



# phocos 181819812 CML-USB Solar Charge Controller User Manual

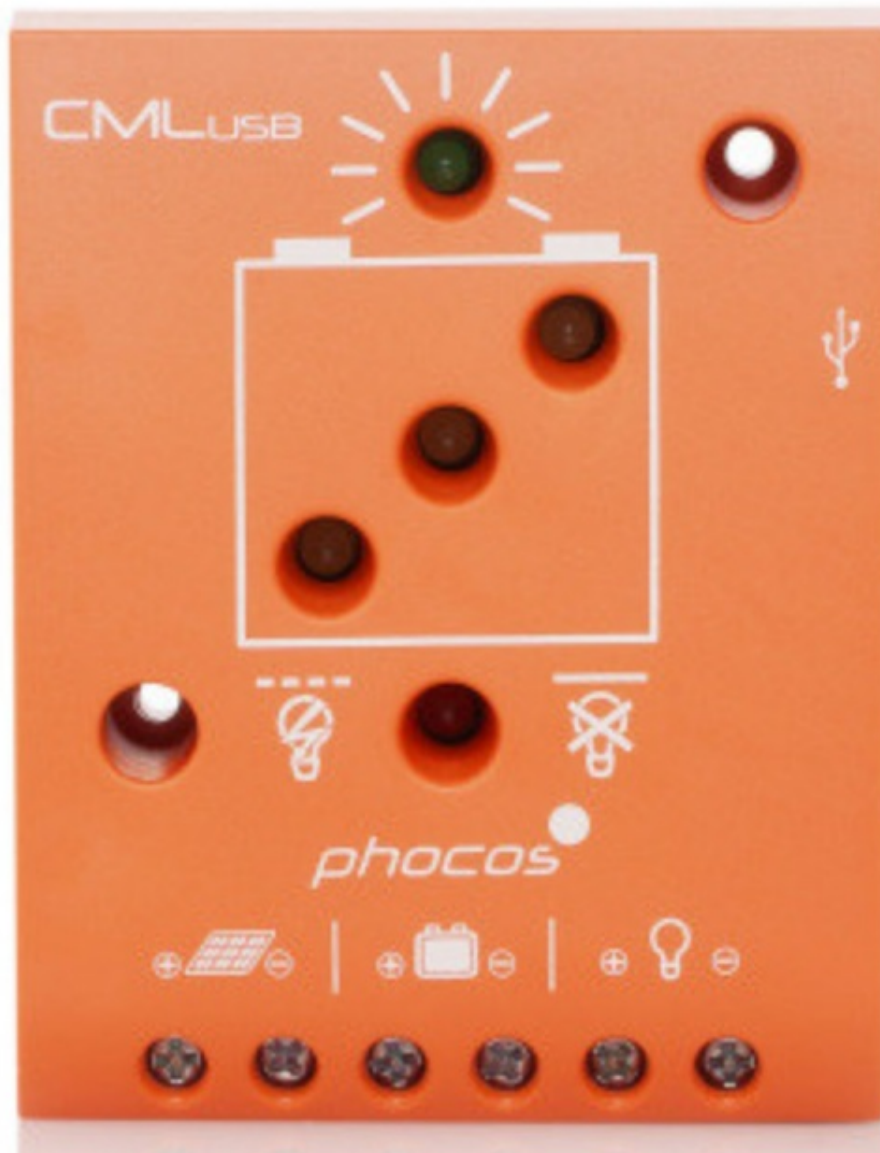
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**phocos 181819812 CML-USB Solar Charge Controller**



Dear customer Thank you very much for buying this Phocos product. Please read the instructions carefully and thoroughly before using the product. [www.phocos.com](http://www.phocos.com)

**Your new CML-USB controller** is a state-of-the-art device that was developed in accordance with the latest available technical standards. It comes with a number of outstanding features, such as:

- A clear indication of the state of charge
- Acoustic signal when the state of charge changes
- Low voltage disconnect is regulated by the state of charge or voltage
- 16 mm' connector clamps
- Complete electronic protection

Please read this manual carefully taking special note of the safety and usage recommendations at the end. The toe manual shows important recommendations for installation, product use, and a troubleshooting guide for potential problems with the controller.

## IMPORTANT SAFETY INSTRUCTIONS

### SAVE THESE INSTRUCTIONS

This manual contains important instructions for the CML-USB controller that shall be followed during the

installation, operation, and maintenance of the charge controller.

