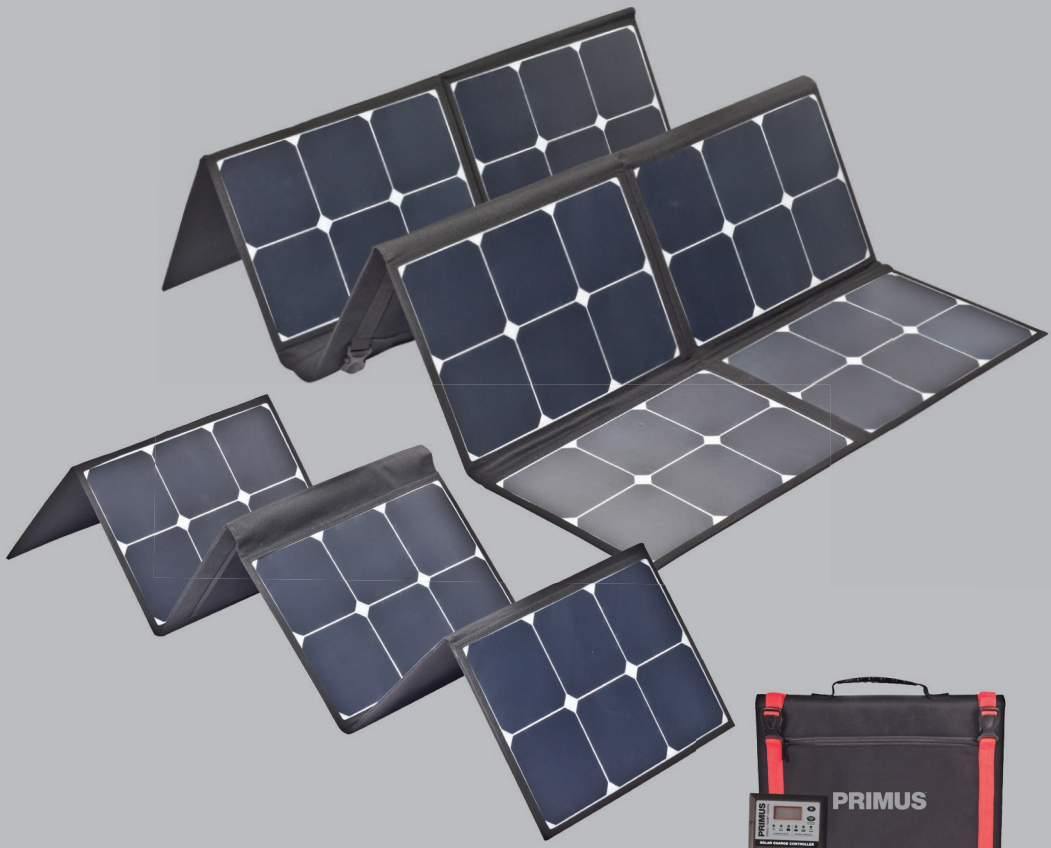
PRIMUS®

120W & 200W Solar Mat Kit

User Manual and Product Specifications



Suitable for camping, 4WDriving, caravanning, boating and other outdoor activities

Part No. **PRI20023 / PRI20034**

Introduction

The Primus Solar Mat Kit is a high performance ultra-compact solution for solar charging all types of 12V DC batteries (excluding lithium).

Ideally suited for camping, 4WDriving, caravanning, boating and other outdoor activities to power a range of 12V DC accessories directly from your 12V DC battery, including; portable fridges, lighting, TVs, DVD players, bulge pumps, food warmers and even water pumps for a shower or a hot water system. You can also connect a 240V AC inverter to your battery to power a limited range of 240V AC appliances*.

Primus Solar Mat Kits are designed for Australia's tough conditions, using high quality components which provide dependable performance and reliability in an easy to use extremely compact solar kit.

After taking the folding solar mat out of the box, choosing a suitably cleared area to unfold and setup the panels facing the sun, select the appropriate battery type on the digital controller, connect the clamps to your battery, and then join the extension leads, you're ready to go. Simple!

