessary action required.

7. Warranty

The workmanship warranty (assembly, wiring and accessories) and the solar charge controller warranty, provided by Photonic Universe, are 1 year long. The warranty does not cover:

- The fuse
- Usual wear and tear
- Unauthorised modifications

- Mechanical damage

In addition, solar cells are guaranteed to generate power for at least 25 years. This guarantee is provided by the solar cells manufacturer which is not affiliated or in any way connected to Photonic Universe.

8. Technical specifications

Solar panels

Model SWD-...	FWP-40M	FWP-60M	FWP-80M	FWP-100M	FWP-120M	FWP-150M
Cell type	mono	mono	mono	mono	Mono	mono
Folded size (mm)	345*470* 60	345*645* 60	505*550* 60	505*690* 60	505*770* *70	505*1005* *70
Net weight (Kg)	5.4	8.0	8.8	10	12.8	15.0
Max. power (W)	40	60	80	100	120	150
Max. power voltage (V)	17.5	17.5	17.5	17.5	17.5	17.5
Max. power current (A)	2.29	3.43	4.57	5.71	6.86	8.6
Open circuit voltage (V)	21.6	21.6	21.6	21.6	21.6	21.6
Short circuit current (A)	2.47	3.7	4.94	6.17	7.4	9.26

Table 5: Specifications for all models of folding solar kits

Specifications under standard test conditions (STC): 1000W/m², AM 1.5, 25 °C. Data provided for the solar panels only, without the effect of the solar charge controller.

Solar charge controller

Electrical and mechanical parameters	
Nominal system voltage	12V DC
Maximum battery voltage	16V (for 12V battery)
Rated current	10A
Self-consumption	≤6mA
Overall dimensions	145*69*31 mm
Net weight	0.4 kg
Working temperature	-35°C to +55°C
Storage temperature	-35°C to +80°C

Threshold voltage parameters	
NTTV (night time threshold voltage)	5V
DTTV (day time threshold voltage)	6V
Temperature compensation coefficient	
Temperature compensation coefficient (TEMPCO) ²	-30mV/ °C / 12V (25°C ref)

Table 6: Specifications of the solar charge controller

Battery voltage parameters (temperature at 25°C)			
	Sealed	Gel	Flooded
Over voltage disconnect	16V	16V	16V
Charging limit	15.5V	15.5V	15.5V
Over voltage reconnect	15V	15V	15V
Equalise charging	14.6V	-----	14.8V
Boost charging	14.4V	14.2V	14.6V
Float charging	13.8V	13.8V	13.8V
Boost reconnect charging	13.2V	13.2V	13.2V

Table 7: Specifications for battery voltage

² Compensation of equalise, boost, float and low voltage disconnect voltage.

Appendix (load settings)

Note: this section is only necessary if you would like to connect a load to the solar charge controller directly. If your load is connected to the battery (most cases), you can leave the load output cables of the controller unconnected, and insulated to prevent short circuit. There is no need to read this section if you are not planning to use the load output of the solar charge controller.

The solar charge controller comes with a pair of 12V load output cables which are not connected or used in your kit. These output cables are designed to protect the battery from over discharging, i.e. when 12V load drains the battery to the critical level, the controller cuts the load off automatically.

You can use the load output of the controller if you want, and connect 12V appliances to it directly. However, the controller can provide the maximum load current of 10A only, and it might be difficult to control current consumption on certain appliances. Please make sure that you only connect small appliances to the controller with the total continuous and maximum peak power below 10A. Do not connect appliances which have significant power peaks, such as electric motors, pumps, or active speakers.

Do not connect inverters to the load output of the solar charge controller, as they are too powerful for it. Your inverter should be connected directly to the battery in all cases.

