

Cloud Solar PWM Solar Charger 20A (PWM-2420-LUS)

General Specifications

- 12V/24V battery voltage
- 20A max. charge current
- 55V max. solar input
- 32bit ARM MCU (STM32L072)
- USB charging
- Low-side load switching
- Remote monitoring and switching

GSM Specifications

- Module used: SIM800C
- Quad-band
850/900/1800/1900MHz
- GPRS multi-slot class 12/10
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
- Class 4 (2 W @ 850/900MHz)
- Class 1 (1 W @ 1800/1900MHz)

Built-in Protection

- Overvoltage

- Undervoltage
- Overcurrent
- PV short circuit
- PV reverse polarity (for max. module open circuit voltage of around 40V)
- Battery reverse polarity

Safety Instructions

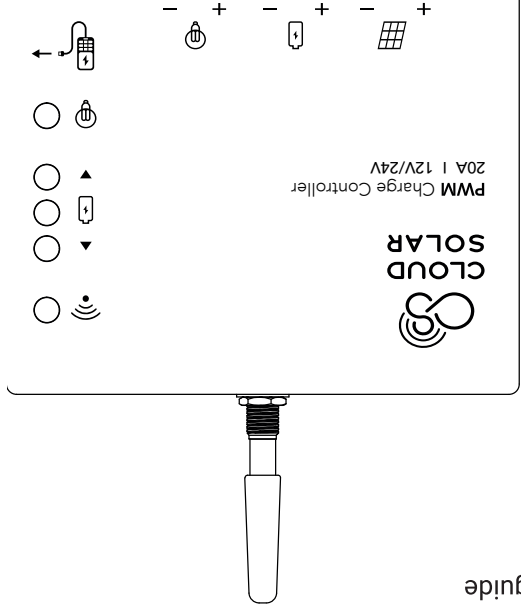
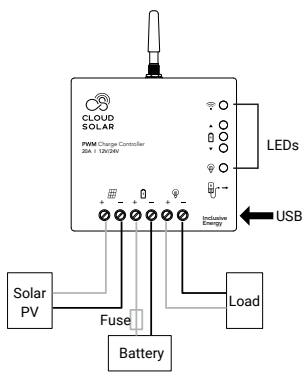


Danger of explosion from sparking.
Danger of electric shock.

- Please read this manual carefully before the product is installed and put into use.
- This product should be used for the designated application only and in accordance with the instruction manual.
- This product is designed for indoor use only. Do not use this product for exterior use.
- Keep the device away from water.
- Keep out of the reach of children.
- Ensure there are no loose contacts at the terminals.
- Make all connections as per the

- indications given on the system. Install the product in a heatproof environment.
- Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.
 - Never use the product at sites where gas or dust explosions could occur.
 - Refer to the specifications provided by the manufacturer of the battery to ensure that the battery is suitable for use with this product.
 - The battery manufacturer's safety instructions should always be observed.
 - Never touch uninsulated cable ends.
 - The installer of the product must provide a means for cable strain relief to prevent the transmission of stress to the connections.
 - Disassembling this product is only allowed by authorised technicians.
 - Disassembly by a non-authorized technician will void the warranty of the product.

- Keep the battery charged properly for a long life.
- Install the solar panel as directed or advised by the system integrator or supplier at the time of purchase.
- The wire cross-section has to be large enough to handle at least the maximum specified current of the charge controller.



Cloud Solar Quick start guide

Usage Agreement

By using this product, you are agreeing to:
Data being sent from the device to servers owned by Inclusive Energy Limited.
Ownership of the data sent from the charge controller and any personal data you wish to share will be accredited to the provider of your solar equipment.
Your data will not be shared with any third party unless it has been anonymised first.
You retain the right to request your data from the operator.
You retain the right to remove your data from the servers.

Online Support

For further support with Cloud Solar please see our online Help Centre at <https://support.inclusive.energy>. You can also contact your cloud solar provider or email - support@cloud-solar.com

Warranty

This product is subject to a one year manufacturer warranty guaranteed by Inclusive Energy Limited. This covers any defects or material issues under normal use and conditions for the above stated period from the original invoice date. The manufacturer agrees to repair or replace any defected components of the product within the period.
THIS WARRANTY IS VOID IF THE DEVICE IS OPENED WITHOUT THE PERMISSION OF A STAFF MEMBER OF INCLUSIVE ENERGY LIMITED OR A TRAINED TECHNICIAN.