## **RISKS OF FIRE, USE CONTROLLER WITHIN 0,5 m OF BATTERIES!**

- **Battery type:** Lead acid (GEL, AGM, flooded)
- **Nominal voltage rating of the battery:** 12 V or 24 V
- **Battery fuse:** Use a fast-acting fuse with an interruption rating
- [www.phocos.com](http://www.phocos.com)
- the capacity of 1000 A on the battery side. We recommend using a fast-acting melting fuse (e. g. car type fuses) as close as possible to the battery terminal. The maximum
- current rating should be 1.5 times the nominal current of the charge controller.
- Please do not disassemble or attempt to repair Phocos products. Phocos charge controllers do not contain user-serviceable parts.
- Please observe all instructions with regard to external fuses/breakers as indicated.

## **Maintenance and installation notes**

- When installing or working on the PV system, please disconnect the PV (solar) modules from the charge controller first, to prevent any damage to the charge controller!  
Verify all cable/wire connections are tightly fastened to the connectors/binding posts in order to avoid any bad or loose connections that could result in excessive heating.
- Install a fuse or breaker near the battery before installing or adjusting the controller!
- Install and operate the controller in a dry environment.

## **High voltage risks**

- Operation of this device may produce a high voltage which can cause severe injuries or death in case of improper installation or operation of the device.  
PV modules can generate high DC voltages!
- Make sure the cables are always connected to the correct terminal. An electrical shock can be lethal. In general, any electric shock can be dangerous to your health.

## **CE labeling**

- The product is CE-compliant.

## **Description of Functions**

- The charge controller protects the battery from being overcharged by the solar array and from being deeply discharged by the loads.
- The charging characteristics include several stages which include automatic adaptation to the ambient temperature.
- The charge controller adjusts itself automatically to 12V or 24V system voltage.
- The charge controller has a number of safety and display functions.

## Mounting and Connecting

The controller is intended for indoor use only. Protect it from direct sunlight and place it in a dry environment. Never install it in humid rooms (like bathrooms). The controller measures the ambient temperature to determine the charging voltage. The controller and battery must be installed in the same room. The controller warms up during operation, and should therefore be installed on a non-flammable surface only.

**REMARK:** Connect the controller by following the steps described below to avoid installation faults.

Mount the controller to the wall with screws that fit the wall material. Use screws with a 4 mm shaft and max. 8 mm head diameter, no counter sink. The screws must be able to carry the force applied by the wiring. Make sure that the ventilation slits on the sides are unobstructed.



A DIN Rail mounting plate is available as an accessory (CX-DR2). This allows mounting the controller on a standard 35mm DIN rail. Remove the screws at the backside of the controller and screw the mounting plate with the (long) fastening screw onto the backside of the controller. Connect the wires leading to the battery with the correct polarity. To avoid any voltage on the wires, first connect the controller, then the battery. Follow the recommended wire length (min 30 cm to max approx. 100 cm) and the wire size:



- **CML-USB0S:** min 2.5 mm<sup>2</sup> (AWG13)
- **CML-USB10:** min 4 mm<sup>2</sup> (AWG11)
- **CML-USB20:** min 6 mm<sup>2</sup> (AWG9)
- If the polarity is wrong, solely the red lights up.

**WARNING:** If the battery is connected with reverse polarity, the load terminals will also have the wrong polarity. Never connect loads during this condition!

**REMARK:** Follow the recommendations of your battery manufacturer. We strongly recommend connecting a fuse directly to the battery to protect against any short circuit in the battery wiring. The fuse should be 50% larger than the charge controller nominal current:

**CML-USB05: 7.5A, CML-USB10: 15A, CML-USB20: JOA**



Connect the wires leading to the solar array with the correct polarity. To avoid any voltage on the wires, first connect the controller, then the solar array. Mind the recommended wire size:

- **CML-USB05:** min 2.5 mm<sup>2</sup> (AWG13)
- **CML-USB10:** min 4 mm<sup>2</sup> (AWG11)
- **CML-USB20:** min 6 mm<sup>2</sup> (AWG9)