Load wiring

- The controller load cables can be connected to low power 12V electrical equipment, such as LED lights or phone chargers, which have the same working voltage as the battery.
- The load output of the controller does not regulate the voltage in any way, neither it keeps it sharp at 12.0V. The voltage from the load cables will be identical to the battery voltage (e.g. it can go as high as 14.0V when the battery is being charged). You need to make sure that the equipment which you connect to the load output can withstand voltage fluctuations of the same sort as from a regular 12V lead acid battery.

- You will need to connect the positive (+) and negative (-) of your 12V loads to the controller load cables via an inline fuse. The fuse current rating should be slightly higher than the current consumption of your load, but in any case not higher than 10A, to adequately protect the controller.

Load settings

You can programme the controller to switch power supply to the load output cables automatically by timer, or manually using the orange setting button as an on/off switch. Detailed explanation of the load work modes is given below.

- Dual timer function.** 12V power supply to the load output of the controller will switch on and off twice during the day: Timer 1 will switch the power on 10 minutes after sunset, then off after a certain number of hours after sunset. Timer 2 will switch the power on several hours before sunrise, and off 10 minutes after sunrise. The default night length is 10 hours initially, but then the controller will adapt to the actual night length by referring to the previous night.

Timer 1	
Function	LED digital number
Disable	N
Dusk to dawn – load on all night	0
Load will be on for 1 hour, after 10 min delay after sunset	1
Load will be on for 2 hours, after 10 min delay after sunset	2
Load will be on for 3 hours, after 10 min delay after sunset	3
...	...
Load will be on for 15 hours, after 10 min delay after sunset	15
Test mode	16
On/off mode	17

Timer 2	
Disable	N
Load will be on for 1 hour before sunrise	1
Load will be on for 2 hours before sunrise	2
Load will be on for 3 hours before sunrise	3
...	...
Load will be on for 15 hours before sunrise	15

Table 8: Timer settings to control power supply to load cables

- Dusk to dawn.** When the solar module voltage goes below the point of NTTV (night time threshold voltage) at sunset, the controller will recognise the starting voltage and turn on the load after a 10 minute delay. When the solar module voltage goes above the point of DTTV (day time threshold voltage), the solar controller will recognise the starting voltage and turn off the load after a delay of 10 minutes.
- Test mode.** This mode is the same as dusk to dawn but with no ten minute delay while the controller recognises the starting voltage. When below the starting voltage, the controller will turn on the load; if higher, it will turn off the load. The test mode makes it easy to check the system installation by covering the solar panel.

Load indicator

The load status indicator will produce a signal when a load is connected and faulty: RED flashing ‘**L**’, which means overload or short-circuit

Troubleshooting for the load output

Trouble / indication	Possible cause	Suggested solution
Battery LED indicator is constant red and the load is not working	Battery over-discharged	To protect the battery, the controller automatically cuts off the output. The LED indicator will return to green automatically when the battery is recharged.

Digital display shows “L” (flashing)	Overload	Reduce the load and press the button once. The controller will resume working after 3 seconds.
	Short-circuit	The controller will automatically restart after 10 seconds. After a second short-circuit, press the button, and the controller will resume working.

Table 9: Troubleshooting for the load output of the controller

Battery no longer able to hold a charge?

Choose 12V deep cycle AGM or GEL **Photonic Universe** batteries specially designed for solar charging kits and leisure applications



AGM Batteries

Best for large or powerful appliances such as fridges, pumps and inverters.

- ✓ Absorbed Glass Mat technology
- ✓ Completely sealed, non-spillable and maintenance free
- ✓ Low self-discharge
- ✓ 3-4 years design service life
- ✓ Better recovery from deep discharge
- ✓ Faster charging up to 25A

GEL Batteries

Best for small appliances such as lighting, TV and phone charging.

- ✓ Electrolyte in gel form
- ✓ Completely sealed, non-spillable and maintenance free
- ✓ Very low self-discharge
- ✓ 4-7 years design service life
- ✓ Better recovery from deep discharge
- ✓ Suitable for outdoor installations and temperatures up to -10°C

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