SUNBOLT

SUNBOLT™

Velocity Solar Charging Workstation

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VELOCITY

SOLAR WORKSTATION

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IMPORTANT SAFETY INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

Velocity Model V1 components may produce voltages and currents capable of causing severe injury or death. Extreme caution must be taken when installing, commissioning or troubleshooting the Velocity Model V1.

The following symbols are used throughout this manual to indicate potentially dangerous conditions or important safety instructions.

WARNING: Indicates a potentially dangerous condition.

CAUTION: Indicates a critical procedure for safe and proper operation of Velocity Model V1. Use extreme caution when performing this task.

Read all of the instructions and cautions in the manual before starting the installation.

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PRODUCT DESCRIPTION

Product Description

The Velocity Model V1 includes a non-utility-interactive solar photovoltaic and battery storage system intended to provide device charging to users. The system includes (2) battery-based inverter, (1) dc-coupled solar photovoltaic array comprised of (2) modules, (1) charge controller and (1) storage battery. The system outputs 120Vac Single Phase Two-Wire power that provides convenience lighting, GFCI-protected receptacles, and USB ports for device charging.

The product includes a dc-coupled solar photovoltaic array input source. It is connected to a charge controller. The charge controller output is connected in parallel to a battery bank and an inverter input circuit. The product is a stand-alone system and shall not be connected to the utility under any circumstances. The product includes an AC inverter connected in parallel to a battery bank and a charge controller output circuit. The AC inverter input is 12Vdc and its output is 120Vac Single Phase Two-Wire. The AC output (neutral) is bonded to ground.

The photovoltaic system does not include an integral DC ground-fault detector/interrupter protection device, as it is exempted per the exception provided in NEC 2017 690.41(B) for PV arrays with not more than two PV source circuits and with all PV system DC circuits not on or in buildings where solidly grounded.

The inverter is a stand-alone or non-utility-interactive type. It therefore does not have trip limits for voltage and frequency. Further, it does not include field adjustable trip limits. Its “as shipped” default settings include operating as an AC voltage source with a 115V +/- 10% range and as an AC frequency source with a 60 Hz +/- 0.1% range.

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INSTALLATION

Before proceeding read these instructions entirely. Check that all tools and components are available prior to the VELOCITY installation.

Installation Procedures

1. All personnel on-site during table installation shall be protected with OSHA appropriate safety gear, such as: protective work gloves, hard hat, safety glasses, and shoes. OSHA appropriate procedures should also be followed for all relevant installation procedures. The customer must provide an OSHA compliant pedestrian safety perimeter around each table installation site.

2. Only Qualified Personnel trained in the principles of electricity and electrical equipment should perform any electrical work required for installation.

3. A forklift, pallet jack and qualified operator shall be present for removing the VELOCITY from the freight truck upon delivery and transporting the VELOCITY to the site location.

4. The solar modules produce electricity when exposed to light. To avoid electric shock or injury, make sure the solar panels are covered with an opaque material
until the table is ready to be placed in operation.

5. Do not handle any loose parts without protective gear. Some parts may have sharp edges. Also, metal parts may be hot on a sunny day.

6. Do not install VELOCITY during inclement weather.

7. There are detailed safety instructions for all electrical equipment in the manufacturer's literature, which are included in this manual. Prior to installation please review these documents.

8. Do not install the VELOCITY in areas where snow and wind loads may exceed the ratings of the VELOCITY.

9. Document the condition of the packaged VELOCITY once it arrives by taking several photographs. Inspect package for any indication of broken or loose parts. If any damage is apparent, ensure that it is documented with photographs and notify Sunbolt immediately.

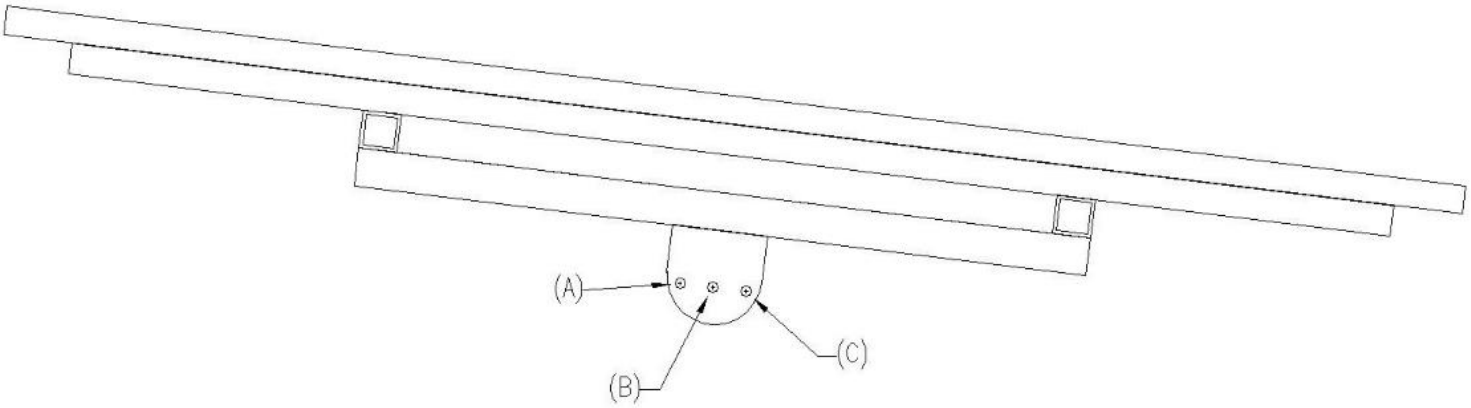
10. The site must be prepped and ready to receive the workstation per Sunbolt Siting Requirements that have been discussed and agreed upon.

11. While it is still packaged, the customer is responsible for transporting the VELOCITY to the site using appropriate handling and transportation methods. Please see item #3 for recommended transportation method. The

client assumes responsibility for all damage incurred at this time.

12. The VELOCITY is shipped with the solar canopy in a horizontal position (0°). The bolt labeled" A" which secures the canopy in the horizontal position must be removed and placed in the "C" position. This adjusts the canopy to the appropriate angle (Fig. 3.0).

Figure 3.0 The Velocity is shipped with the solar canopy in a horizontal position (0°). The bolt labeled "B" which secures the canopy in the horizontal position must be removed and placed in the "C" position. This adjusts the canopy angle.



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START-UP AND OPERATING PROCEDURES

Start-Up and Operating Procedures

Velocity Model V1 components may produce voltages and currents capable of causing severe injury or death. Extreme caution must be taken when installing, commissioning or troubleshooting Velocity Model V1.

The following symbols are used throughout this manual to indicate potentially dangerous conditions or important safety instructions.

WARNING: Indicates a potentially dangerous condition.

CAUTION: Use extreme caution when performing the following tasks.

Read all of the installation and cautions in the manual before starting the installation.

The VELOCITY includes a non-utility-interactive solar photovoltaic and battery storage system intended to provide device charging to users. The system includes (1) battery-based inverter, (1) dc-coupled solar photovoltaic array comprised of (2) modules, (1) charge controller and (2) storage battery. The system outputs 120V AC Single Phase, Two-Wire power that provides convenience lighting, GFCI-protected receptacles, and USB ports for device charging.

1. Switch lever on the 60A battery inline fuse to the down position. This is located on the West side of the unit, adjacent to the handicap side of the unit.

2. On the East side of component cabinet, switch the inverter power button in the up position.

3. Once energized, the Inverter will initially perform a self-test for +/- 10 seconds. Once this period has elapsed, the light will turn green indicating a successful start-up.

4. Push down lever on the inline fuse above the inverter.

5. Flip breaker up to the on position. Please note that the when the breaker is on the indicator will be red. When the breaker is off the indicator will be green.

6. On the controller press the USB power on by pressing the USB indicator arrow once.

7. There is a Battery Capacity Meter located on the VELOCITY mast. Verify that the LEDs on the Battery Capacity Meter indicate a minimum of 12.50 volts.

8. Press the reset button on each GFCI receptacle to assure they are in the proper state.

9. Turn on the LED lights by pressing illuminated push button light timer located on the East side of the Velocity. Please note that timer is set for 15 minutes and will automatically shut off after 15 minutes. Verify that both lights are functioning properly.

10. Have a mobile device with verified battery charge indicator on hand. Also, plan to have both a USB cable (to test the USB outlets) and USB power adapter or basic wall charger (to test the GFCI receptacles). Test all receptacles and USB ports by plugging in the mobile device and observing that it is indicating a charge state. Alternatively, USB or GFCI testing devices will suffice to verify outlets are performing properly.

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TROUBLESHOOTING PROCEDURES

Troubleshooting Procedures

The following troubleshooting procedures involve potentially dangerous conditions. Extreme caution should be taken when troubleshooting the Café. Only Qualified Personnel should perform these procedures.


WARNING: Indicates a potentially dangerous condition.


CAUTION: Indicates a critical procedure for safe and proper operation of Velocity Model V1. Use extreme caution when performing this task.

ISSUE #1: No power available to users for device charging and/or LED spotlights.
TROUBLESHOOTING STEPS:

Action 1: Confirm specifically the extent that power is not available to users. Attempt to charge a device using each of the receptacles and USB ports using a device that is in working order, capable of charging, and capable of provided clear indication of charging/power-available status.

a. Is charging capable in all receptacles and USB ports? YES or NO_____
If YES, troubleshooting is complete. If NO, proceed to next step.

b. Confirm charging capable in some but not all receptacles and USB ports. YES or NO_____
If YES, do not use receptacles or USB ports for device charging as the Sunbolt likely has a failed receptacle or USB port. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed.
Proceed to the next step in this section. If charging is NOT capable in any of the receptacles or USB ports, proceed to next step included in this section.

Action 2: Confirm specifically the extent that LED spotlights are not available to users. Attempt to turn on the LED spotlights using the table-level timed switch. Note if the LED spotlights will turn on and operate normally.

a. Confirm the LED spotlights turn on and operate normally and is charging capable in all of the receptacles and USB ports.
YES or NO_____

If YES, the Sunbolt is now operating normally for device charging and LED Spotlight operation. The troubleshooting is complete. If, NO (meaning all LED spotlights will not turn on and operate, but charging is capable in all of the receptacles and USB ports), the Sunbolt likely has a failed LED Spotlight. Do not use the LED Spotlights. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed.

b. If the LED spotlights turn on and operate normally, but charging is capable in some, but not all of the receptacles or USB ports, the Sunbolt likely has a failed receptacle or USB port. Do not use the receptacles or USB ports for device charging. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed. CHECK TO

CONFIRM_____

c. If the LED spotlights will not turn on and operate, but charging is capable in all of the receptacles and USB ports, the Sunbolt likely has a failed LED Spotlight. Do not use the LED Spotlights. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed. CHECK TO CONFIRM_____

d. If the LED spotlights will not turn on and operate, and charging is capable in some, but not all of the receptacles or USB ports, the Sunbolt likely has a failed receptacle or USB port and a failed LED Spotlight. Do not use the receptacles or USB ports for device charging. Do not use the LED Spotlights. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed. CHECK TO CONFIRM_____

e. If the LED spotlights will not turn on and operate and device charging is not capable in any of the receptacles or USB ports, proceed to next step included in this section.

Action 3: Check the table-level User Battery State of Charge Meter. Note the percentage, time of day, and weather.

a. Is the battery state of charge percentage below 20%? YES OR NO ____

b. If YES, the storage battery state of charge is likely too low for the inverter to operate normally and provide power to users. It has automatically disconnected to protect the battery from extreme discharge. The battery state of charge should recover in one to three days of sunny weather and normal charging. If it does not recover to an operational state, see the Troubleshooting Issue “Prolonged Low Battery State of Charge”. If NO, and the percentage is above 20%, the storage battery state of charge should be high enough for the Sunbolt to operate normally. Continue following the steps included in this section.