**REMARK:** Place positive and negative wires close to each other to minimize electromagnetic effects.

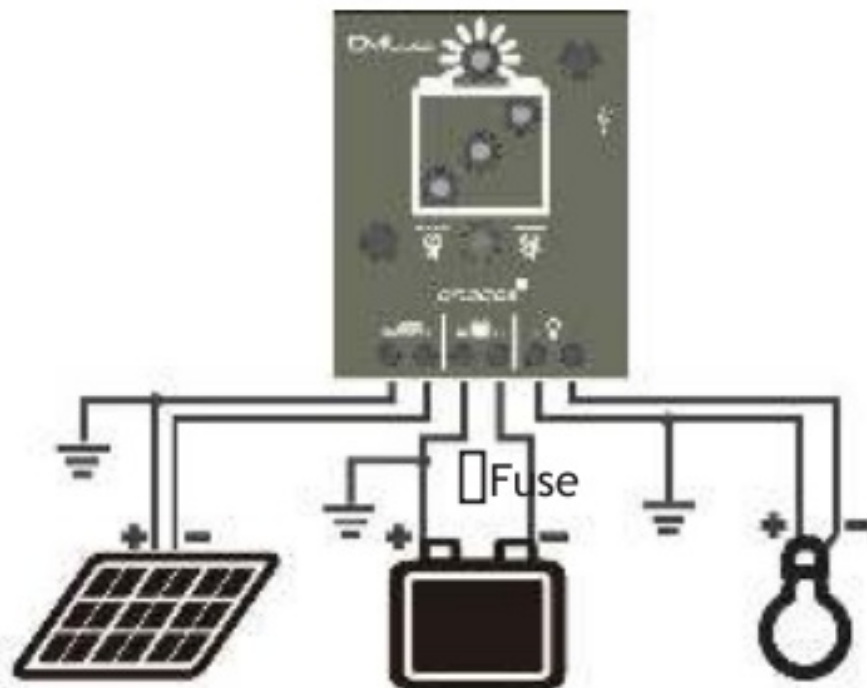
**REMARK:** Solar panels provide voltage as soon as exposed to sun light. Follow the solar panel manufacturer's recommendations for installation, safety, and use.

- Connect the wires leading to the loads with correct polarity.
- To avoid any voltage on the wires, first connect the wire to the load, then to the controller. Follow the recommended wire size:



- **CML-USB05:** min 2.5 mm<sup>2</sup> (AWG13)
- **CML-USB10:** min 4 mm<sup>2</sup> (AWG11)
- **CML-USB20:** min 6 mm<sup>2</sup> (AWG9)

## Grounding the Solar System



Be aware that the positive terminals of the CML-USB controller are connected internally and therefore have the same electrical potential. If any grounding is required, always do this on the positive wires.

**REMARK:** If the device is used in a vehicle which has the battery negative on the chassis, loads connected to the regulator must not have an electric connection to the car body. Otherwise the Low Voltage Disconnect function and the electronic fuse function of the controller are short circuited.

## Starting up the Controller

### Self Test

As soon as the controller is supplied with power either from the battery or the solar array, it starts a self-test routine. Then the display changes to normal operation.

### System Voltage

The controller adjusts itself automatically to 12 V or 24 V system voltage. As soon as the voltage at the time of start-up exceeds 18 V, the controller assumes a 24 V system. If the battery voltage is not within the normal operation range at start-up, a status display according to the section ERROR DESCRIPTION occurs.

### Battery Type

The controller is preset to operate with lead-acid batteries with solid electrolytes (GEL type or AGM type). If you intend to use a lead-acid battery with liquid electrolyte, you can adjust the charging characteristics (see "settings"). The equalization charge mode is added then. In case of any doubts consult your local dealer.

## Recommendations for Use

The controller warms up during normal operation.

