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

Contents

1. Product overview

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

This kit is constructed from two identical aluminium frame solar panels; each made with tempered glass. Although 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 strong impact, for example if the kit is accidentally dropped and comes into contact with a sharp object.

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 the rigid storage case made with a layer of soft material for added protection.

For ease of initial installation, the solar kit comes with crocodile clips for fast connection to your battery. You can later replace these crocodile clips with the ring terminals included in the kit. For example, if you require 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 with ring terminals, you will still be able to connect / disconnect the kit using this plug.

Charging of your battery will be regulated by a waterproof automatic solar charge controller mounted on the back of the solar kit. This controller constantly measures the state of

charge of your battery and chooses the appropriate charging parameters accordingly (voltage, current and charging programme). The controller also provides important protection functions for your battery:

- **Overcharge protection** - one of the most important functions of the controller. When your battery is full, the controller will either switch to a trickle-charging mode where it will continue to gently top-up the battery, or it will stop the charging completely.
- **Reverse current protection** - stops the power flow from the battery into the solar panel at night.
- **Reverse polarity protection** - if you accidentally connect the kit to the battery using the wrong polarity, your system is safe.
- **Overheating protection** - switches off the charging when the controller or ambient temperature reaches a critical level.
- **Load protection** – if you have connected a 12V load to the controller (optional), the controller will be protected from short circuits and excessive current.

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

2. Installation instructions

1) Ensure that your battery is not fully discharged. **The battery must generate at least 9V 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 the battery. In such case, charge the battery first by other means for a short period of time to allow the voltage to reach 9V.

2)   At the initial 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 if your battery compartment is too small for crocodile clips, please replace the crocodile clips with the ring terminals provided (or purchase an optional 0.5m lead with a battery plug and ring terminals from Photonic Universe – product code CRING40). To replace the crocodile clips, cut them off and attach the ring terminals using a crimping tool or pliers. When the ring terminals are permanently fixed to your battery, you can use the battery plug to connect and disconnect the kit.

Figure 1: CRING40

Note: It is recommended that the kit is always connected to the battery terminals directly. Unless you are certain, do not use any existing 12V inputs or sockets (e.g. a cigarette lighter socket) for connecting the kit because these inputs or sockets may not be rated / may not have their connecting cables rated to the required power. Moreover, such inputs or sockets may be connected via other electronic components (e.g. ignition or another controller) which would interfere with the operation of your solar kit.

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

3)   Check and confirm that the solar charge controller has started and detected the battery. If the battery has been detected, the Battery LED on the controller should turn on. If there is enough light falling on the solar panels, the Charging Status LED will also switch on (flashing), indicating that the kit has started charging the battery.

Note: The Battery Status and Charging Status LED lights may not be easily visible in bright, direct sunlight. If you have any doubts, try checking the LED status indoors or in an area without the interference of bright sunlight.

*Note: The battery type will be automatically set by the controller to **sealed** type. The default charging voltage of 14.4V (at 25°C) should be suitable for most 12V lead acid batteries. If you require a different level of voltage for your lead acid battery, it can be set in the controller using one of the advanced system monitoring & programming methods listed in the Appendix.*

4)   Place the kit outside in a sunlit area, with no obstructions or shading on the solar panels. To maximize the output, adjust the position of the kit periodically to track the movement of the sun in the sky.

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

5)   If your area has a high risk of theft, you can chain the kit down using the holes in the aluminium frame on the back.
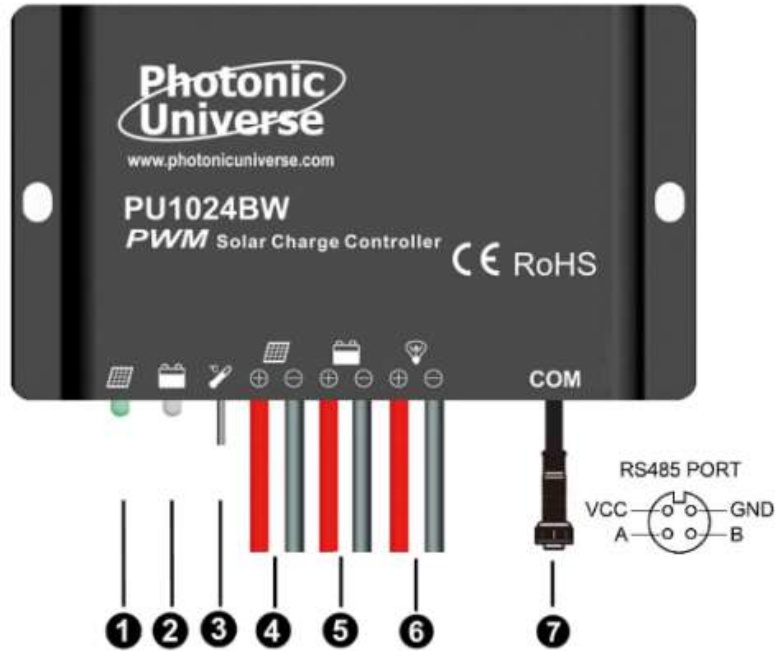
3. Solar charge controller operation