Action 4: Check each of the table-level GFCI protected receptacles. Note if any are currently tripped. Press the Reset button on each one. Note if any will not reset to the normal operation position. Attempt to charge a device using each of the receptacles and USB ports using a device that is in working order, capable of charging, and capable of provided clear indication of charging/power-available status.

a. Confirm charging is capable in all of the receptacles and USB ports, the Sunbolt is now operating normally and the troubleshooting is complete. CHECK TO CONFIRM _____

b. If charging is capable in some, but not all of the receptacles or USB ports, the Sunbolt likely has a failed receptacle or USB port. Do not use the receptacles or USB ports for device charging. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed.
CHECK TO CONFIRM_____

c. If charging is not capable in any of the receptacles or USB ports, proceed to next step included in this section. CHECK TO CONFIRM_

PLEASE NOTE: The following steps involve accessing circuit breakers within the Power Distribution Panel (PDP) located within the component cabinet. The next steps should only be undertaken by Qualified Personnel that are authorized to do so.


WARNING: Indicates a potentially dangerous condition.


CAUTION: Use extreme caution when performing the following tasks.

Action 5: Open the west side of the component cabinet to verify status of 120VAC BUS circuit breakers in Power Distribution Panel.

a. Note that live 12VDC and 120VAC voltages are present within the PDP in the area of the Morningstar SureSine Inverter exposed terminals. Caution should be taken as a shock hazard is present.

b. Open west side of the component cabinet by removing the access panel. Carefully remove the access panel so as to not damage it. Place it aside in a safe location.

c. Review the enclosed PDP Interior Circuit Breaker Layout diagram for additional information pertaining to individual circuit breaker identification and circuit breaker groups. CHECK TO CONFIRM_____

Action 6: With the PDP cover open, check the status of the 120VAC BUS circuit breakers. Note if any are tripped.

a. If any 120VAC BUS circuit breakers are tripped, reset them. If each resets without issue, proceed to the next step within this section. CHECK TO CONFIRM_____

b. If any 120VAC BUS circuit breakers will not reset or immediately trip upon resetting, proceed to the final step in this section. CHECK TO CONFIRM_____

Action 7: Attempt to charge a device using each of the receptacles and USB ports using a device that is in working order, capable of charging, and capable of provided clear indication of charging/power-available status.

a. If charging is capable in all of the receptacles and USB ports, the Sunbolt is now operating normally and the troubleshooting is complete.
CHECK TO CONFIRM_____

b. If charging is capable in some, but not all of the receptacles or USB ports, the Sunbolt likely has a failed receptacle or USB port. Do not use the receptacles or USB ports for device charging. Report the issue to the facility personnel and provide them with the information noted. They will need to investigate further and service the Sunbolt as needed. CHECK TO CONFIRM_____

c. If charging is not capable in any of the receptacles or USB ports, proceed to next step included in this section. CHECK TO CONFIRM_

Action 8: If all of the above steps fail to correct the issue present and power remains unavailable to users for device charging and the LED spotlights continue to not operate, or if any circuit breakers will not successfully reset, further troubleshooting is required as follows:

a. Contact Sunbolt for further support.

b. Provide detailed information on all of the steps completed thus far and include all items noted.

c. Refer to Morningstar SureSine inverter manual for continued troubleshooting steps as the issue is likely related to the inverter functionality, battery bank functionality, or load circuit functionality.

ISSUE #2: Prolonged Low Battery State of Charge
TROUBLESHOOTING STEPS:

Action 1: Check the Table-level User Battery State of Charge Meter. Note the percentage, time of day, and weather. CHECK TO CONFIRM_____

Action 2: Confirm specifically the number of days that the battery state of charge meter has been low.

a. If battery state of charge has been below 20% for less than 3 days with normal weather, the Sunbolt may be operating normally and require additional time to recover from heavy user device charging usage causing a high level of battery discharge. CHECK TO CONFIRM_____

b. If there has been a prolonged weather event, such as snowfall or extended overcast weather, the Sunbolt may be operating normally and just require additional time to recover from poor solar generation and a high level of battery discharge. CHECK TO CONFIRM_____

c. If the battery state of charge has been below 20% for 3 days or more with normal weather and normal user device charging usage, proceed to next step included in this section. CHECK TO CONFIRM_____

PLEASE NOTE: The following steps involve accessing circuit breakers within the Power Distribution Panel (PDP) located within the component cabinet. The next steps should only be undertaken by Qualified Personnel that are authorized to do so. Note that live 12VDC and 120VAC voltages are present within the PDP in the area of the Morningstar SureSine Inverter exposed terminals. Caution should be taken as a shock hazard is present.


WARNING: Indicates a potentially dangerous condition.


CAUTION: Use extreme caution when performing the following tasks.

Action 3: Open the BLANK END of the component cabinet containing the electrical equipment by removing the access panel. Carefully remove the access panel so as to not damage it. Place it aside in a safe location. Review the enclosed PDP Interior Circuit Breaker Layout diagram for additional information pertaining to individual circuit breaker identification and circuit breaker groups.

a. With the PDP cover open, check the status of the PV circuit breakers. Note if any are tripped. If any PV circuit breakers are tripped, reset them. If each resets without issue, proceed to the next step within this section. CHECK TO CONFIRM_____

b. If any 150VDC PV circuit breakers will not reset or immediately trip upon resetting, proceed to the final step in this section. CHECK TO CONFIRM _____