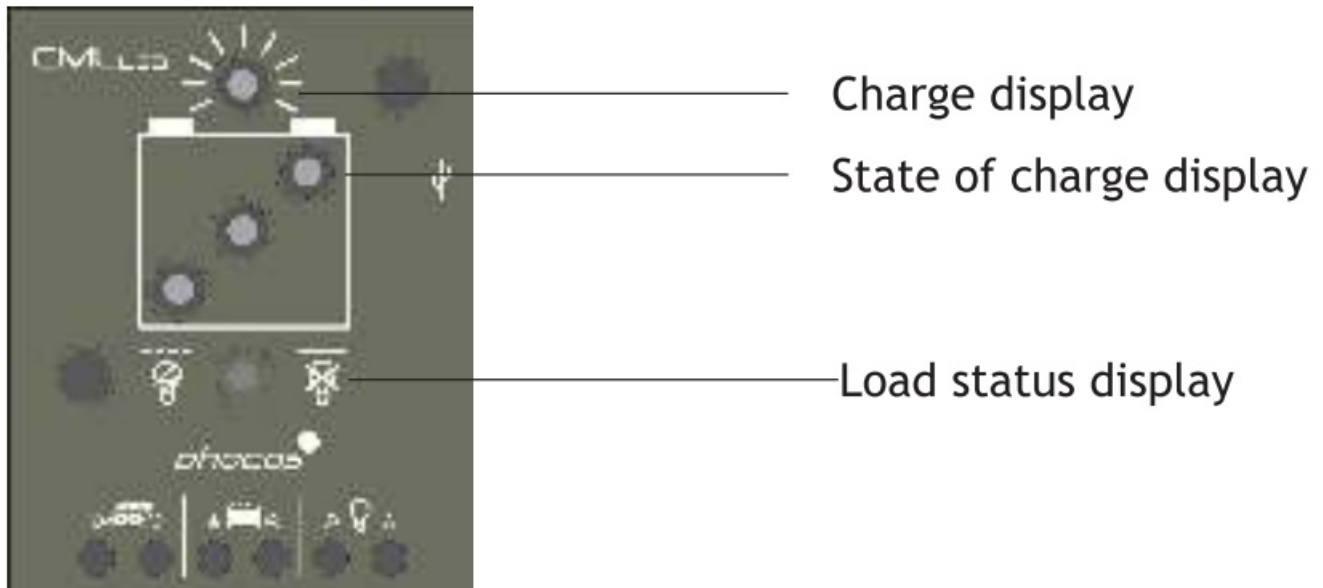
The controller does not need any maintenance or service. Remove dust with a dry tissue.

It is important that the battery gets fully charged frequently (at least monthly). Otherwise, the battery will be permanently damaged.

A battery can only be fully charged if not too much energy is drawn during charging. Keep that in mind, especially if you install additional loads.

## Display Functions in normal operation

The controller is equipped with 5 LEDs and an acoustic warning signal.



In normal operation, the controller shows the state of charge of the battery and the charge from the solar panels. Any change of the state of charge (SOC) to a lower status is additionally signaled acoustically.

### Charge display

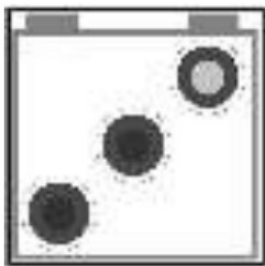


Solar array supplies  
electricity  
(LED on)

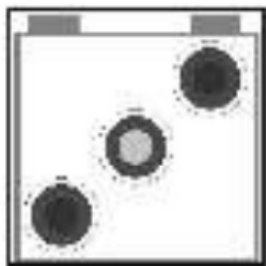


Solar array does not  
supply electricity  
(LED off)

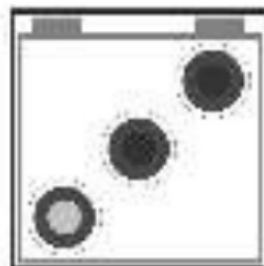
### State of charge display



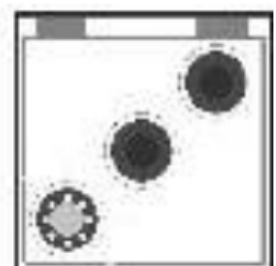
>75%



25-75%



<25%

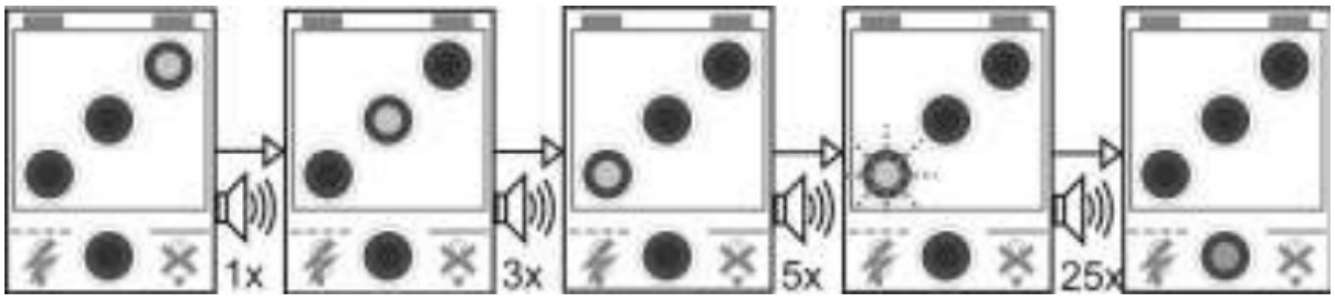


flashes: <10%

The percentage corresponds to the available energy until Low Voltage Disconnect in relation to a fully charged battery.