Platform Walkthrough Video

Scan the QR code.

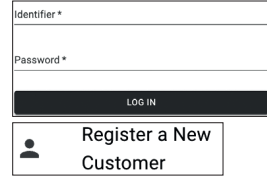


Set up

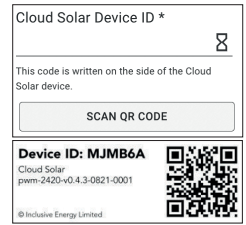
1. Go to www.cloud-solar.com or scan the QR code.



2. Login and click on Register a New Customer. If you don't have a Cloud Solar login, please contact your supplier or Inclusive Energy.



3. Enter the device ID written on the side of the Cloud Solar unit or Scan QR code.

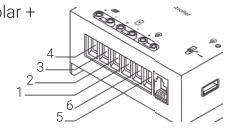


4. Fill in the Initial Registration form, then either click Save and Exit to complete the registration later, or Next if you want to fill in all the customer details now.

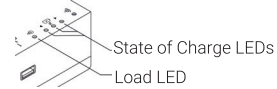


5. Install the charge controller wiring in the numbered order.

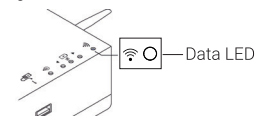
1. Battery -
2. Battery +
3. Solar -
4. Solar +
5. Load -
6. Load +



6. After connecting the battery terminals, the device will power up and all LEDs will turn on. You will then see the load LED and the state of charge of the battery. When the solar panel is connected and charging the battery, one of the state of charge LEDs will flash.



7. After 2 minutes or so, the data LED will flash when the device establishes a connection to a network and sends data. The LED will change and stay solid green if it is connected to a network and will only flash again when data is sent.



8. Go to the platform, refresh the Customers page, and check if the device's Last Seen information has been updated.

Status	Last Seen ↓
Enabled	7 minutes ago

Installation

Mounting

- Mount vertically on a non-flammable substrate, with the power terminals facing downwards.
- Observe a minimum clearance of 10 cm above and below the product for optimal cooling.
- Mount close to the battery, but never directly above the battery (in order to prevent damage due to gassing of the battery).
- Mount with the antenna facing up and the screw terminals facing down to ensure best signal strength and to avoid water or dust entering the terminals.

Connection Order

1. Connect the battery to the battery port. As the charge controller cannot protect the wire between battery and charge controller, an additional fuse should be installed close to the positive battery

- terminal.
2. Cover the solar panel and afterwards connect the wires to the PV input terminal.
3. Connect the loads (lights, etc.) to the load output.
4. Ensure all the polarities are correct. The charge controller is now ready to use. Disconnection should be done in the reverse order.

Wiring, Fuse and Grounding

The minimum wire cross-section should be 2.5 mm². It is recommended to use 4 mm² wires, which is the maximum the terminals can handle. The wire length between the charge controller and battery should be less than 1 m. A fuse rated appropriately for the wire used has to be installed between positive terminal on the battery and the battery positive terminal on the device. The maximum rating of the fuse must be below 25A.

If the cross section is decreased, suitable fuses should be used in the wiring harness connected to the load terminal.

Compatible Batteries

This charge controller can charge any battery with a nominal voltage of 12 V or 24 V. The default settings are safe for all lead-acid batteries but should be adjusted according to the information provided in the battery data sheet. For Li-ion batteries you need to configure the voltage set points manually using the LS.one serial interface. You must also deactivate the float charging stage. This will be done at manufacture if you request Li-ion compatibility.

Solar Modules

12V battery systems can use 36 cell solar PV modules (open circuit voltage of 44-46V, voltage

at max power point 36V) with as many wired in parallel to provide a maximum solar current of 20A. For 24V battery systems, we recommend to use 60 cell panels, known as grid-tie standard (Voc ~38V, Vmpp=31V) - again with as many connected in parallel to achieve the desired solar power, up to 20A.

Solar panels with 72 cells are also supported (Voc=44-46V, Vmpp=36V) but recommended only for 24V systems.

Note that using 60 cell or 72 cell panels with 12V systems is supported and safe but will be inefficient, as the controller will not source current from the panel at the maximum power point, but at the current battery voltage (which increases with increased state of charge). The maximum open circuit voltage of the solar array is 55 V with a maximum short circuit current of 20A.

Description of Functions

Three-stage battery charging

The advanced 3-stage battery charging increases the life of lead-acid batteries. The set points for the different stages are fully configurable via the serial interface and can be adjusted to your system setup.