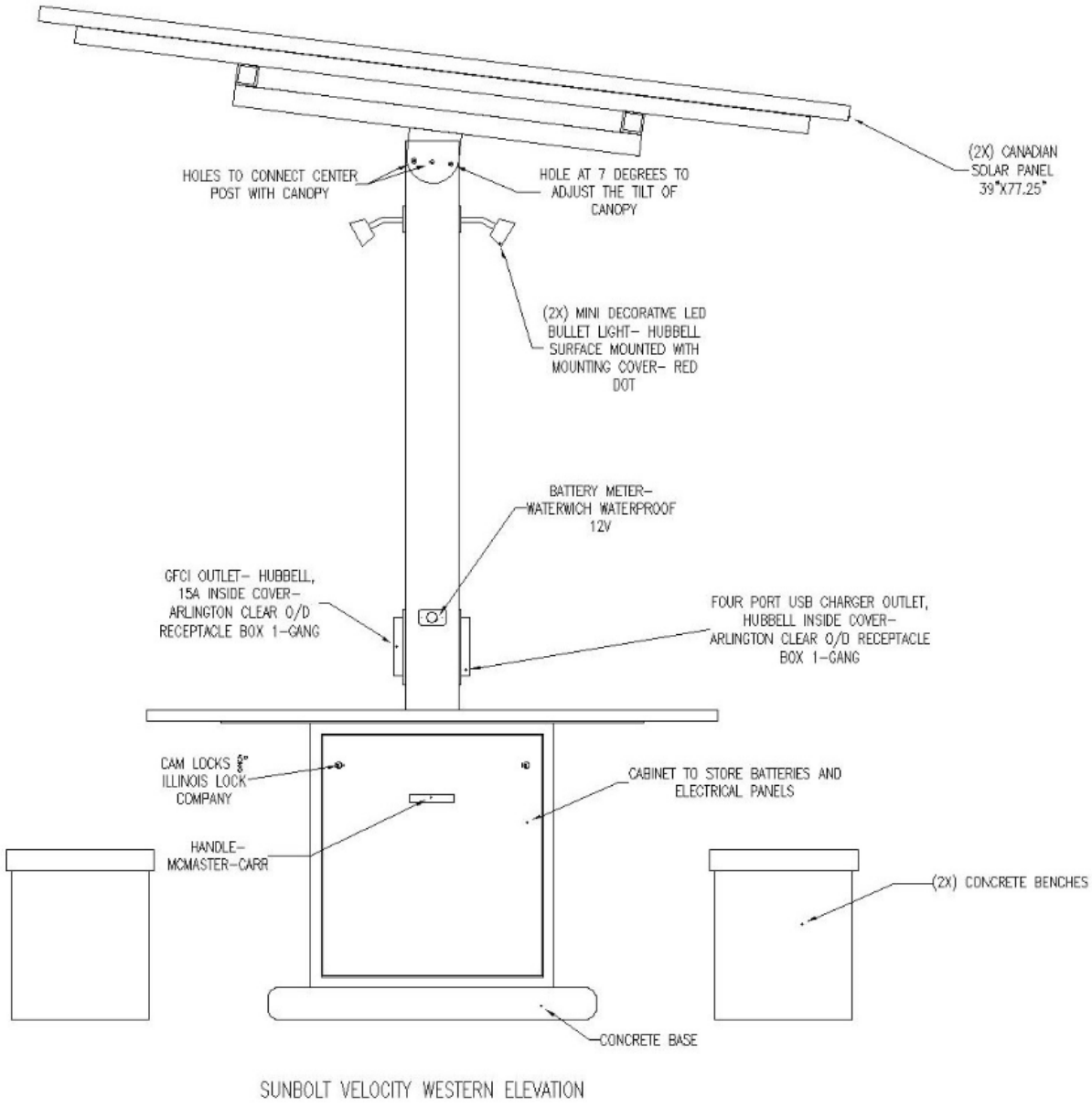

Figure 5.0 - Sunbolt VELOCITY Western Elevation

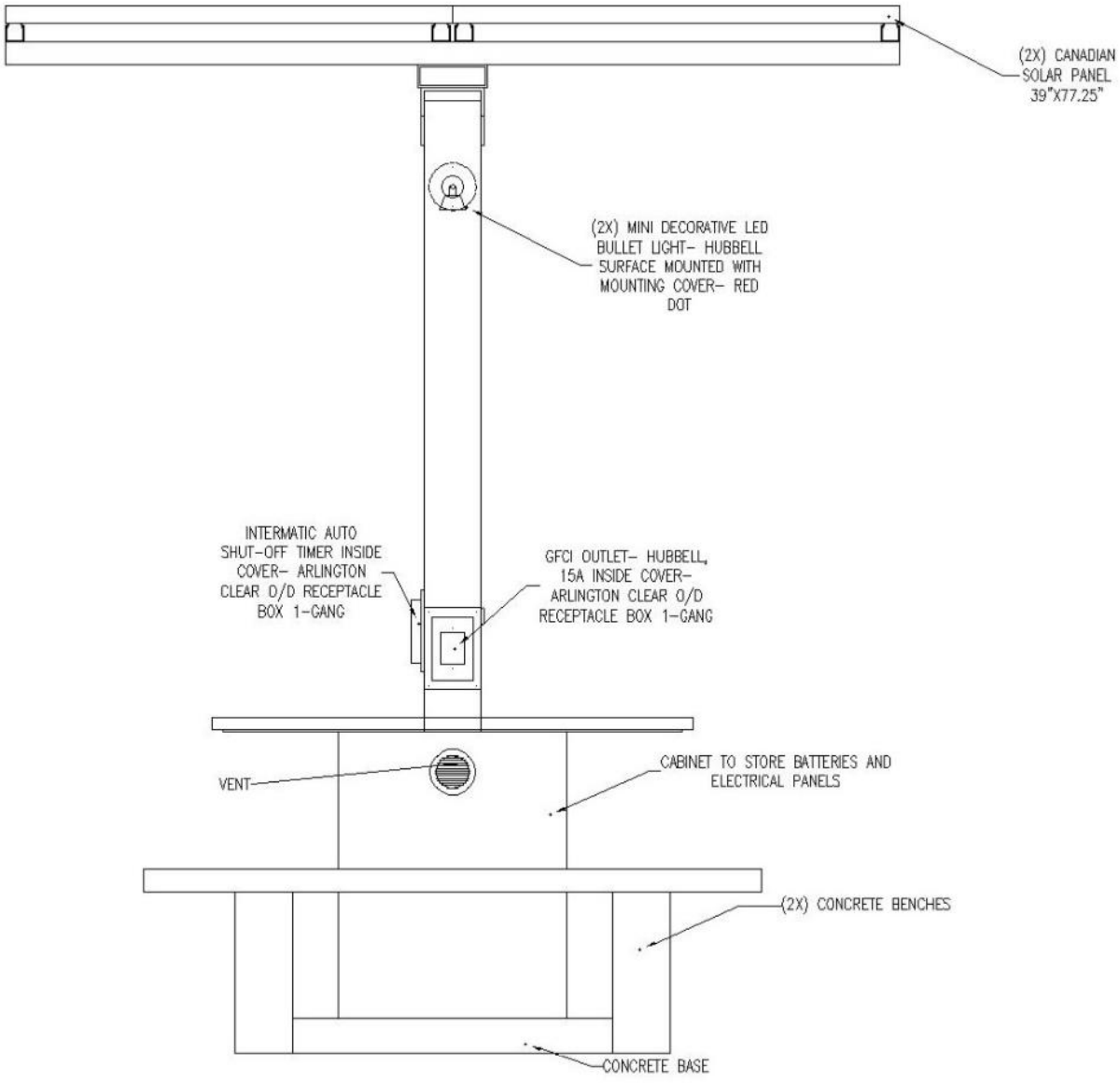

Figure 5.1 - Sunbolt VELOCITY Northern/Southern Elevation

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MAINTENANCE

MAINTENANCE

Solar Panel Maintenance

Maintenance is recommended to ensure optimal performance:

Depending on local conditions, periodically inspect and clean the surface of the module with water and a soft cloth or sponge when the modules surface becomes dirty and rain water is insufficient to remove dirt/debris. Never clean the modules during the middle of the day when the glass is hot to avoid injury. Never scratch or rub away any dirt when the modules are dry.
Check the electrical and mechanical connections annually to ensure all the connections are secure, tight, clean and free of corrosion.

Concrete Product Maintenance

Maintenance and Cleaning Instructions for outdoor concrete products.

1. To clean or remove dirt and debris use a mild solution of soap and water. Mild off-the-shelf cleaners (Simple Green, Citrus cleaner) may be used as an option. Use a rag or medium bristle brush.

2. A product manufactured by So Safe (http://www.sosafeusa.com/) Graffiti Remover Black is great for removing paint and/or magic marker. Follow labeled directions on all cleaning products and solvents. Wear protective glasses, gloves and respirators if recommended.

3. Pressure washers can be used periodically for overall cleaning. Be careful when using pressure washers. Narrow tipped nozzles or holding the tip too close can remove sealers and cause streaking.

4. Your products have been sealed with two coats of concrete sealer. We recommend that the products be resealed periodically. The frequency of resealing depends on usage.

Electrical System Maintenance

WARNING: Indicates a potentially dangerous condition.

CAUTION: Use extreme caution when performing the following tasks.

As a general rule, all routine maintenance, service, and troubleshooting shall be completed per the instructions of the original equipment manufacturer's instructions, which are included in this manual.
Electrical system maintenance on the table is comprised of 3 steps. First open both the north and south benches. Under the south bench look for any signs of corrosion on the battery terminals. If any issues are found, document and photograph them and send info to customerservice@gosunbolt.com.

Under the north bench, ensure both lights on your inverter are green and cycle through the output menus on the charge controller to confirm normal operation. If any issues are found, consult your troubleshooting checklist (included on this CD) to diagnose the issue. If

after troubleshooting the unit does not return to normal operation, please document the issue and send your completed troubleshooting checklist to aruby@gosunbolt.com or call our Customer Service Line at 267-419-8496.

Metal Surface Maintenance

All that is required to maintain your metal surfaces is a brief scrub with a clean, damp cloth or rag to remove dirt and grime.

Star Board Maintenance

The King StarBoard family of marine-grade polymers is chemically resistant. Most chemicals, except the harshest solvents and acids, will have little effect on the material.

1. Keep teak oil and other wood preservatives and stains away from King StarBoard components. They may permanently stain King StarBoard.

2. Rust stains are very difficult to remove from King StarBoard, especially light colors. Keep uncoated metals away from your new King StarBoard.

3. Soft deck shoes are recommended for walking surfaces made with King StarBoard marine polymers. Hard, black soles can leave scuff marks that are difficult to remove.

4. Do not mark the material with pencils, pens or magic markers. If you are constructing or attaching something to King StarBoard, use china markers or wax pencils.

5. Clean up any gasoline spills immediately with a water and soap flush.

6. King StarBoard will melt if exposed to extreme heat. Your boat builder has chosen King StarBoard for particular applications based on normal environmental conditions and considerable testing. Do not subject the material to a consistent operating temperature of over 150º Fahrenheit. Heat sources such as hot plates and lit cigarettes can mar the finish.

7. You will not be able to paint King StarBoard. Even polyurethanes do not hold to the material for long.

8. To clean everyday dirt and stains, use a cleaner such as Soft Scrub® and a nylon scrubby or stiff nylon brush. Scrub lightly; excess force can mar the finish.

9. Persistent stains will usually go away if you soak the area with bleach. Do not use 100% chlorine used to treat swimming pools and do not use a pressure washer.

10. To clean a petroleum stain such as grease or oil; use a citrus cleaner, alcohol or mineral spirits.

11. For severe petroleum-based stains, spray with WD40®. Then use toluene or acetone and a white nylon scrub pad (colored pads release staining dyes when combined with acetone).

12. Do not use MEK, turpentine or naphtha solvent.

Furniture polish or products such as Armor-All® can add an attractive luster to the finish of King StarBoard and hide small surface blemishes. To prevent slipping, do not use these products on walking surfaces.

If a mark or stain won't come out, you may lightly sand the area. Be careful to only work on the stained area because sanding will remove the matte finish.

Any high-quality silicone marine caulk works well to replace old or worn caulking. Before caulking, the surface should be prepared by abrading it with medium-grit sandpaper; cleaning it with acetone, toluene or alcohol, and flame treating.

SUNBOLT

Recycled Plastic Lumber Maintenance

POLYFORCE™ STRUCTURAL RECYCLED PLASTIC LUMBER

PolyForce™ Structural Recycled Plastic Lumber shapes are manufactured from purified blends of post consumer, pre consumer and/or virgin HDPE (high density polyethylene) resins. Additional proprietary additives and strengthening reinforcements are compounded into each product.

FEATURES

- Manufactured to exacting specifications.
- Essentially maintenance free due to exceptional resistance to moisture, fading, insects, splintering, warping and other common outcomes from environmental stress that one observes with common wood or wood fiber / plastic composite products.
- Requires no waterproofing, staining, or other common reoccurring maintenance other than the occasional washing with soap and water to remove dirt and debris if desired.
- Very color stable due to UV pigment systems which resist breakdown from prolonged sun and weather exposure.
- Tangent Technologies LLC has over one hundred custom shapes in house to meet your requirements or we can customize a unique shape to meet your needs.
- The Standard colors for **PolyForce**™ in the popular wood tones are: Cedar, Sand, Gray, Redwood, Mahogany, Light Oak, and Tudor Brown. Custom colors can be matched and made available.

It is possible that the material may fade very slightly over the entire service life of the product. However, most wood and wood composite products will fade quickly to a weathered grey look due to the wood fiber content inherent in the products.

BASIC USES

PolyForce™ Products are perform very well for exterior applications where reinforcing properties, resistance to weathering and minimal maintenance are required along with maintaining appearance such as color stability and surface finish over the useful service life.

Used in municipal and commercial applications **PolyForce**™ is well suited for marine, boardwalks dock & deck planks to name just a few fresh and salt water shoreline applications where strength, stiffness and low maintenance are required.

Property	ASTM Method	Units	Value
Specific Gravity	D6111-13	lbs/in³	0.0216-0.030*
Water Absorption	D570-05	%	< 0.1
Secant Modulus @ 1% Strain** *Flexural Property*	D6109-05	psi	137,861***
Stress @ 3% Strain** *Flexural Property*	D6109-05	psi	2,114***
Screw Withdrawal	D6117-97	lbf	703
Coefficient of Thermal Expansion	D6341-98	in/in/°f	0.0000281

**Lower density may occur in larger cross sections.*
***Testing performed on samples of 2" x 6" nominal size.*
****Stiffness & strengths can be increased by adjusting reinforcement and processing conditions – Contact for additional data.*

ASTM D6109-05, Standard Tests Methods for Flexural Properties of Unreinforcedand Reinforced Plastic Lumber is a 4-point flexural test which gives a measure of the stiffness of the beam (secant modulus at 1% strain) and a flexural strength (stress @ 3% strain).

Hygrothermal Cycling Test (ASTM D6662-01) was performed on a flexural test sample to water immersion for 24 hour periods until water absorption reaches equilibrium. The samples are then frozen at -20° F for 24 hours and then immersed in water again for a total of three cycles. The modulus and strength values were determined by ASTM D6109 and when compared to baseline values exhibited very little change.

TANGENT

Tangent Technologies LLC
1001 Sullivan Road
Aurora, Illinois 60506-1065
tel 630.264.1110
fax 630.264.6881
www.tangentusa.com

Date: 01/20/16 Rev: 1.6

SUNBOLT

POLYFORCE™ STRUCTURAL RECYCLED PLASTIC LUMBER

SUITABILITY AND LIMITATIONS

These products have greater impact resistance than wood but conversely less rigidity and therefore prior to use a thorough design engineering study must be performed to determine the suitability of **PolyForce**™ in any critical application.

Fabrication is similar to wood and normal woodworking tools can be used. One should be advised that by transforming the product by drilling holes and routing edges the integrity and strength of the part can be altered. Eye protective wear, dusk maks, gloves and normal safety precautions must be used when handling and fabricating the product. (See MSDS sheet for more details)

Inherent in **PolyForce**™ Products you will observe a greater coefficient of thermal expansion than stiffer wood products. Therefore when designing your application an accommodation must be made to properly allow for expected expansion and contraction over the length of the product.

Static electricity is a naturally occurring phenomenon to all resin based products. On extremely dry days there is the potential to experience a small static shock if you walk across a **PolyForce**™ product and touch a conducting surface such as a metal fixture. This is comparable to walking across your carpet and receiving a static shock when you touch the door handle. We do not warranty against static electricity as it is a natural occurring phenomenon and is not a manufacturing defect.

During winter conditions, you might find any surface made from **PolyForce**™ to be slippery in snow, wet and frost conditions. Unlike most other surfaces you can easily spread rock salt or calcium chloride to restore decent traction and melt the frost or ice layer with no harmful effect to the **PolyForce**™ products.

WARRANTY

Tangent Technologies LLC the manufacturer of the **PolyForce**™ product offers a limited warranty that this product will not rot, splinter, decay or suffer structural damage directly from termites or fungal decay under normal use. Tangent Technologies LLC does not recommend or approve this product for all end use applications. The appropriate national and local code authorities should be consulted for safety, suitability and applicability for intended use prior to purchasing product. (See Full Warranty Details)

This guideline and summary is intended to provide the distributor, installer and end user with basic guidelines and technical specifications for designing and properly installing the **PolyForce**™ products. However, the installer and/or purchaser of any **PolyForce**™ product is solely responsible for interpreting specific job conditions, and determining the engineering design and suitability of end use and application of any **PolyForce**™ product. Adherence to applicable building and safety codes for specific locations and applications of this product are the sole responsibility of the installer and/or purchaser. In no event shall Tangent Technologies LLC the manufacturer of the **PolyForce**™ products be liable for labor, installation, reinstallation or for any indirect, punitive, exemplary or consequential damages of any kind whatsoever from the provisions of this information.