Utilizing the abundance of free sunlight available, the SunPower™ monocrystalline cells convert this sunlight into usable DC (direct current) electricity. Due to the cells high efficiency, the electricity produced or voltage output (measured directly at the cell) is too high to be used effectively. To better control the voltage output we have included a digital, 5 stage 15A PWM (pulse width modulated) weatherproof controller to automatically adjust the voltage output no matter what type of battery is being charged.

Simply, select the correct battery type, being either; GEL, AGM, WET (Lead-Acid) or Calcium, connect the supplied battery clamps to the correct battery terminals and the digital controller will automatically decide the amount and rate of charge battery needs.

Note: The controller supplied with this product is NOT suitable for charging lithium batteries.

Part No. PRI20023 Product Features;

- 22.5% highly efficient SunPower™ monocrystalline C60 solar cells
- Six 20W panels, utilizing six SunPower™ cells per panel
- Extremely compact and lightweight
- Heavy duty 900D outer material
- Carry handle with non-slip rubber grip
- 12V digital, 5 stage 15A PWM (pulse width modulated) weatherproof controller
- 50A heavy duty Anderson style plugs
- 5m Extension lead – twin core, 3.31mm^2 with UV stable outer sheath
- 0.8m Extension lead with battery clamps
- Very easy to setup and use
- Everything needed to charge your battery is included in the kit, except the sun!

Part No. PRI20034 Product Features;

- 22.5% highly efficient SunPower™ monocrystalline C60 solar cells
- Ten 20W panels, utilizing six SunPower™ cells per panel
- Extremely compact and lightweight
- Heavy duty 900D outer material
- Carry handle with non-slip rubber grip
- 12V digital, 5 stage 15A PWM (pulse width modulated) weatherproof controller
- 50A heavy duty Anderson style plugs
- 5m Extension lead – twin core, 3.31mm^2 with UV stable outer sheath
- 0.8m Extension lead with battery clamps
- Very easy to setup and use
- Everything needed to charge your battery is included in the kit, except the sun!

IMPORTANT: This user manual contains important safety information and operating instructions. Please read this manual carefully to familiarise yourself with the product and accessories before connecting to the battery being charged. Keep this manual in a safe place for future reference.

General Warnings

- Do not connect the solar mat output wire directly to the battery being charged. A controller/ regulator must be used inline. Failure to do so, could cause permanent damage to the battery and or personal injury if the battery ruptures
- Follow the assembly instructions within this manual carefully as to not cause harm to yourself or others, particularly when 'connecting' and 'disconnecting' the DC clamps (Direct Current clamps) to or from the battery being charged
- Do not charge 'dry' cell rechargeable batteries with this product. To charge 'dry' cell rechargeable batteries, connect an appropriate sized 240V invertor to the 'wet' cell battery being charged by the solar mat. Then connect the 240V 'dry' cell charger which came with the batteries to the 240V inverter ensuring that the manufactures guidelines are followed
- Do not charge 'dry' cell non-rechargeable batteries
- Do not charge a damaged battery
- Do not charge a frozen battery
- Do not use this solar mat if it is damaged in anyway. Please contact customer service for advice if necessary, details are at the back of this booklet
- Do not disassemble the solar mats or controller
- Ensure that the battery being charged is in a well ventilated area as poisonous gasses may be emitted during the charging process
- Ensure that appropriate personal protective equipment (PPE) is worn while in close proximity to the battery being charged; Safety glasses, Gloves, Protective clothing as a minimum
- Ensure that no metal objects or jewellery contacts the battery terminals. It is recommended to remove rings, bracelets etc when working with lead-acid batteries. A lead-acid battery can produce a short-circuit current high enough to melt metallic materials possibly causing severe burns
- Do not smoke or have the battery in the vicinity of sparks, open flame, fuel or solvents while the battery is being charged. Gasses emitted could be ' EXPLOSIVE'
- Battery acid is highly corrosive. Avoid 'CHEMICAL BURNS' wash effected area immediately with clean running water if contact is made with your skin or eyes. Seek medical advice
- Disconnect power from the solar mat by separating at least one join between either extension lead before 'connecting' or 'disconnecting' the DC clamps to or from the battery
- Ensure correct DC clamp connection '***sequence***' when 'connecting' and 'disconnecting' the DC clamps to or from the battery being charged. A simple way to remember is; The negative '-' DC clamp is '**Last**' on and '**First**' off (the negative '-' battery terminal). This will reduce the dangers of a potential short-circuit and excessive sparking of the battery terminals
- Ensure correct DC clamp connection '***polarity***' when 'connecting' to the battery being charged. Connect the Red coloured DC clamp to the positive '+' battery terminal. Then connect the Black coloured DC clamp to the negative '-' battery terminal
- Immediately cease charging if the battery being charged is found to be excessively hot, leaks or appears to be taking a long time to charge
- This product must not be used by children or by an adult who has reduced physical or mental capabilities. Also, this product is not to be used by an adult who has a lack of knowledge or experience with this type of product, unless they are being supervised by a person who is competent in the safe use of this type of product.