### Acoustic signals

A change in the state of charge (SOC) to a lower status is indicated by an acoustic signal.



The loads are disconnected approx. 1 minute after a series of 25 signals.

#### Load status display

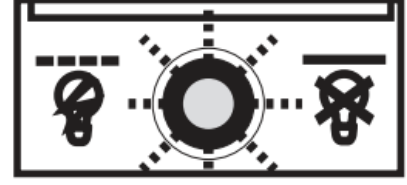
In case of deep discharge or overload/short-circuit of load, the load output is switched off. This is indicated by:



Normal operation  
(LED off)



Low voltage  
disconnect (LED on)



Overload or  
Short-circuit of load  
(LED flashing)

#### Low Voltage Disconnect Function (LVD)

The controller has 2 different modes to protect the battery from being deeply discharged:

1. State of charge controlled: Disconnect at 11.4 V (at nominal load current) up to 11.9 V (at no load current).  
Normal operation mode for good battery protection.
2. Voltage controlled: Disconnect at 11.0 V fixed setting. Appropriate if bypass loads draw current directly from the battery.

The controller is preset to Mode 1 from the factory. Changing the mode setting is described below.

If in doubt about which mode to choose, consult your dealer. This will have to be evaluated depending on the battery used.

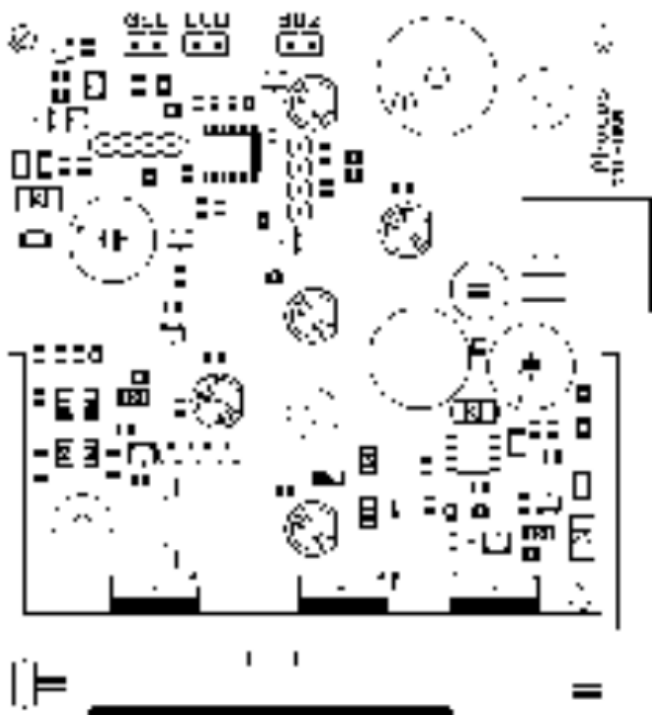
#### Settings

The controller can be configured for special operation. For this purpose, open the cover of the controller by removing the screws on the back side.

**WARNING:** The controller should not be opened while connected and in operation!

When the controller is opened, there are 3 jumpers on the electronic board:





For changing, put the jumper either on both contact pins or only on one contact pin:



Closed jumper



Open jumper

With these jumpers, the following settings can be configured:

Jumper	GEL (1)	LVD (2)	BUZ (3)
<b>Function</b>	Battery type	The function of low voltage disconnect	Acoustic alarm signal
Setting <b>jumper open</b>	Liquid electrolyte	Voltage controlled	Alarm off
Setting jumper closed	GEL (VRLA battery)	State of charge controlled	<b>Alarm on</b>
Factory setting	Jumper closed (GEL)	Jumper closed state of charge controlled	Jumper closed <b>Alarm on</b>

After completing the setting, replace the cover and tighten it with the screws.

## Safety Features

The controller is protected against improper installation or use:

	PY terminals	Battery terminals	Load terminals
Reverse polarity	Protected	<b>Warning:</b> Red LED on	Protected(1)
Short circuit(2)	Protected	Protected(3)	Switches off immediately
<b>Over Current</b>			Switches off with a delay(4)
<b>Reverse Current</b>	Protected		
Overvoltage	<b>Max. 50 V</b>	<b>Max. 50 V</b>	Switches off
Undervoltage			Switches off
<b>Over temperature</b>	<b>Reduces the charging current if over temperature occurs and switches off the load if the temperature reaches a high level.</b>		

1. The controller can protect itself, but any connected loads might be damaged.
2. Short circuit: >4x- 6x nominal current.
3. The battery must be protected by a fuse, or it might be permanently damaged in case of a short circuit.
4. >200% nominal current: disconnect with 3s delay



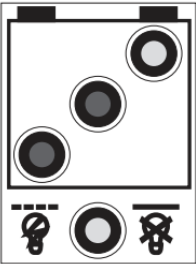
**WARNING:** The combination of different error conditions may cause damage to the controller. Always remove the fault condition before you continue connecting the controller!