This revision 1.5 [12/21/15] supersedes all other PolyForce™ technical data sheets.

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7

BATTERY SPECIFICATIONS

SUNBOLT

RENOGY

DEEP CYCLE AGM BATTERY 12 VOLT 100AH

RENOGY **DEEP CYCLE AGM BATTERY 12 VOLT 100AH**

Due to its outstanding performance, the Renogy 12V Deep Cycle AGM Battery is a favorite in a wide variety of applications. Maintenance-free and leak-proof, the battery is ideal for standby projects that require minimal monitoring. Beyond applications such as uninterruptible power supplies (UPS) and telecommunication systems, the battery can also handle cyclic uses, such as RVs, boats, medical equipment, and lawnmowers, thanks to its high discharge rate and wide operation temperature range. Its high power-to-weight ratio makes it suitable for solar and wind energy storage applications. With the finest materials, state-of-the-art production techniques, and the strictest quality control measures, Renogy AGM batteries aim to provide the most reliable, convenient, and economic rechargeable battery solution.

KEY **FEATURES**

Maintenance Free
Manufactured with thick absorbent glass mat (AGM) separators and advanced valve regulated technology, Renogy Deep Cycle AGM Batteries save you from acid leakage and frequent maintenance.

Excellent Discharge Performance
Proprietary quinary alloy plates and specially treated plate grids enable low internal resistance and high discharge currents of up to 10 times the battery rated capacity.

Long Shelf Life
Made of high purity materials, Renogy Deep Cycle AGM Batteries reduce the monthly self-discharge rate below 3% at 77°F (25°C.), which is 5 times lower than their flooded counterparts.

Wide Operation Temperature Range
Improved electrolyte formula ensures stable battery capacity and outstanding discharge performance at low temperatures below 32°F (0°C).

RENOGY.COM
2775 EAST PHILADELPHIA ST. ONTARIO, CA 91761

ELECTRIC CHARACTERISTICS

Nominal Voltage	12V
Number of Cells	6
Rated Capacity (77°F/25°C)	100Ah (10 Hour Rate to 10.5V)
Internal Resistance	5 mΩ
Self-discharge Rate (77°F/25°C)	<3% / month
Float Charge Voltage (77°F/25°C)	13.5V~13.8V Temperature Compensation: -18mV/°C
Cycle Use Voltage (77°F/25°C)	14.4V~14.8V Temperature Compensation: -24mV/°C
Equalization Voltage (77°F/25°C)	14.4V~14.8V
Max Charge Current	30A
Max Discharge Current	1100A (5 Seconds)

TEMPERATURE PARAMETERS

Normal Operating Temperature	77°F±5.4°F (25°C±3°C)
Operating Temperature Range	Discharge: 5°F~122°F (-15°C~50°C) Charge: 5°F~104°F (-15°C~40°C)
Storage Temperature Range	5°F~104°F (-15°C~40°C)

MECHANICAL PROPERTIES

Terminal Bolt Size	M8 x 1.25 x 20 mm
Recommended Terminal Torque	109.8 inch-lb / 12.4 N·m
Container Material	ABS
Weight	63.9 lb. / 29 kg
Dimension (L x W x H)	13.1 x 6.9 x 8.6 inch / 332 x 175 x 219 mm

CONSTANT CURRENT DISCHARGE CHARACTERISTICS (77°F/25°C) UNIT: A

F.V/Time	15min	30min	1hr	3hr	5hr	8hr	10hr	20hr
1.60V	165.5	100.00	58.70	26.76	17.90	11.78	9.81	5.15
1.67V	158.7	96.51	57.00	26.20	17.52	11.68	9.71	5.10
1.70V	155.9	91.23	55.10	25.83	17.33	11.59	9.62	5.05
1.75V	149.1	86.32	54.00	25.56	17.24	11.40	9.52	5.00
1.80V	142.4	79.62	50.20	25.09	17.05	10.93	9.33	4.90
1.85V	130.8	70.19	47.40	24.26	16.76	10.75	9.14	4.80

CONSTANT POWER DISCHARGE CHARACTERISTICS (77°F/25°C) UNIT: WPC

F.V/Time	15min	30min	1hr	3hr	5hr	8hr	10hr	20hr
1.60V	304.0	179.06	107.70	51.94	35.52	23.55	19.62	10.30
1.67V	294.4	175.00	105.80	51.11	34.86	23.36	19.43	10.20
1.70V	290.6	167.64	104.00	50.56	34.57	23.18	19.24	10.10
1.75V	279.0	160.38	102.80	50.28	34.38	22.80	19.14	10.05
1.80V	266.5	151.70	97.00	49.81	34.19	22.06	18.86	9.90
1.85V	247.3	135.75	93.20	48.80	34.00	21.78	18.57	9.75

CHARGING PROCEDURES

Application	Charge Voltage (V/Cell)			Max Charge Current
	Temperature	Set Point	Allowable Range	
Cycle Use	25°C	2.450	2.40~2.50	0.3C
Standby	25°C	2.275	2.25~2.30	

DISCHARGE CURRENT VS. DISCHARGE VOLTAGE

Final Discharge Voltage (V/Cell)	1.75	1.70	1.65	1.60
Discharge Current (A)	<0.2C	0.2C~0.5C	0.5C~1.0C	>1.0C

EFFECT OF TEMPERATURE ON CAPACITY

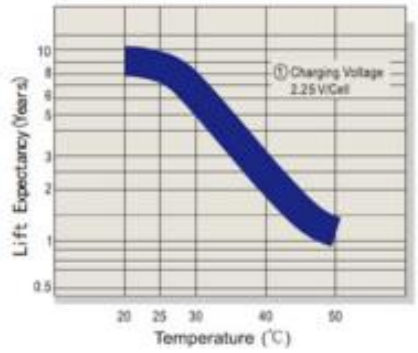
Temperature	Dependency of Capacity (20hr)
40°C	102%
20°C	100%
0°C	85%
-15°C	65%

SELF-DISCHARGE CHARACTERISTICS

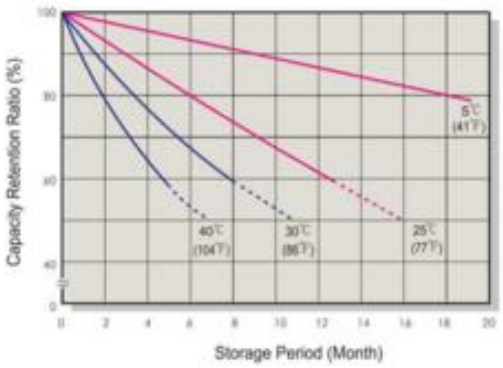
Storage Time	Preservation Rate
3 Months	91%
6 Months	82%
12 Months	64%

SUNBOLT

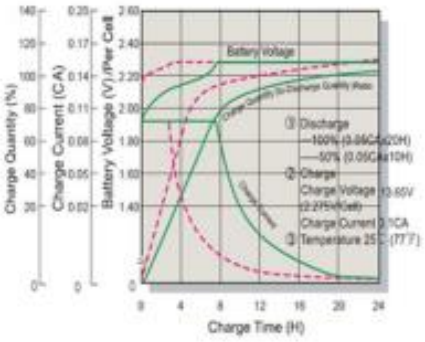
Float Service Life



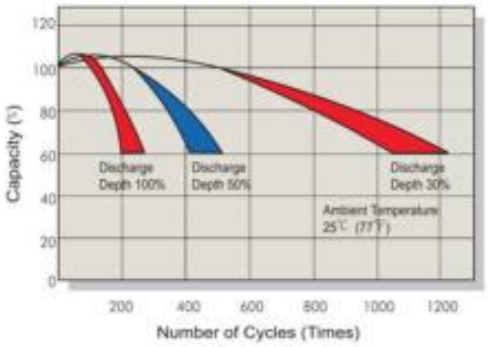
Capacity Retention Characteristics



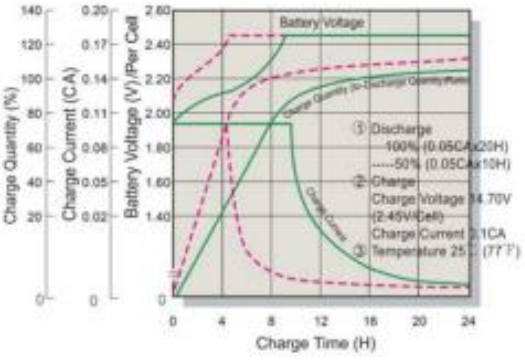
Battery Voltage and Charge Time for Standby Use



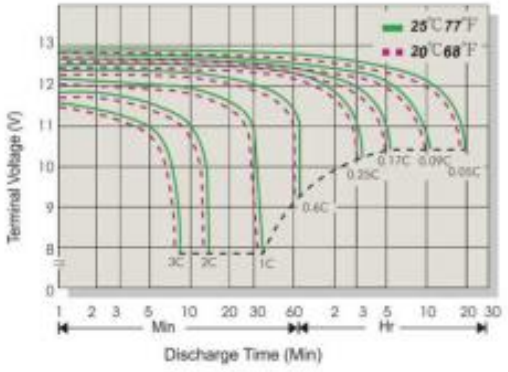
Cycle Service Life



Battery Voltage and Charge Time for Cycle Use



Teminal Voltage and Discharge Time



VELOCITY

SOLAR WORKSTATION

8

SOLAR PANEL SPECIFICATIONS

SUNBOLT

CanadianSolar

MAXPOWER CS6U-325|330|335P

Canadian Solar's modules use the latest innovative cell technology, increasing module power output and system reliability, ensured by 16 years of experience in module manufacturing, well-engineered module design, stringent BOM quality testing, an automated manufacturing process and 100% EL testing.

KEY FEATURES

- Excellent module efficiency of up to: 17.23 %
- High PTC rating of up to: 92.18 %
- IP68 junction box for long-term weather endurance
- Heavy snow load up to 5400 Pa, wind load up to 3600 Pa*

25 years linear power output warranty

10 years product warranty on materials and workmanship

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2008 / Quality management system
ISO 14001:2004 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730: VDE / CE

* If you need specific product certificates, and if module installations are to deviate from our guidance specified in our installation manual, please contact your local Canadian Solar sales and technical representatives.

CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading PV project developer and manufacturer of solar modules with over 25 GW deployed around the world since 2001, Canadian Solar Inc. is one of the most bankable solar companies worldwide.

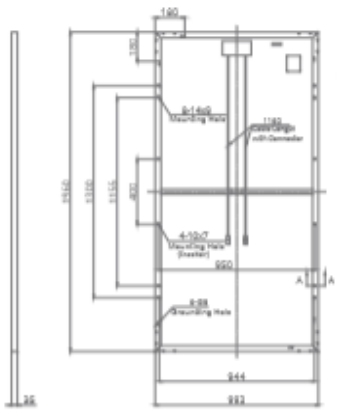
*For detail information, please refer to Installation Manual.