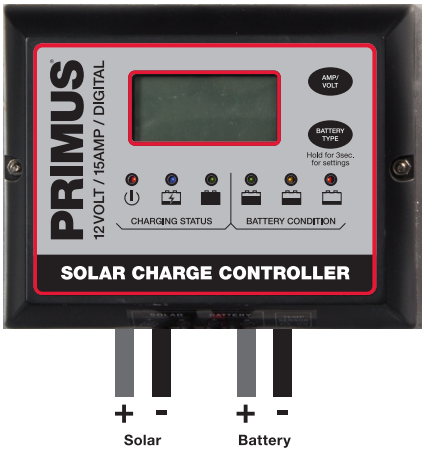
Understanding your Solar Mat

1. Folded Solar Mat
2. Heavy duty 900D polyester material
3. Carry handle with rubber grip insert
4. Retaining straps with quick release buckles
5. Front and rear storage pockets
6. Output lead with 50A Anderson style plug
7. 5m extension lead
8. 0.8m battery clamp extension lead
9. PWM Digital weatherproof 15A controller
10. Instruction manual
11. Unfolded 120W Solar Mat (PRI20023)
12. Unfolded 200W Solar Mat (PRI20034)

Controller/Regulator Specification and Operation

FEATURES

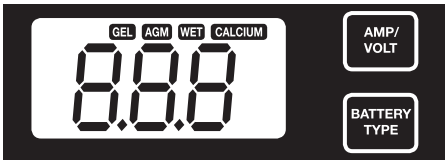
- Advanced MCU control Pulse Width Modulated (PWM) technology, high efficiency operation
- To be used on GEL, AGM, Conventional lead-acid (WET) and Calcium Batteries ONLY
- Built in regulator prevents your battery from being over or undercharged. Overcharging occurs when the charge voltage is unregulated and can result in premature battery failure. Undercharging is common with some conventional lead-acid and calcium batteries and your battery will not perform to its capacity
- Automatic equalization feature to revive deeply drained lead-acid and calcium batteries
- Can be connected to the battery permanently to keep the battery fully charged by using a process called “floating”. This means the controller will stop charging when the battery is full and will automatically start charging the battery as required. This process will also reduce water loss and help prevent the battery from ‘drying out’
- Protects your battery from discharge at night. Under low light or no light conditions the solar panel voltage could be less than the battery voltage. The unit contains a special circuit which prevents current flowing back from the battery and into the solar panel



- Coloured LEDs to easily indicate the operational status and battery condition
- Digital LCD to directly display battery voltage, charging current, charging capacity (Amp hour), battery types, full charge and fault codes
- Provides external battery temperature sensor (Optional)
- Multi charging protections against reverse polarity, short circuit, over temperature, over voltage, etc
- Weatherproof design.

Operation - LCD (Liquid Crystal Display)

Please check your battery manufacturer's specifications to select correct battery type. There are 4 battery types to select from: GEL, AGM, WET (conventional lead-acid), and Calcium.



Press **BATTERY TYPE** button and hold for 3 seconds to go into the battery type selection mode, the battery type you select will be shown on the LCD, the default battery setting is AGM. The controller will automatically memorize your battery type.

Caution: Incorrect battery type setting may damage your battery.