Figure 2: 10A waterproof solar charge controller features

1. Charging Status LED indicator
   Shows whether charging is on or off and also indicates when the solar energy / voltage is low.
2. Battery Status LED indicator
   Shows state of charge of the battery.
3. Temperature sensor
   Measures ambient temperature and automatically adjusts charging voltage depending on the temperature.
4. Solar panel connection
   For connecting the solar panel cables.
5. Battery connection
   For connecting the battery or battery bank.
6. Load connection (optional)
   For connecting optional 12V loads (not used in your kit).
7. RS485 communication port
   For connecting optional monitoring accessories.

Indicator	Colour	Status	Instruction
Charging Status LED ▦	Green	On solid	Solar connection normal but solar energy / voltage is low, no charging
	Green	OFF (if Battery Status LED is ON at this time)	No solar energy or voltage (e.g. night time) or solar connection error
	Green	Slow flashing (1 x per second)	Charging
	Green	Fast Flashing (4 x per second)	Reverse polarity of solar panel connection
Battery Status LED 🔋	Green	On solid	Normal
	Green	Slow flashing (1 x per second)	Full
	Green	Fast Flashing (4 x per second)	Over voltage
	Orange	On solid	Under voltage
	Red	On solid	Over discharged
	Red	Slow flashing (1 x per second)	Battery overheating
Charging (green) and Battery indicator (orange) flashing simultaneously			Controller overheating
Charging (green) and Battery indicator (red) flashing simultaneously			System voltage error

Figure 3: LED indicators and explanations

4. Troubleshooting

Fault	Possible cause	Suggested solution
Both LED indicators are OFF	Fuse is blown	Check the fuse in the fuse holder at the end of the battery cables of your kit and replace if required.
	Reverse polarity	Battery has been connected with a reversed polarity. Please check and amend your connections.
	Battery voltage under 9V	Measure battery voltage with a digital multimeter. Min 9V is required for start-up of the kit. If your battery is too low or completely discharged, charge it first by other means.
	Battery power not supplied to controller	Battery power is not reaching the solar charge controller for any other reason. Please check the battery cables of your kit for signs of damage. Pull-test any cable joints (strongly) between the controller and your battery: - connections straight under the controller; - attachment of cables to the battery plug; - fuse holder connection; - attachment of cables to the crocodile clips.
Charging LED is off during daytime	Solar panels disconnected	Confirm that solar and battery wire connections are correct and tight.
Battery LED green, flashing fast (4 times / second)	Battery over voltage	Using a digital multimeter check if the battery voltage is higher than the over-voltage disconnect point (16V), and if confirmed, disconnect the solar kit. Contact your supplier or manufacturer for advice.
Battery LED is orange or red, constant	Battery is too low / battery is over-discharged	Remove any loads or power drain on the battery. Allow the solar charging kit sufficient time to recharge the battery.
Battery LED red, flashing fast	Battery overheating	The system will automatically switch off. Operation will resume when temperature is less than 50ºC.

Charging LED flashing green + Battery LED flashing orange	Controller Overheating	Cool down the surrounding area. Improve ventilation around the solar kit. Decrease the power or remove any load if it is connected to the load output of the charge controller.
Charging LED flashing green + Battery LED flashing red	System voltage error	Check battery voltage is suitable for the controller's operating voltage. If not, change to a suitable battery or reset the working voltage.
No load output (from the controller load cables)	Load is off in the current load working mode	Using one of the communication methods in the Appendix, programme the controller to switch to a different load working mode, e.g. permanently ON or using timer
	Low battery	Recharge the battery. The load output will turn on automatically when normal battery voltage is resumed.
	Output overload	Reduce the connected number of devices below 10A (including peak power) and check load connections
	Output short circuit	Remove the short circuit and restart the controller by disconnecting / reconnecting the kit

Figure 4: 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 cars, caravans, motorhomes, boats etc). The battery cannot be too small; you need to ensure that it can safely accept the maximum current provided by your solar kit. 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

Figure 5: Minimum recommended battery capacity

You may be able to use a smaller battery if it can accept high current and faster charging. Please check the battery specifications with the supplier or manufacturer of the battery.