CANADIAN SOLAR INC.
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

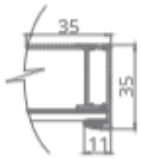
SUNBOLT

ENGINEERING DRAWING (mm)

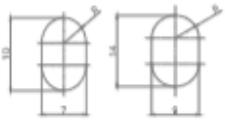
Rear View



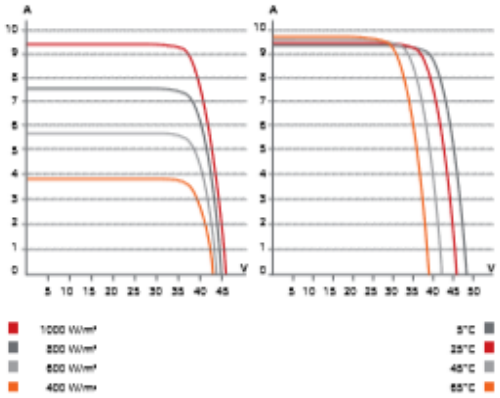
Frame Cross Section A-A



Mounting Hole



CS6U-330P / I-V CURVES



ELECTRICAL DATA | STC*

CS6U	325P	330P	335P
Nominal Max. Power (Pmax)	325 W	330 W	335 W
Opt. Operating Voltage (Vmp)	37.0 V	37.2 V	37.4 V
Opt. Operating Current (Imp)	8.78 A	8.88 A	8.96 A
Open Circuit Voltage (Voc)	45.5 V	45.6 V	45.8 V
Short Circuit Current (Isc)	9.34 A	9.45 A	9.54 A
Module Efficiency	16.72%	16.97%	17.23%
Operating Temperature	-40°C ~ +85°C		
Max. System Voltage	1000 V (IEC/UL) or 1500 V (IEC/UL)		
Module Fire Performance	TYPE 1 (UL 1703) or CLASS C (IEC 61730)		
Max. Series Fuse Rating	15 A		
Application Classification	Class A		
Power Tolerance	0 ~ + 5 W		

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

ELECTRICAL DATA | NMOT*

CS6U	325P	330P	335P
Nominal Max. Power (Pmax)	239 W	243 W	247 W
Opt. Operating Voltage (Vmp)	34.0 V	34.2 V	34.4 V
Opt. Operating Current (Imp)	7.03 A	7.10 A	7.17 A
Open Circuit Voltage (Voc)	42.4 V	42.5 V	42.6 V
Short Circuit Current (Isc)	7.54 A	7.63 A	7.70 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

PERFORMANCE AT LOW IRRADIANCE

Outstanding performance at low irradiance, with an average relative efficiency of 96.0 % for irradiances between 200 W/m² and 1000 W/m² (AM 1.5, 25°C).

MECHANICAL DATA

Specification	Data
Cell Type	Poly-crystalline, 6 inch
Cell Arrangement	72 (6 × 12)
Dimensions	1960 × 992 × 35 mm (77.2 × 39.1 × 1.38 in)
Weight	22.4 kg (49.4 lbs)
Front Cover	3.2 mm tempered glass
Frame Material	Anodized aluminium alloy
J-Box	IP68, 3 bypass diodes
Cable	4.0 mm² (IEC), 12 AWG (UL), 1160 mm (45.7 in)
Connector	T4 series
Per Pallet	30 pieces
Per Container (40' HQ)	720 pieces

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.40 % / °C
Temperature Coefficient (Voc)	-0.31 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature (NMOT)	43 ± 3 °C

PARTNER SECTION

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Canadian Solar Inc. reserves the right to make necessary adjustment to the information described herein at any time without further notice.

CANADIAN SOLAR INC.
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

SUNBOLT

Mono Multi Solutions

THE

Residential Module

MULTI-BUSBAR120 HALF-CELL BOB MODULE

PRODUCTS	BACKSHEET COLOR	POWER RANGE
TSM-DD06M.05(II)	Black	310-335W
FRAME COLOR:	Black	

120-Cell
MONOCRYSTALLINE MODULE

310-335W
POWER OUTPUT RANGE

19.7%
MAXIMUM EFFICIENCY

0~+5W
POSITIVE POWER TOLERANCE

Founded in 1997, Trina Solar is the world's leading total solution provider for solar energy. With local presence around the globe, Trina Solar is able to provide exceptional service to each customer in each market and deliver our innovative, reliable products with the backing of Trina as a strong, bankable brand. Trina Solar now distributes its PV products to over 100 countries all over the world. We are committed to building strategic, mutually beneficial collaborations with installers, developers, distributors and other partners in driving smart energy together.

Comprehensive Products and System Certificates

IEC61215/IEC61730/IEC61701/IEC62716
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
OHSAS 18001: Occupation Health and Safety Management System

Trinasolar

High power output

- Reduce BOS cost with high power bin and module efficiency
- New cell string layout and split J-box location reduces the energy loss caused by inter-row shading
- Lower resistance of half-cut cells and increased MBB (Multi Busbar) reflectance ensure higher power

High energy generation, low LCOE

- Excellent 3rd party validated IAM and low light performance with cell process and module material optimization
- Low Pmax temp coefficient (-0.36%) increases energy production
- Better anti-shading performance and lower operating temperature

Outstanding visual appearance, easy to install

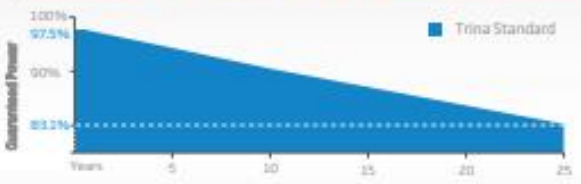
- Designed for superior rooftop aesthetics
- Thinner wires give a eye cacthing all black look
- Safe and easy to transport, handle, and install

Certified to perform in highly challenging environments

- High PID resistance through cell process and module material control
- Resistant to salt, acid, sand, and ammonia
- Over 30 in-house tests (UV, TC, HF etc)
- Certified to 5400 Pa positive load and 2400 Pa negative load

PERFORMANCE WARRANTY

10 Year Product Warranty · 25 Year Power Warranty



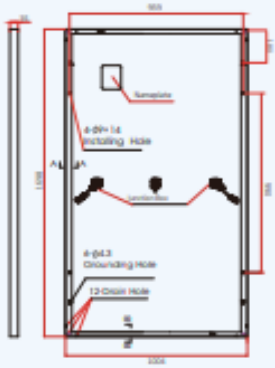
From the 2nd year to the 25th year, the average annual power decline will be no more than 0.6%.

SUNBOLT

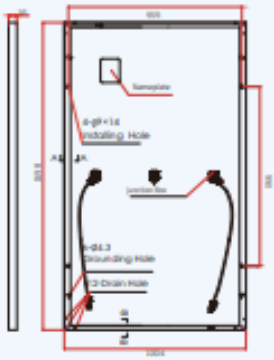
Residential Module

MULTI-BUSBAR 120 HALF-CELL BOB MODULE

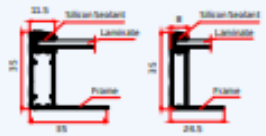
DIMENSIONS OF PV MODULE(mm)



String Inverter Configuration

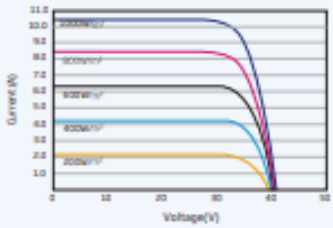


Microinverter or Optimizer Configuration

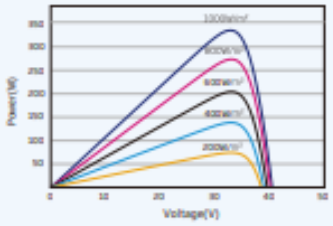


A-A B-B

I-V CURVES OF PV MODULE (335W)



P-V CURVES OF PV MODULE (335W)



ELECTRICAL DATA (STC)

Peak Power Watts-P_{MAX} (Wp)*	310	315	320	325	330	335
Power Output Tolerance-P_{MAX} (W)	0 ~ +5					
Maximum Power Voltage-V_{MPP} (V)	33.0	33.2	33.4	33.6	33.8	34.0
Maximum Power Current-I_{MPP} (A)	9.40	9.49	9.58	9.67	9.76	9.85
Open Circuit Voltage-V_{OC} (V)	39.9	40.1	40.3	40.4	40.6	40.7
Short Circuit Current-I_{SC} (A)	10.03	10.12	10.20	10.30	10.40	10.50
Module Efficiency η_m(%)	18.2	18.5	18.8	19.1	19.4	19.7

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5.
*Measuring tolerance: ±3%.

ELECTRICAL DATA (NMOT)

Maximum Power-P_{MAX} (Wp)	235	238	242	246	250	254
Maximum Power Voltage-V_{MPP} (V)	31.0	31.2	31.4	31.6	31.7	31.9
Maximum Power Current-I_{MPP} (A)	7.57	7.64	7.71	7.79	7.86	7.94
Open Circuit Voltage-V_{OC} (V)	37.6	37.8	38.0	38.1	38.3	38.4
Short Circuit Current-I_{SC} (A)	8.08	8.15	8.22	8.30	8.38	8.46

NMOT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
Cell Orientation	120 cells (6 × 20)
Module Dimensions	1698 × 1004 × 35 mm (66.85× 39.53 × 1.38 inches)
Weight	18.7kg (41.2lb)
Glass	3.2mm (0.13 inches), High Transmission, AR Coated Tempered Glass
Encapsulant Material	EVA
Backsheet	Black
Frame	35 mm (1.38 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²) Portrait: N 140mm/P 285mm (5.51/11.22 inches) Landscape: N 1200 mm /P 1200 mm (47.24/47.24 inches)
Connector	MC4

TEMPERATURE RATINGS

NMOT (Nominal Module Operating Temperature)	41°C (±3°C)
Temperature Coefficient of P_{MAX}	-0.36%/°C
Temperature Coefficient of V_{OC}	-0.26%/°C
Temperature Coefficient of I_{SC}	0.04%/°C

MAXIMUM RATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1000V DC (IEC)
	1000V DC (UL)
Max Series Fuse Rating	20A

(Do not connect Fuse in Combiner Box with two or more strings in parallel connection)

WARRANTY

10 year Product Workmanship Warranty
25 year Power Warranty

(Please refer to product warranty for details)

PACKAGING CONFIGURATION

Modules per box: 30 pieces
Modules per 40'container: 780 pieces

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CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

Version number: TSM_DD06M.05(II)_EN_2019_B

www.trinasolar.com

SUNBOLT

EAGLE 60HM G2

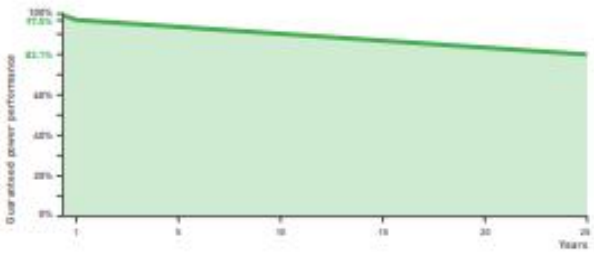
315-335 WATT • HALF CELL MONO PERC MODULE

Positive power tolerance of 0~+3%

- NYSE-listed since 2010, Bloomberg Tier 1 manufacturer
- Best-selling panel globally for last 4 years
- Top performance in the strictest 3rd party labs
- 99.9% on-time delivery to the installer
- Automated manufacturing utilizing artificial intelligence
- Vertically integrated, tight controls on quality
- Premium solar assembly in USA and Malaysia

LINEAR PERFORMANCE WARRANTY

25-Year Performance Warranty



- ISO9001:2008 Quality Standards
- ISO14001:2004 Environmental Standards
- IEC61215, IEC61730 certified products
- OHSAS18001 Occupational Health & Safety Standards
- UL1703 certified products

KEY FEATURES

Diamond Half Cell Technology
World-record breaking efficient mono PERC half cut solar cells deliver high power in a small footprint.