When the controller powers on, the unit will run a self-test and will automatically show the details on the LCD before going into charging process, for example:

8.8.8 Self-test starts, digital meter segments test

2.0.3 Software version test

12.0 V 15.0 A
Rated voltage and current test

25 °C
External battery temperature sensor test (if connected)

After going into charging process, the LCD displays the charging status as below: Press **AMP/VOLT button** in sequence, the LCD will display in turn with Battery Voltage, Charging Current, Charged Capacity (Amp-hour) and Battery Temperature (if external temperature sensor connected)

Display during the day

(12.6 V ⇨ 16.0 A ⇨ 95.0 AH ⇨ 25 °C)

Display during the night

(12.6 V ⇨ 25 °C)

Display when battery is fully charged

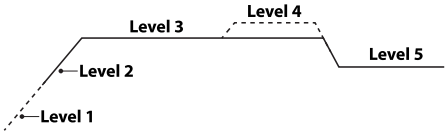
Press **AMP/VOLT button** in sequence, the LCD will display in turn with Battery Voltage, Charging Current, if you do not press the button, the LCD will alternatively display FULL and VOLT or FULL and AMP every 2 seconds.

(12.6 V ⇨ FUL °C) or (15.0 A ⇨ FUL °C)

CHARGING STAGES

The **AMP/VOLT button** can be changed at any time during charging process.

The LCD also can be treated as an independent voltage meter or thermometer. A voltage less than 11.5V indicates that the battery is discharged and needs recharging.



1. **Soft Charge:** When a battery has been over-discharged, the controller will softly ramp the battery voltage up to 10V.
2. **Bulk Charge:** Maximum current charging until the battery rises to absorption level.
3. **Absorption Charge:** Constant voltage charging until the battery is over 85%.
4. **Equalization Charge:** Only for WET or Calcium battery types, when the battery is deeply drained below 10V, it will automatically run this stage to bring the internal cells to an equal state in an attempt to restore lost capacity. (GEL and AGM battery do not run equalization charge)
5. **Float Charge:** Battery is fully charged and maintained at a safe level. A fully charged battery has a voltage of more than 12.6Volts.

Operation - LED Indication

The 6 LEDs indicate the charging status and the battery condition	Red	Blue	Green	Green	Yellow	Red
Solar power present - No battery connected	**ON**	OFF	OFF	OFF	OFF	**FLASH**
Soft charging	**ON**	**FLASH**	OFF	OFF	OFF	**ON**
Bulk charging	**ON**	**ON**	OFF	**Subject to battery voltage**		
Absorption charging	**ON**	**ON**	OFF	**ON**	OFF	OFF
Equalization charging	**ON**	**ON**	OFF	**ON**	OFF	OFF
Float charging	**ON**	OFF	**ON**	OFF	OFF	OFF
Solar panel weak	**FLASH**	OFF	OFF	**Subject to battery voltage**		
At night no charge	OFF	OFF	OFF	**Subject to battery voltage**		
Battery voltage below 11.5V (+/-0.2V)	**ON**	**ON**	OFF	OFF	OFF	**ON**
Battery voltage between 11.5V - 12.5V (+/-0.2V)	**ON**	**ON**	OFF	OFF	**ON**	OFF
Battery voltage above 12.5V (+/-0.2V)	**ON**	**ON**	OFF	**ON**	OFF	OFF

Abnormal Operation Mode

Solar mat abnormal mode	LCD display	LED indication	LCD backlight
Solar panel weak		FLASH	ON
Solar panel reverse connection	E01	FLASH	FLASH
Solar panel over voltage (>26.5V)	E02	FLASH	FLASH

Battery abnormal mode	LCD display	LED indication	LCD backlight
Battery disconnected or less than 3.0V	b01	FLASH FLASH FLASH	FLASH
Battery reverse connection	b02	FLASH	FLASH
Battery over voltage (>17.5V)	b03	FLASH	FLASH
Battery temperature over 65°C	b04	FLASH FLASH FLASH	FLASH

Solar controller abnormal mode	LCD display	LED indication	LCD backlight
Controller over temperature protection	bEP		FLASH

Set Up

STEP 1

Remove the solar mat and accessory leads from the original packaging. Check the solar mat, leads and connectors for any damage before use.

Note: If damage is found on any part, it is highly recommended that they are replaced with genuine parts available from Primus Australia Pty Ltd. Please contact Primus customer service, details are at the back of this booklet if spare parts are required.

Select a suitably cleared area to unfold the solar mat. The position should allow the solar mat to have a clear view of the sun and facing in the direction of 'North' as close as possible.