## USB charger



USB connector for 5 V supply to small appliances like for charging cell phones, compact portable computers, small music players; with up to 700 mA of current consumption.

**Warning:** Do not connect the charging device anywhere else! USB negative contact is connected to load negative.

## Error Description

Error	Display	Reason	Remedy
Loads are not supplied		Battery is low (Red LED on)	<b>Load will reconnect as soon as battery is recharged.</b>
		<b>Overcurrent/</b> Short circuit of loads (Red	Switch off all loads. <b>Remove short circuit. Controller will switch on load</b>
		LED flashing)	automatically after <b>max 1 minute.</b>
		Battery voltage too high ( $>15.5 / 31.0 \text{ V}$ )	Check if other sources overcharge the battery. If not, controller is damaged.

		Battery wires or battery fuse damaged, battery has high resistance	Check battery wires, fuses and battery.
Battery is empty after a short time		Battery has low capacity (Red LED on)	Change battery

Error	Display	Reason	Remedy
Battery is not being charged during the day		<b>Solar array</b> faulty or wrong polarity (Green LED on)	Remove faulty <b>connection</b> / <b>reverse polarity</b>
Battery <b>wrong</b> polarity	 <b>Permanent sound</b>	Battery is <b>connected with</b> reverse polarity	<b>Remove reverse</b> polarity

## Technical Data

System Voltage	<b>12 / 24 V, automatic recognition</b>
<b>Max. Charge/Load Current</b>	5/10/20A according to model number

Float Charge	13.8 / 27.6 V (25°)
<b>Main Charge</b>	14.4 / 28.8 V (25° C),0.5h(daily)
Boost Charge	14.4 / 28.8 V (25°) ,for 2h activation:battery voltage<12 .3 /24 .6V
<b>Equalization Charge</b>	14.8 / 29.6 V (25° C),for 2h activation:battery voltage<12 .1 /24 .2V (at least every 30 days)
Deep-Discharge <b>Protection</b>	11.4-11.9V / 22.8-23.8V (by SOC) 11.0 / 22.0 (by voltage)
<b>Reconnect Level</b>	12.8 / 25.6 V
<b>Overvoltage Protection</b>	15.5/31.0V
<b>Undervoltage Protection</b>	10.5 / 21.0 V
Max. Panel Voltage	30 / 50 V

<b>Temperature Compensation</b>	-24 mV/K (12 V); -48 mV /K (24 V);
Idle Self-Consumption	< <b>4 mA</b>
<b>Grounding</b>	<b>Positive grounded</b>
<b>Ambient Temperature</b>	-40 to+ 45°C
Max. Altitude	<b>4,000m above sea level</b>
Battery Type	Lead acid(gel, AGM, flooded)
USB Port	USB type A, 5 V, 700 mA
<b>Max. Wire Cross section</b>	16 mm <sup>2</sup> (AWG 6)
Dimensions(WxHxD)	80 x 100 x 36 mm/3.1 x 4 x 1.3 in


Weight	0.16 kg/ 0.35 lb
Ingress Protection	IP65
Certificates	CE-compliant, RoHS compliant
Warranty	5 years

## Liability Exclusion

The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

- **Specifications are subject to change without notice.**
- **Version: 20191119**
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## Documents / Resources

 <p>The image shows the cover of the user manual for the Phocos CML-USB Solar charge controller. It features the Phocos logo at the top, followed by the product name 'Phocos CML-USB Solar charge controller'. Below this, there is a list of languages: Betriebsanleitung, User Manual, Manual de instrucciones, Guide de l'utilisateur, and Manual de l'utilisateur. A small image of the orange solar charge controller is also visible.</p>	<p><a href="#">phocos 181819812 CML-USB Solar Charge Controller</a> [pdf] User Manual  181819812 CML-USB Solar Charge Controller, 181819812, CML-USB Solar Charge Controller, Solar Charge Controller, Charge Controller</p>
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