Bulk stage

The battery is charged with maximum possible current until the topping stage voltage limit is reached.

Topping stage

The batteries are charged for some time using the maximum charge voltage. After a current cut-off limit or a time limit is reached, the charger goes into trickle mode for lead-acid batteries or into standby mode for Li-ion batteries. This stage is also called absorption mode. In the case of Li-ion batteries, this is the constant voltage (CV) charging

phase. This is the stage where the PWM algorithm is active.

Trickle stage

This stage can be kept forever for a lead-acid battery and keeps the battery at a full state of charge. If too much power is drawn from the battery, the charger automatically goes back to bulk charging stage.

Load Output

In order to protect the battery from deep-discharge, appliances connected to the load output are automatically disconnected at low state of charge. When the voltage rises again, the load port is switched back on after 1 hour.

USB Output

The USB port provides power supply for mobile devices like phones. The maximum current is 500 mA.

Temperature compensation

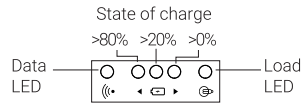
The battery voltage set points for the different charging stages have to be adjusted depending on the battery temperature. The temperature can be estimated based on temperatures measured inside the charge controller or it can be directly measured at the battery using the external temperature sensor to maximize performance. The external temperature sensor is also connected via the LS.one port.

Data Transmission

The charge controller is fitted with wireless technology that sends data over the GSM network. Our devices use a message queuing system, meaning that data can be recorded at set intervals and sent in batches. The maximum number of messages that can be sent together is 16. Both the data recording interval and sending interval are configurable.

LED Display

The data LED blinks rapidly when data is being sent or received. The LED stays permanently on when data is sent successfully, until the next time data is due to be sent. If the LED is off, that means that last data sending attempt was unsuccessful. The load LED will be permanently on when the load is available and off when there is no load available. This is true of the USB charging port too. If there is a fault such as a short circuit, this light will flash rapidly. One of the state of charge LEDs will flash while charging.

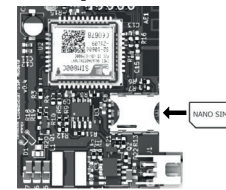


SIM Card Insertion / Replacement

In most cases a SIM card will come supplied and already fitted into the

charge controller but if it is not or you need to install a different SIM or replace the SIM for any reason, you will need:

- 1) Nano SIM , 2) 2G enabled SIM , 3) Minimum of 8MB per month data pack , 4) Recurring data pack.
- Most networks have will not need a change to the APN settings but if you are using a specialised M2M SIM card, the APN settings may need to be changed at the manufacturer. It is advised to be sure that 2G network is available in the area where you are installing. To insert the SIM, remove the device enclosure and insert according to the image.



Specifications

Electrical specifications

Battery Voltage	12/24V auto select
Rated battery current	20A
Nominal PV power, 12V	<300W
Nominal PV power, 24V	<600W
Maximum PV open circuit voltage	55V
Maximum PV short circuit current	20A
Operation temperature	-10°C to +50°C
Operation humidity	95%, non-condensing
Environmental condition	Indoor type 1, unconditioned

Mechanical specifications

Material	HDPE plastics
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Weight	260
Dimensions	100.50w x 107.75l x 44.50d (mm)
Terminal	Max. 4 mm ² / AWG11
IP rating	IP20
Standard settings	
Battery type	Lead-acid
Load disconnect voltage	11.7V (current-compensated)
Load reconnect voltage	12.3V
Temperature compensation	-3 mV/K/cell

Troubleshooting

Problem : Charge controller does not turn ON.

Cause : Incorrect or loose connections.

Fix : Ensure the connections are

correct as of this manual. Connect them in the recommended order.

Cause : Broken circuitry.

Fix : Return to manufacturer.

Problem : Load does not turn on.

Cause : Short circuit. If the load LED is flashing rapidly, the device has detected a short circuit.

Fix : Find and fix the short circuit.

When you are sure there is no short circuit, restart the charge controller by disconnecting and reconnecting all the terminals.

Cause : The battery has a low state of charge.

Fix : Re-charge the battery. If this does not happen after 3 days, contact the operator, the battery or solar panel may be damaged.

Cause : The load has been purposefully disconnected by the operator.

Fix : Contact the operator to find out the reason for being disconnected.

Problem : Battery overcharge.

Cause : Defective battery.

Fix : Replace battery.