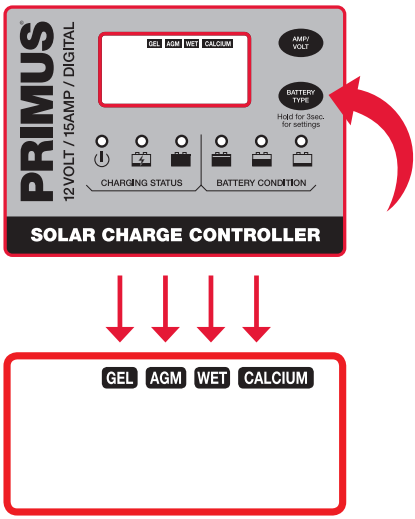
Warning;

Cells (panels) will start producing electricity as soon as they are exposed to the sun. Care must be taken when connecting the DC clamps to the battery and joining the extension leads. To reduce the possibility of an electric shock or short-circuit, it is recommended to place a blanket or tarp over the panels to block out any sunlight temporally while all connections are made.

STEP 2

Refer to the specification label on your battery or consult the battery manufacture to establish the type of battery being charged. On the controller front panel, push the '**Battery Type**' button to cycle through the menu to match the battery type being charged. The different battery types are displayed at the top of the LCD.

Once selected, the battery type will remain in memory for next time



STEP 3

FIRST, connect the DC clamp on the 0.8m extension lead to the correct polarity terminals on the battery being charged. Example; Ⓐ 'RED' DC clamp to the Positive '+' terminal and the Ⓑ 'BLACK' DC clamp to the negative '–' terminal.

Note: Please refer to "General Warnings" on page 3 of this manual regarding the correct sequence when "connecting" & "disconnecting" the DC clamps from the battery being charged.

Ⓒ Connect other end of the 0.8m extension lead (50A plug) to controller output lead (50A plug)
Note: These connection plugs are red in colour for ease of identification

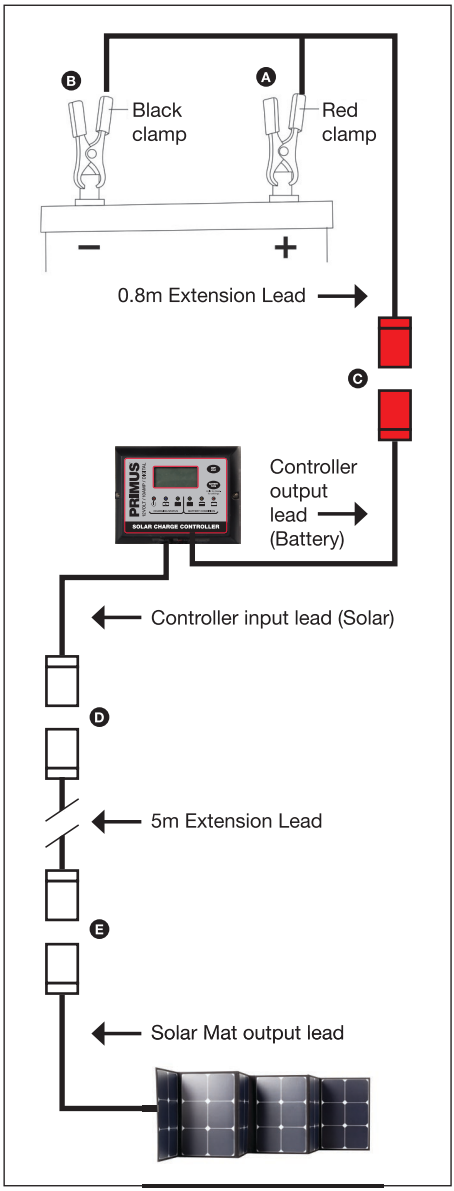
Ⓓ Connect controller input lead (50A plug) to either end of the 5m extension lead (50A plug) then finally, join the remaining end of the 5m extension lead to the solar mat output lead. Ⓔ

Ensure the all connections are firm and that the extension lead is positioned not to cause a tripping danger to people walking by. And that's it, your battery will now be charging.

Monitor the output of the solar mat via the controller display. Also ensure that the solar mat is kept in direct sunlight for optimum efficiency. The solar mat may have to be moved periodically throughout the day to track the suns path.