Designed for Long Life
Uses the same DuPont protective film as the Space Station, Mars Lander, and jetliners. 25-year warranty.

Shade Tolerant
Twin array design allows continued performance even with shading by trees or debris.

Power Boost in Cloudy Conditions
A special film diffuses light, boosting performance even without direct sunlight.

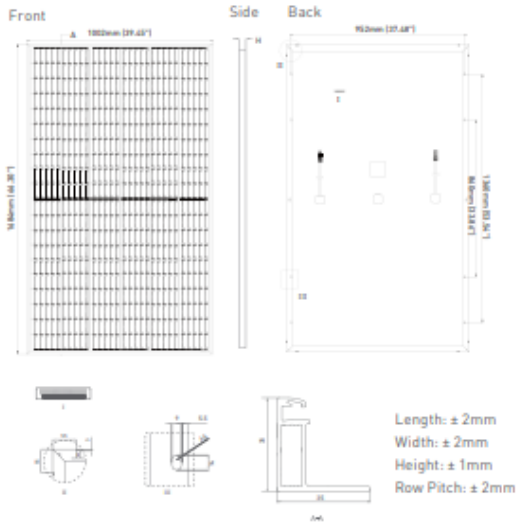
Protected Against All Environments
Certified to withstand humidity, heat, rain, marine environments, wind, hailstorms, and packed snow.

BUILDING YOUR TRUST IN SOLAR. JINKOSOLAR.US

JinKO Solar

SUNBOLT

ENGINEERING DRAWINGS



MECHANICAL CHARACTERISTICS

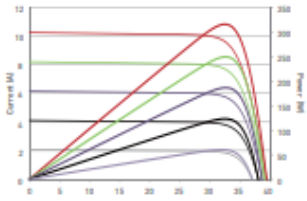
Cells	Mono PERC Diamond Cell (158.75x158.75mm)
No. of Half Cells	120 (6×20)
Dimensions	1684×1002×35mm (66.30×39.45×1.38in)
Weight	19.0kg (41.9lbs)
Front Glass	3.2mm, Anti-Reflection Coating High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminum Alloy
Junction Box	IP67 Rated
Output Cables	12 AWG, 1825mm (71.85in) or Customized Length
Fire Type	Type 1
Pressure Rating	5400Pa (Snow) & 2400Pa (Wind)

TEMPERATURE CHARACTERISTICS

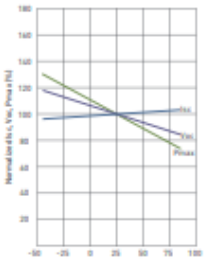
Temperature Coefficients of Pmax	-0.36%/°C
Temperature Coefficients of Voc	-0.28%/°C
Temperature Coefficients of Isc	0.048%/°C
Nominal Operating Cell Temperature (NOCT)	45±2°C

ELECTRICAL PERFORMANCE & TEMPERATURE DEPENDENCE

Current-Voltage & Power-Voltage Curves (335W)



Temperature Dependence of Isc, Voc, Pmax



MAXIMUM RATINGS

Operating Temperature (°C)	-40°C~+85°C
Maximum System Voltage	1000VDC
Maximum Series Fuse Rating	20A

PACKAGING CONFIGURATION

(Two pallets = One stack)

31pcs/pallet, 62pcs/stack, 806pcs/40'HQ Container

ELECTRICAL CHARACTERISTICS

Module Type	JKM315M-60HBL		JKM320M-60HBL		JKM325M-60HBL		JKM330M-60HBL		JKM335M-60HBL	
	STC	NOCT	STC	NOCT	SCT	NOCT	SCT	NOCT	SCT	NOCT
Maximum Power (Pmax)	315Wp	235Wp	320Wp	239Wp	325Wp	242Wp	330Wp	246Wp	335Wp	250Wp
Maximum Power Voltage (Vmp)	33.2V	31.2V	33.4V	31.4V	33.6V	31.6V	33.8V	31.8V	34.0V	32.0V
Maximum Power Current (Imp)	9.49A	7.56A	9.59A	7.62A	9.68A	7.66A	9.77A	7.74A	9.87A	7.82A
Open-circuit Voltage (Voc)	40.7V	37.6V	40.9V	37.8V	41.1V	38.0V	41.3V	38.2V	41.5V	38.4V
Short-circuit Current (Isc)	10.04A	8.33A	10.15A	8.44A	10.20A	8.54A	10.31A	8.65A	10.36A	8.74A
Module Efficiency STC (%)	18.37%		18.67%		18.96%		19.26%		19.85%	

***STC:** Irradiance 1000W/m² Cell Temperature 25°C AM = 1.5
NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM = 1.5 Wind Speed 1m/s

*Power measurement tolerance: ±3%

The company reserves the final right for explanation on any of the information presented hereby. JKM315-335M-60HL-A2.1-US

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Jinko Solar

VELOCITY

SOLAR WORKSTATION

9

ELECTRICAL COMPONENTS – LIGHTS

Commercial Electric 28-WATT, 2200- Lumen Metal LED Dual Spotlight

- Dual-head light provides 180-degree coverage
- Delivers 2200 lumens
- Metal weatherproof design for outdoor use
- Fixture is built to last with maintenance-free energy efficient LEDs with 35,000-hours of life (equivalent to 32-years at 3-hours per day)

Dimensions:

- Product Depth (in.): 4
- Product Width (in.): 6.5
- Product Height (in.): 6.5
- Details:
- Product Weight(lb.): 1.5

Warranty / Certifications: ETL Listed

Manufacturer Warranty: 5-year limited warranty

VELOCITY

SOLAR WORKSTATION

9

ELECTRICAL COMPONENTS – SOLAR CONTROLLER

SUNBOLT

ROVER SERIES

20A | 30A | 40A

RENOGY EMPOWERED

Version 1.3

⚠ Important Safety Instructions ⚠

Please save these instructions.

This manual contains important safety, installation, and operating instructions for the charge controller. The following symbols are used throughout the manual to indicate potentially dangerous conditions or important safety information.

WARNING	Indicates a potentially dangerous condition. Use extreme caution when performing this task
CAUTION	Indicates a critical procedure for safe and proper operation of the controller
NOTE	Indicates a procedure or function that is important to the safe and proper operation of the controller

General Safety Information

- Read all of the instructions and cautions in the manual before beginning the installation.
- There are no serviceable parts for this controller. Do **NOT** disassemble or attempt to repair the controller.
- Do **NOT** allow water to enter the controller.
- Make sure all connections going into and from the controller are tight.

Charge Controller Safety

- **NEVER** connect the solar panel array to the controller without a battery. Battery must be connected first.
- Ensure input voltage does not exceed 100 VDC to prevent permanent damage. Use the Open Circuit Voltage (Voc) to make sure the voltage does not exceed this value when connecting panels together.

Battery Safety

- Use only sealed lead-acid, flooded, gel or lithium batteries which **must be deep cycle.**
- Explosive battery gases may be present while charging. Be certain there is enough ventilation to release the gases.
- Be careful when working with large lead acid batteries. Wear eye protection and have fresh water available in case there is contact with the battery acid.
- Carefully read battery manuals before operation.
- Do **NOT** let the positive (+) and negative (-) terminals of the battery touch each other.
- Recycle battery when it is replaced.
- Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high of an equalizing charge or too long of one may cause damage. Please carefully review the specific requirements of the battery used in the system.
- Equalization is carried out only for non-sealed / vented/ flooded / wet cell lead acid batteries.
- Do **NOT** equalize VRLA type AGM / Gel / Lithium cell batteries UNLESS permitted by battery manufacturer.
- Default charging parameters in Li mode are programmed for 12.8V Lithium Iron Phosphate (LFP) Battery only. Before using Rover to charge other types of lithium battery, set the parameters according to the suggestions from battery manufacturer.
- Please set the correct battery type the first time you use.

WARNING

Connect battery terminals to the charge controller BEFORE connecting the solar panel(s) to the charge controller. NEVER connect solar panels to charge controller until the battery is connected.

Do NOT connect any inverters or battery charger into the load terminal of the charge controller.

Once equalization is active in the battery charging, it will not exit this stage unless there is adequate charging current from the solar panel. There should be NO load on the batteries when in equalization charging stage.

SUNBOLT

Table of Contents

General Information

The Rover Series charge controllers are intelligent controllers suitable for various off-grid solar applications. It protects the battery from being over-charged by the solar modules and over-discharged by the loads. The controller features a smart tracking algorithm that maximizes the energy from the solar PV module(s) and charge the battery. At the same time, the low voltage disconnect function (LVD) will prevent the battery from over discharging.

The Rover's charging process has been optimized for long battery life and improved system performance. The comprehensive self-diagnostics and electronic protection functions can prevent damage from installation mistakes or system faults.

Key Features

- Automatically detect 12V or 24V DC system voltages
- Innovative MPPT technology with high tracking efficiency up to 99% and peak conversion efficiency of 98%
- Deep cycle Sealed, Gel, Flooded and Lithium (12.8V LFP) battery option ready
- Electronic protection: Overcharging, over-discharging, overload, and short circuit
- Reverse protection: Any combination of solar module and battery, without causing damage to any component
- Customizable charging voltages
- Charges over-discharged lithium batteries
- RS232 port to communicate with BT-1 Bluetooth module

MPPT Technology

The MPPT Charge Controller utilizes Maximum Power Point Tracking technology to extract maximum power from the solar module(s). The tracking algorithm is fully automatic and does not require user adjustment. MPPT technology will track the array'smaximum power point voltage (Vmp) as it varies with weather conditions, ensuring that the maximum power is harvested from the array throughout the course of the day.

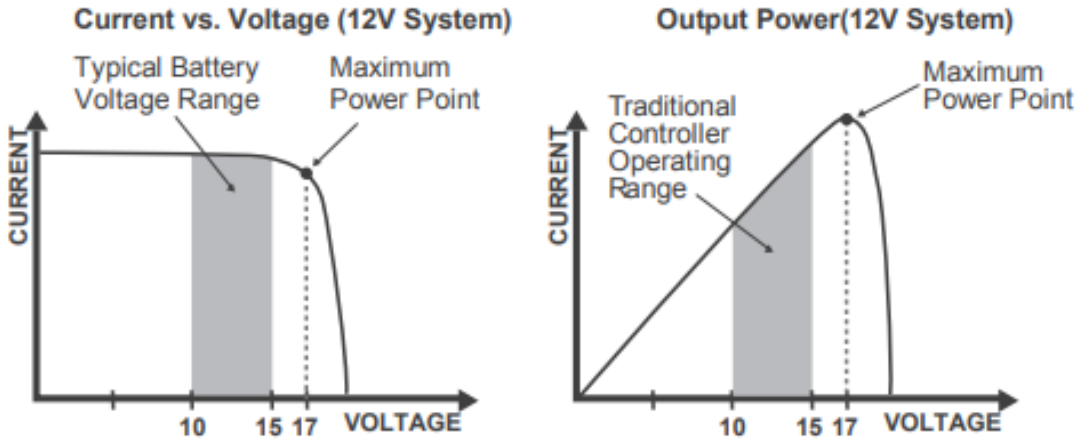
Current Boost

In many cases, the MPPT charge controller will "boost" up the current in the solar system. The current does not come out of thin air. Instead, the power generated in the solar panels is the same power that is transmitted into the battery bank. Power is the product of Voltage (V) x Amperage (A).