Q. Can this kit charge a Lithium battery?
A. No. This folding kit is not suitable for charging Lithium batteries. If you have a lithium battery, please consider our folding kits which come without solar charge controllers – perfect for fitting with one of our Lithium-battery-compatible controllers.

Q. What is the pair of unconnected "+" and "-" cables on the right side of the controller?
A. These cables are the optional 12V load output of the controller. It is not necessary to connect anything to them as the charging function of the solar kit / controller will operate regardless of whether these cables are connected or not. If needed, this 12V output can be used to power small 12V devices (with current up to 10A) such as LED lights, 12V-to-USB converters etc. This load output can be programmed to turn on and off at certain times, e.g. dusk to dawn, or by timer (see Appendix for programming methods and available working modes). The output also has over-discharge battery protection i.e. it turns itself off automatically when the battery becomes critically low.

Q. What is the cable with an end plug on the right side of the controller under the "COM" sign?
A. This is a communication cable for connecting an optional remote LCD meter MT50 or any other monitoring or programming accessories (see Appendix). Connection of any of these monitoring or communication devices is optional. If you plan to connect the remote meter MT50, it is

recommended that the original RS485 to RJ45 cable (product code BW2MT50) is used to keep the connection point splash-proof.

Q. Can this kit charge a 24V battery?
A. No, this kit is designed to charge a 12V battery. Technically it is possible to re-wire the solar panels to work in 24V and the solar charge controller can also support charging of a 24V battery. However, such modification of the solar charging kit should only be undertaken by an appropriately qualified and experienced person approved by the manufacturer.
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. No. One of the main protection functions of the charge controller is to ensure that your battery is not overcharged.

Q. Can I extend the battery leads?
A. Yes, it's possible – please choose a cable with the same cross section for extension.

Figure 6: Item 5ALEAD40

Photonic Universe offers 5m cables with battery plugs for extension (product codes 5ALEAD25 and 5ALEAD40) - please visit our website for more information: www.photonicuniverse.com

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

Q. Can the kit be connected to my battery through a cigarette lighter or another connector?
A. You can use another connector between the kit and the battery with care. You must ensure that the connector is wired directly to your battery (with no other electrical components in between) and also that both the connector and the cables connecting it are rated to the power of your kit.

Q. Can rain damage the solar kit?
A. No, 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, corrosion or discolouration.

6. Maintenance

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

- Clean the solar panel glass using a regular household glass cleaner, then wipe and dry the kit.
- Use a suitable lubricant on hinges.
- Remove any dirt or insects from the frame.
- Check all the wires to ensure that the insulation is not damaged from serious solarisation, frictional wear, dryness, insects or vermin etc. Maintain or replace wires if necessary.

7. Warranty

This product is covered by a 1 year warranty provided by Photonic Universe which guarantees the quality of assembly, wiring and materials for the kit and the solar charge controller.

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

The warranty does not cover:
- The fuse
- Usual wear and tear
- Unauthorised modifications
- Mechanical damage or damage in transit

8. Technical specifications

Solar panels:

	Models 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 x 470 x 60	345 x 645 x 60	505 x 550 x 60	505 x 690 x 60	505 x 770 x 70	505 x 1005 x 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

Figure 7: 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	≤9mA
Overall dimensions	108.5 x 63 x 25.6 mm
Net weight	0.26 kg
Working temperature	-35°C to +55°C
Storage temperature	-35°C to +80°C

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

Temperature compensation coefficient	
Temperature compensation coefficient (TEMPCO)[1]	-3mV/℃/2V (25°C ref)

Figure 8: Specifications of the solar charge controller

Battery voltage:

Battery voltage parameters (temperature at 25°C)				
	Sealed	**Gel**	**Flooded**	**User[2]**
Over voltage disconnect	16V	16V	16V	9～17V
Charging limit	15.5V	15.5V	15.5V	9～17V
Over voltage reconnect	15V	15V	15V	9～17V
Equalise charging	14.6V	------	14.8V	9～17V
Boost charging	14.4V	14.2V	14.6V	9～17V
Float charging	13.8V	13.8V	13.8V	9～17V
Boost reconnect	13.2V	13.2V	13.2V	9～17V
Equalize duration	120 min	------	120 min	0～180 min
Boost duration	120 min	120 min	120 min	10～180 min