For disconnection, simply reverse the sequence above.

Note: It is recommended to establish connections (DC clamps) at the battery being charged first. Then, join the connectors in sequence working back towards the solar mat. This will eliminate the danger of having 'live' battery clamps inadvertently being sort-circuited causing equipment damage and possibly fire.



Frequently Asked Questions

Q: How does the solar mat work?

A: The solar mat converts sunlight energy into DC (direct current) electric power to charge rechargeable batteries. The batteries are then used to run your lights, fridge or power an inverter

Q: What type of batteries can be charged with this solar mat kit?

A: The controller is factory set for AGM batteries, however the controller can also be set to charge GEL, WET or Calcium batteries by scrolling though the menu. Do not charge 'dry' cell rechargeable batteries or 'dry' cell non-rechargeable batteries.

Q: Can I bypass the controller to charge my battery?

A: No, the voltage output directly from the solar mat exceeds the optimum voltage recommended to charge the battery. The controller automatically regulates the voltage output to suit the particular battery size and type being charged.

Q: Will the solar mat overcharge my battery?

A: The controller (regulator) ensures that a steady charge is supplied and will not over charge the battery. The controller has up to five levels of charging and will automatically evaluate the battery's condition to establish whether to; Soft Charge, Bulk Charge, Absorption Charge, Equalization Charge (only for WET or Calcium batteries) or Float Charge.

Q; How many Amps do I get out of my 120w Solar Mat and what can I run?

A: A 120W kit can supply between 6 and 7 Amps in optimal conditions on a sunny day or for most of the sunlight hours of the day. There are many variables, but let's assume that we can achieve 6 to 7 sunlight hours in a day, anymore sunlight hours would be considered a bonus.

Provided it is not too cloudy, the solar mat is moved every now and again to best track the suns path and the solar mat is kept out of the shade, it is safe to assume that the solar mat can supply between 6 and 7 Amps per charging hour.

So, putting this into perspective, let's assume that the 120W solar mat is charging a 100Ah battery. You wish to run a 40L Fridge which draws on average 1.5A over a 24hr period, and 2 x LED camp lights which draw 1.0A each when running.

You want to have the fridge running (cycling) 24 hours a day, and the camp lights on for 3 hours each night.

Fridge: 1.5A x 24h = 36Ah

Lights: 1.0A x 3h = 3Ah x 2 lights = 6Ah

Total: 42Ah per day.

Your solar mat can supply:
6.5A x 6h = 39Ah each day.

Therefore the battery is being discharged by:
42Ah – 39Ah = 3Ah each day.

Although you have a 100Ah battery, it is recommended when calculating run times is to allow yourself a buffer and calculate using only 50% of the battery specification. So, in this case using 50Ah you could run your fridge and lights for: 50Ah / 3Ah = 16.6 days or over 2 weeks without any other form of charge.

Q: How many Amps do I get out of my 200w Solar Mat and what can I run?

A: A 200W kit can supply between 11 and 12 Amps in optimal conditions on a sunny day or for most of the sunlight hours of the day. There are many variables, but let's assume that we can achieve 6 to 7 sunlight hours in a day, anymore sunlight hours would be considered a bonus.

Provided it is not too cloudy, the solar mat is moved every now and again to best track the suns path and the solar mat is kept out of the shade, it is safe to assume that the solar mat can supply between 11 and 12 Amps per charging hour.

So, putting this into perspective, let's assume that the 200w solar mat is charging a 2 x 100Ah batteries.

You wish to run a 40L Fridge which draws on average 1.5A over a 24hr period, 2 x LED camp lights which draw 1.0A each when running and a 1000W inverter with a 600W load.

You want to have the fridge running (cycling) 24 hours a day, the camp lights on for 3 hours each night and the inverter under load for a total of 2 hours throughout the day

Fridge: 1.5A x 24h = 36Ah

Lights: 1.0A x 3h = 3Ah x 2 lights = 6Ah

Inverter: 60.0A x 2h = 120Ah

Total: 162Ah per day.

Your solar mat can supply:
11.5A x 6h = 69Ah each day.

Therefore the battery is being discharged by:
162Ah – 69Ah = 93Ah each day.