Therefore, assuming 100% efficiency:

Power In = Power Out Volts In * Amps In = Volts out * Amps out

Although MPPT controllers are not 100% efficient, they are very close at about 92-95% efficient. Therefore, when the user has a solar system whose Vmp is greater than the battery bank voltage, then that potential difference is proportional to the current boost. The voltage generated at the solar module needs to be stepped down to a rate that could charge the battery in a stable fashion by which the amperage is boosted accordingly to the drop. It is entirely possible to have a solar module generate 8 amps going into the charge controller and likewise have the charge controller send 10 amps to the battery bank. This is the essence of the MPPT charge controllers and their advantage over traditional charge controllers. In traditional charge controllers, that stepped down voltage amount is wasted because the controller algorithm can only dissipate it as heat. The following demonstrates a graphical point regarding the output of MPPT technology.

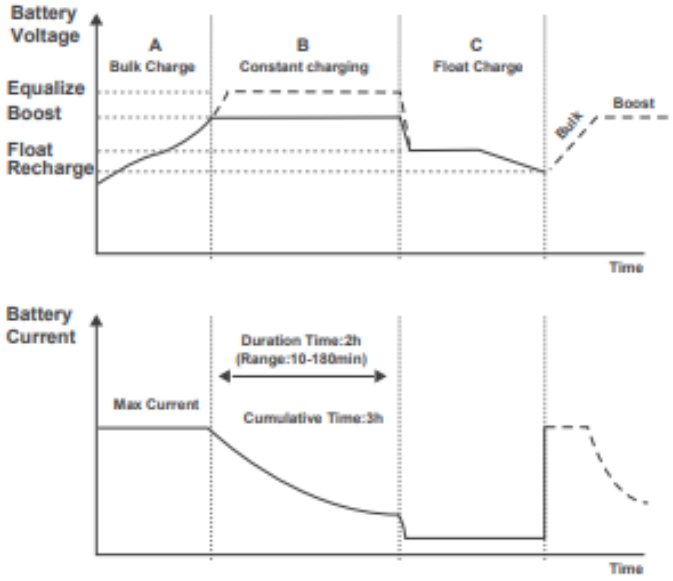


Limiting Effectiveness

Temperature is a huge enemy of solar modules. As the environmental temperature increases, the operating voltage (Vmp) is reduced and limits the power generation of the solar module. Despite the effectiveness of MPPT technology, the charging algorithm will possibly not have much to work with and therefore there is an inevitable decrease in performance. In this scenario, it would be preferred to have modules with higher nominal voltage, so that despite the drop in performance of the panel, the battery is still receiving a current boost because of the proportional drop in module voltage.

Four Charging Stages

The Rover MPPT charge controller has a 4-stage battery charging algorithm for a rapid, efficient, and safe battery charging. They include: Bulk Charge, Boost Charge, Float Charge, and Equalization.



Bulk Charge: This algorithm is used for day to day charging. It uses 100% of available solar power to recharge the battery and is equivalent to constant current. In this stage the battery voltage has not yet reached constant voltage (Equalize or Boost), the controller operates in constant current mode, delivering its maximum current to the batteries (MPPT Charging) .

Constant Charging: When the battery reaches the constant voltage set point, the controller will start to operate in constant charging mode, where it is no longer MPPT charging. The current will drop gradually. This has two stages, equalize and boost and they are not carried out constantly in a full charge process to avoid too much gas precipitation or overheating of the battery.

- **Boost Charge:** Boost stage maintains a charge for 2 hours by default. The user can adjust the constant time and preset value of boost per their demand.

Float Charge: After the constant voltage stage, the controller will reduce the battery voltage to a float voltage set point. Once the battery is fully charged, there will be no more chemical reactions and all the charge current would turn into heat or gas. Because of this,

The charge controller will reduce the voltage charge to smaller quantity, while lightly charging the battery. The purpose for this is to offset the power consumption while maintaining a full battery storage capacity. In the event that a load drawn from the battery exceeds the charge current, the controller will no longer be able to maintain the battery to a Float set point and the controller will end the float charge stage and refer back to bulk charging.

⚠ **Equalization:** Is carried out every 28 days of the month. It is intentional overcharging of the battery for a controlled period of time. Certain types of batteries benefit from periodic equalizing charge, which can stir the electrolyte, balance battery voltage and complete chemical reaction. Equalizing charge increases the battery voltage, higher than the standard complement voltage, which gasifies the battery electrolyte.

WARNING Once equalization is active in the battery charging, it will not exit this stage unless there is adequate charging current from the solar panel. There should be NO load on the batteries when in equalization charging stage.

WARNING Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high of equalizing charge or for too long may cause damage. Please carefully review the specific requirements of the battery used in the system.

WARNING Equalization may increase battery voltage to a level damaging to sensitive DC loads. Ensure that all load allowable input voltages are greater than the equalizing charging set point voltage.

Lithium Battery Activation

The Rover MPPT charge controller has a reactivation feature to awaken a sleeping lithium battery. The protection circuit of lithium battery will typically turn the battery off and make it unusable if over-discharged. This can happen when storing a lithium battery pack in a discharged state for any length of time as self-discharge would gradually deplete the remaining charge. Without the wake-up feature to reactivate and recharge batteries, these batteries would become unserviceable and the packs would be discarded. The Rover will apply a small charge current to activate the protection circuit and if a correct cell voltage can be reached, it starts a normal charge.

CAUTION

When using the Rover to charge a 24V lithium battery bank, set the system voltage to 24V instead of auto recognition. If auto recognition is accidently selected the Rover will allow you to change it to 24V when the lithium battery activation. In the activation interface press and hold the enter button to trigger the system voltage selector. To change the system voltage, press the Up or Down buttons then long press Enter to save the selected system voltage.

Additional Components

Additional components included in the package:

Remote Temperature Sensor:

This sensor measures the temperature at the battery and uses this data for very accurate temperature compensation.The sensor is supplied with a 9.8ft cable length that connects to the charge controller.Simply connect the cable and adhere the sensor on top or the side of the battery to record ambient temperature around the battery.

NOTE Do Not use this sensor when charging lithium battery.

Mounting Brackets

These brackets can be used to mount the Rover charge controller on any flat surface. The screws to mount the brackets to the charge controller are included, screws to mount charge controller to surface are not included.

Mounting Oval:7.66 x 4.70mm (0.30 x 0.18in)

Optional Components

Optional components that require a separate purchase:

Renogy BT-1 Bluetooth Module:

The BT-1 Bluetooth module is a great addition to any Renogy charge controllers with a RS232 port and is used to pair charge controllers with the Renogy BT App. After pairing is done you can monitor your system and change parameters directly from you cell phone or tablet. No more wondering how your system is performing, now you can see performance in real time without the need of checking on the controller's LCD.

Renogy DM-1 4G Data Module:

The DM-1 4G Module is capable of connecting to select Renogy charge controllers through an RS232, and is used to pair charge controllers with Renogy 4G monitoring app. This app allows you to conveniently monitor your system and charge syeters parameters remotely from anywhere 4G LTE network service is available.

Identification of Parts

Key Parts

1. PV LED Indicator
2. Battery LED Indicator
3. Load LED Indicator
4. System Error LED Indicator
5. LCD Screen
6. Operating Keys
7. Mounting Holes
8. Remote Temperature Sensor Port (optional accessory)
9. PV Terminals
10. Battery Terminals
11. Load Terminals
12. RS-232 Port (optional accessory)

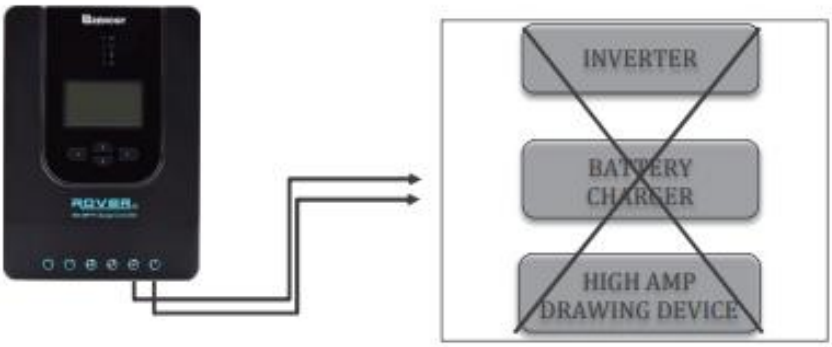
Installation

Recommended tools to have before installation:

Screwdriver	Multi-Meter
	

WARNING Connect battery terminal wires to the charge controller FIRST then connect the solar panel(s) to the charge controller. NEVER connect solar panel to charge controller before the battery.

WARNING Do NOT connect any inverters or battery chargers into the LOAD TERMINAL of the charge controller.

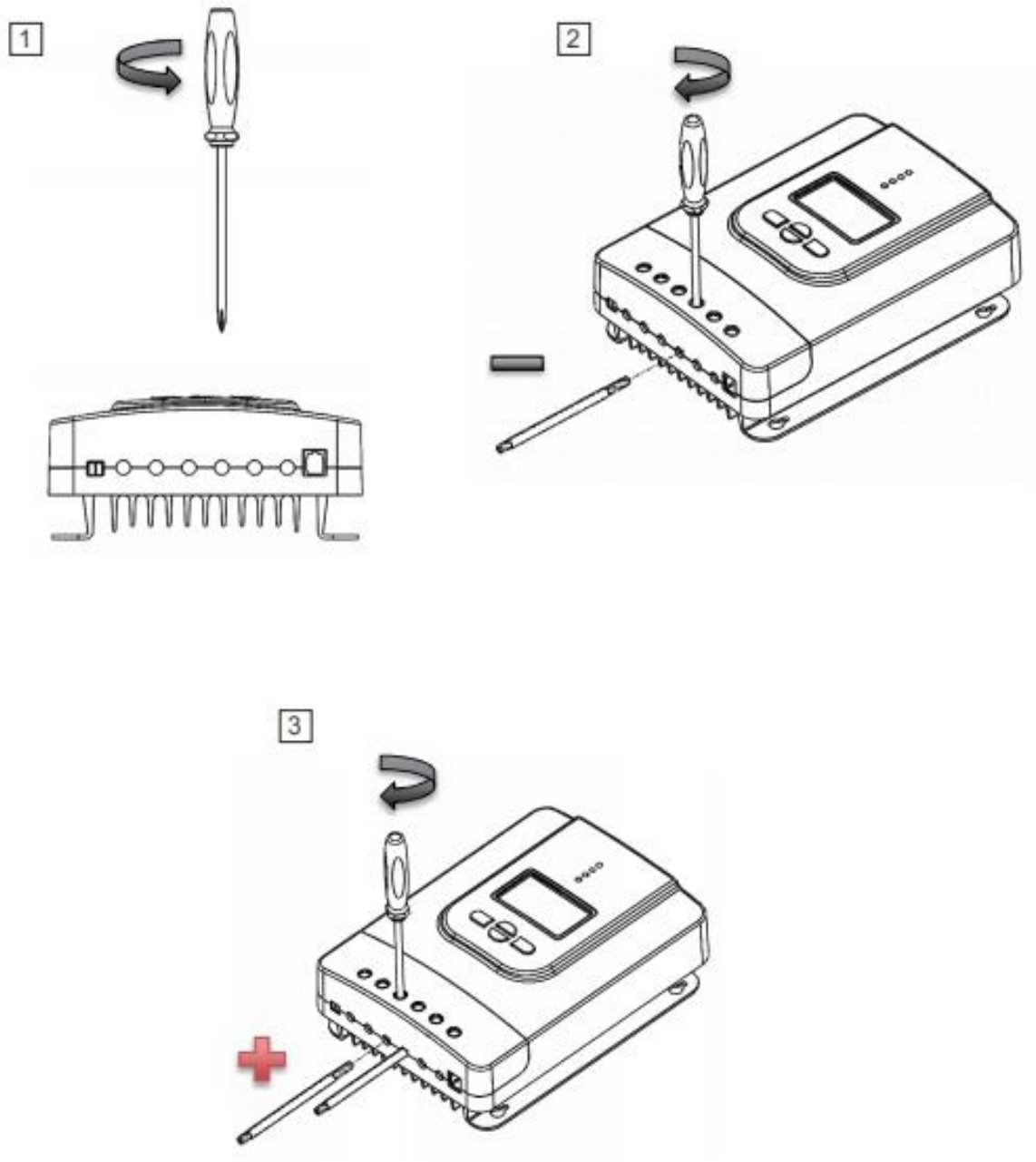


CAUTION Do not over tighten the screw terminals. This could potentially break the piece that holds the wire to the charge controller.