Figure 9: Specifications for battery voltage

Battery voltage parameters for load terminals (optional) (temperature at 25°C)				
	Sealed	**Gel**	**Flooded**	**User[2]**
Low voltage reconnect	12.6V	12.6V	12.6V	9～17V
Under voltage warning reconnect	12.2V	12.2V	12.2V	9～17V
Under voltage warning	12.0V	12.0V	12.0V	9～17V
Low voltage disconnect	11.1V	11.1	11.1V	9～17V
Discharging limit	10.6V	10.6V	10.6V	9～17V

Figure 10: Load terminals protection voltage

---

[1] Compensation of equalise, boost, float and low voltage disconnect voltages.

[2] "User" is the user defined battery type. The option to set this personalised battery type only becomes available using one of the optional advanced programming/monitoring methods listed in the Appendix.

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

Appendix: Advanced system monitoring & programming methods

The controller is pre-programmed with factory default parameters, such as a sealed battery type and a light on/off load working mode.

If these settings or other parameters need to be changed, or if you would like to be able to monitor in-depth charging information for your system, the kit's controller can be connected to one of the following products below:
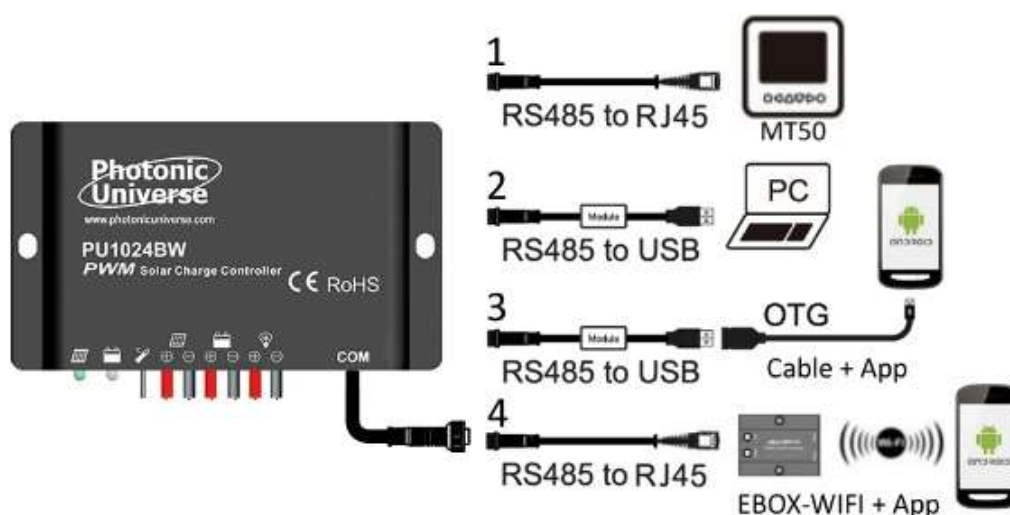

Figure 11: Parameter monitoring and programming

There are four connection options which enable you to view and adjust charging parameters through the controller's RS485 communication port:

1) MT50 remote meter
- Requires RS485 to RJ45 connection cable (product code BW2MT50)

2) PC connection (monitoring software "Solar Station Monitor")
- Requires RS485 to USB connection cable

3) Smartphone or tablet connection (monitoring app "Solar Station Monitor")
- Requires RS485 to USB cable and OTG mobile cable

4) Wi-Fi module (EBOX-WIFI) for wireless connectivity to a smartphone or tablet (monitoring app "Solar Station Monitor")
- Requires RS485 to RJ45 connection cable (product code BW2MT50)

These connection methods and accessories will unlock the following additional features of your solar charging kit:

1) Monitoring of charging parameters:

The additional accessories above allow you to view important charging parameters such as:

- Solar panel voltage
- Solar panel current
- Battery state of charge
- Load voltage and current (if optional load terminals are used)
- Records of accumulated charge and discharge energy
- Records of min / max voltages
- Other parameters

2) Programming of Battery Type and other parameters:

Communication methods also allow you to adjust many charging and load settings of the solar charge controller, including:

- Battery type (sealed, gel, flooded and user-defined)
- Charging voltages (for user-defined battery type only) and duration of charging stages
- Load cut-off voltage and reconnect voltages
- Other parameters relating to charging or discharging

3) Programming of load working modes (for optional load terminals):

Optional load terminals of the solar charge controller can also be programmed to switch the load on / off at required times:

- **Manual Mode**

The load can be switched on via button or remote-control command using one of the communication options above.