Although you have a 2 x 100Ah batteries, 200Ah total, it is recommended when calculating run times is to allow yourself a buffer and calculate using only 50% of the battery specification. So, in this case using 100Ah you could run your fridge, lights and inverter for: 100Ah / 93Ah = 1.07 days without any other form of charge.

Maintenance

Periodically, clean the panels with warm water and a soft sponge or cloth to remove any built up dust or foreign deposits. Keeping your solar mat clean will ensure optimum performance.

Troubleshooting

The Solar Mat and Controller are both sealed units and cannot be repaired. If a problem does occur, double checking all connections, including correct polarity of the DC battery clamps and or disconnect the DC battery clamps from the battery and wait 30 seconds (this will reset the controller). If after reconnecting the DC battery clamps and the problem persists, please contact Primus customer service (details are at the back of this booklet)

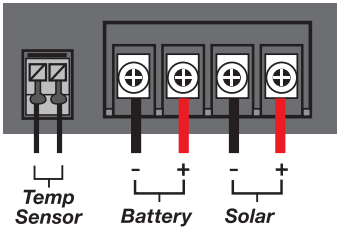
Technical Details - Controller

Charging	
Minimum battery start charging voltage	3VDC
Soft start charging voltage	3-10VDC +/-0.2
Soft start charging current (50% PWM duty)	Up to 15Amp
Bulk charge voltage	10-14VDC +/-0.2
Absorption charging voltage at 25°C	
• GEL type battery	14.1VDC +/-0.2
• AGM type battery (default setting)	14.4VDC +/-0.2
• WET type battery	14.7VDC +/-0.2
• Calcium type battery	14.9VDC +/-0.2
Absorption transits to Equalizing or Float condition	
• Charging current drops to	0.5Amp +/-0.1
• or Absorption charging timer timed out	4 Hours
Equalization charging active (Only for WET or Calcium battery)	
• Battery voltage discharged to less than	10VDC +/-0.2
• Automatic equalizing charging periodical	28 Days
Equalization charging voltage at 25°C	15.5VDC +/-0.2
Equalization charging timer timed out	2 Hours
Float charging voltage at 25°C	13.6VDC +/-0.2
Voltage control accuracy	+/- 1%
Battery temperature compensation coefficient	-24 mV/°C
Temperature compensation range	-20 to +50°C
Protection	
Against reverse polarity or short circuit at solar mat side	Yes
Against reverse polarity or short circuit at battery side	Yes
No reverse current from battery to solar at night	Yes
Over temperature protection during charging	65°C
Transient over voltage protection with TVS or varistor	Yes
Electrical Parts	
Input output terminal	M4 terminals
Temperature sensor port (Press and Release type)	DA 250-350 2P

Technical Details - Controller

Physical	
Controller material	Plastic, Standard ABS
Water & Weatherproof design	Yes
Net weight	Approx. 250g
Environmental	
Operating temperature	-25 to 50°C
Storage temperature	-40 to 85°C
Operating Humidity range	100% no condensation

Optional External Device



Optional external Battery temperature sensor:

As an option, the unit provides a port to connect the external battery temperature sensor; if the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and also provide the battery over temperature protection, in some case, if battery over temperature occurs, the controller will automatically stop charging.

Technical Details - Panels

	120W Solar Mat	200W Solar Mat
Cell make	SunPower™ Maxeon C60	SunPower™ Maxeon C60
Cell type	Monocrystalline Silicone	Monocrystalline Silicone
Cell efficiency	22.5%	22.5%
Cell qty & Panel qty	36 Cells & 6 x 20W Panels	60 Cells & 10 x 20W Panels
Pmax	120W	200W
Imp	6.06A	12A
Vmp	19.8V	16.5V
Voc	22.7V	19.5V
Isc	6.97A	13.8A
Normal operating cell Temp (NOCT)	46°C±2°	46°C±2°
Max system voltage	700V	700V
Standard test conditions	AM=1.5, 25°C, 1000W/M²	AM=1.5, 25°C, 1000W/M²
Max series fuse rating	7A	7A
Dimesions folded LxWxH	30 cm x 41 cm x 4 cm	30 cm x 41 cm x 6 cm
Dimesions unfolded LxW	175 cm x 41 cm	155 cm x 82 cm
Weight (total)	4.0kg	6.0kg

Customer Service

For more information call 1300 555 197
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