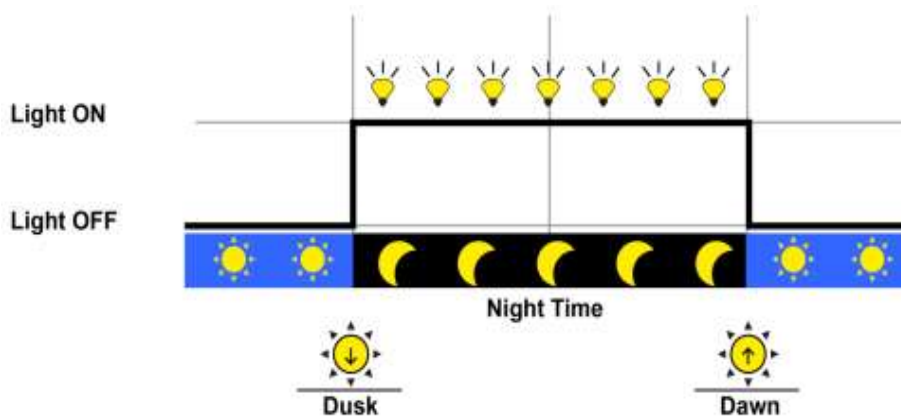- **Light ON/OFF** (provided as default without additional accessories required)

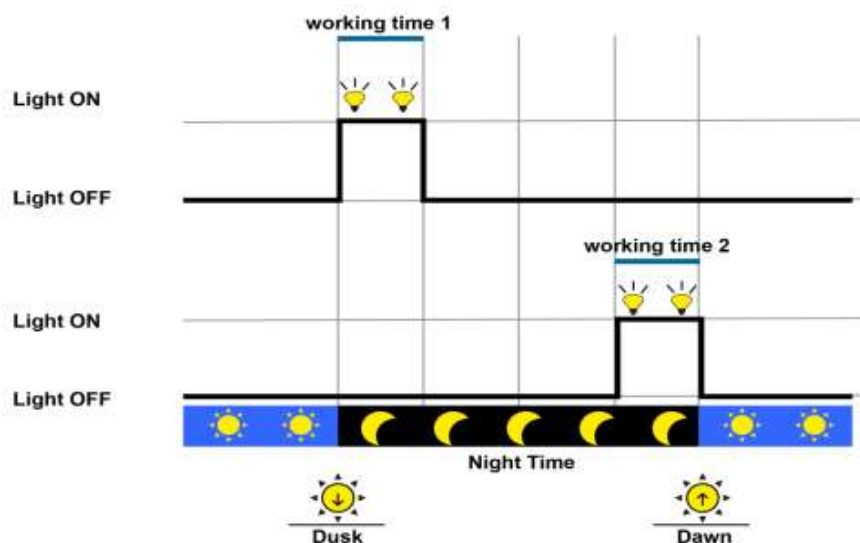**Figure 12: Light ON/OFF working mode**

- **Light ON + Timer**

Figure 13: Light ON + Timer working mode

- **Real-time control**

Control the load ON/OFF time by setting a real-time clock.

Note: In the Light ON/OFF mode and Light ON + Timer mode, the load is turned on after a 10 min delay.

Battery no longer able to hold its charge?

Choose a 12V deep cycle AGM or GEL **Photonic Universe** battery; 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, 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 -10ºC
- ✓ Available in 100Ah and 200Ah

Photonic Universe

-Bringing you the benefits of solar power-

☎ +44 (0) 20 3150 11 11

@ info@photonicuniverse.com

+44 (0) 20 3150 12 12

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M

Need to run 240V household appliances from your 12V battery?

Choose a 12V DC pure sine wave off-grid power inverter from **Photonic Universe** with 240V AC mains power output

Visit our online store at **www.PhotonicUniverse.com** to find out more

Photonic Universe

-Bringing you the benefits of solar power-

+44 (0) 20 3150 11 11

info@photonicuniverse.com

+44 (0) 20 3150 12 12

Models: SWD-FWP-40M   SWD-FWP-60M   SWD-FWP-80M   SWD-FWP-100M   SWD-FWP-120M   SWD-FWP-150M