CAUTION Refer to the technical specifications for max wire sizes on the controller and for the maximum amperage going through wires.

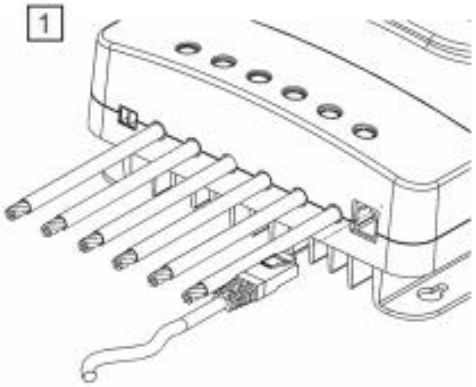
You are now ready to begin connecting your battery to your charge controller.

Battery

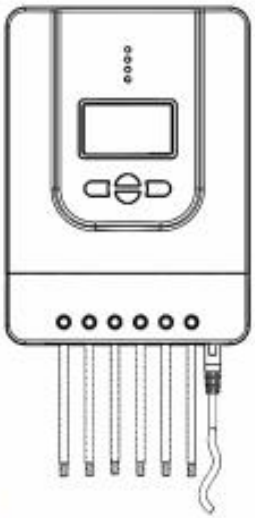


Bluetooth Module communication (optional)

1

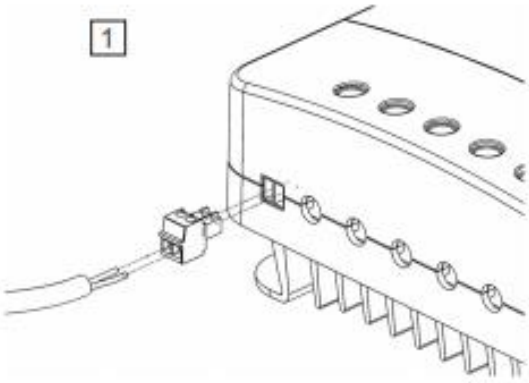


2

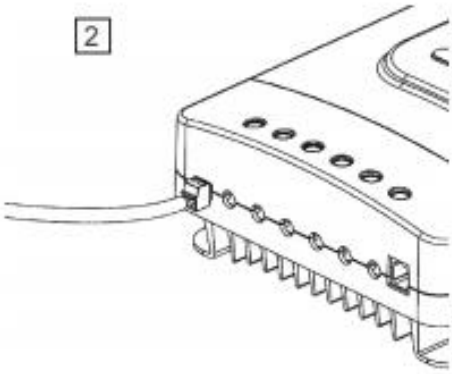


Temperature Sensor (optional, not polarity sensitive)

1



2



3 Place the sensor close to the battery

NOTE Do NOT place the Temperature Sensor lug inside the battery cell.

Mounting Recommendations

WARNING

Never install the controller in a sealed enclosure with flooded batteries. Gas can accumulate and there is a risk of explosion.

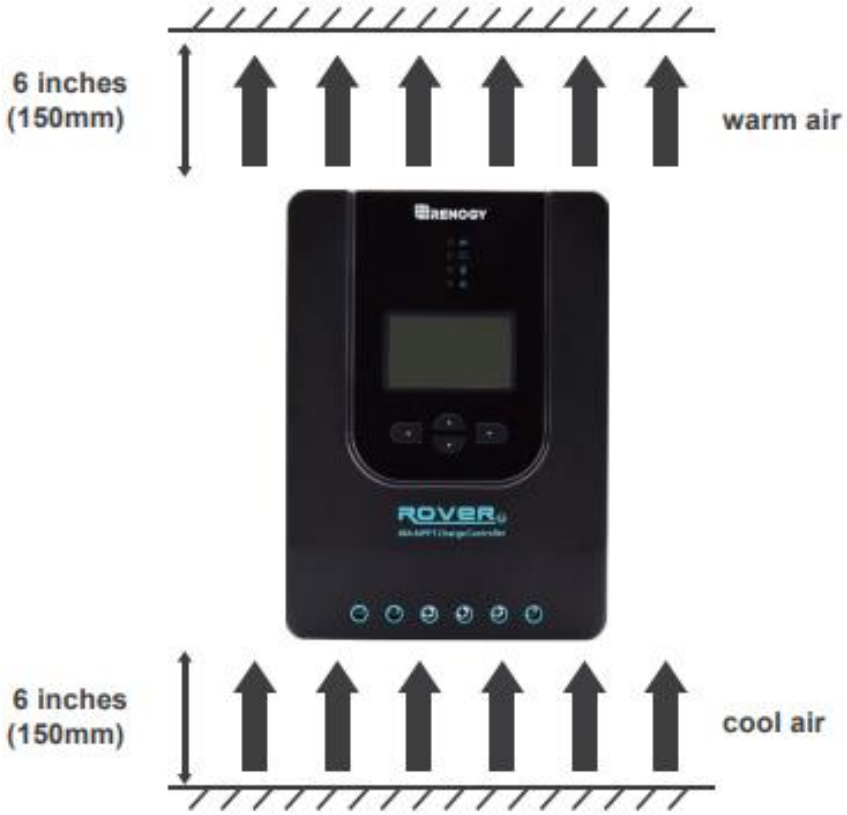
1. Choose Mounting Location—place the controller on a vertical surface protected from direct sunlight, high temperatures, and water. Make sure there is good ventilation.

2. Check for Clearance—verify that there is sufficient room to run wires, as well as clearance above and below the controller for ventilation. The clearance should be at least 6 inches (150mm).

3. Mark Holes

4. Drill Holes

5. Secure the charge controller.



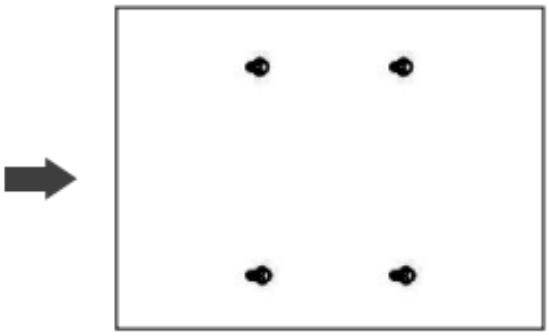
Mounting Methods

The controller can be mounted using the existing mounting holes or using the included mounting brackets.

Using Mounting Hole

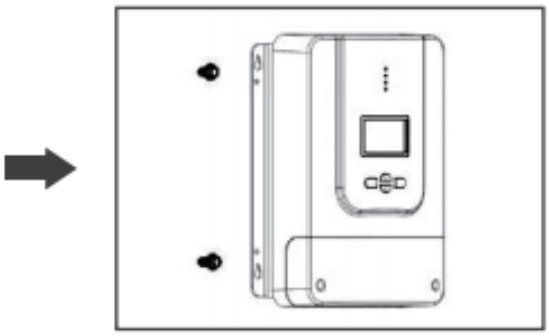
Step 1.

Measure the distance between each mounting hole on the Rover. Using that distance drill 4 screws onto desired surface.



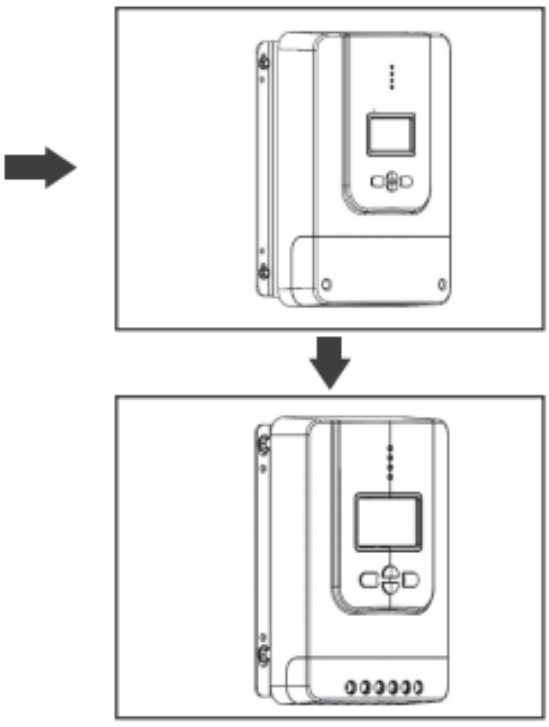
Step 2.

Align the Rovers mounting holes with the screws



Step 3.

Verify all screw heads are inside the mounting holes. Release controller and check if mounting feels secure.

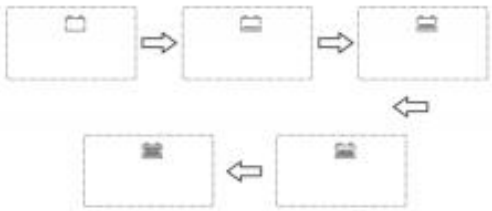


Operation

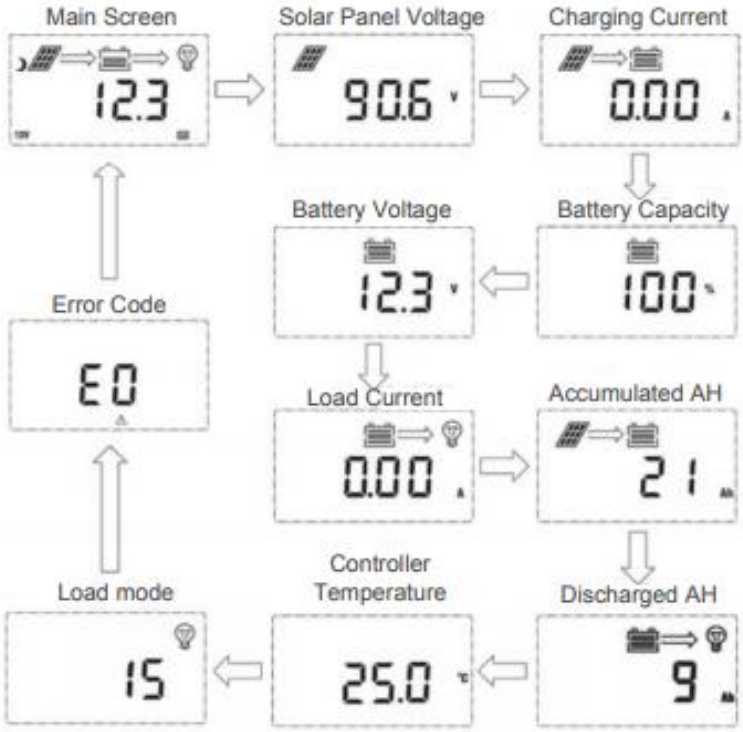
Rover is very simple to use. Simply connect the batteries, and the controller will automatically determine the battery voltage. The controller comes equipped with an LCD screen and 4 buttons to maneuver though the menus.

NOTE: Please set the correct battery type the first time you use.

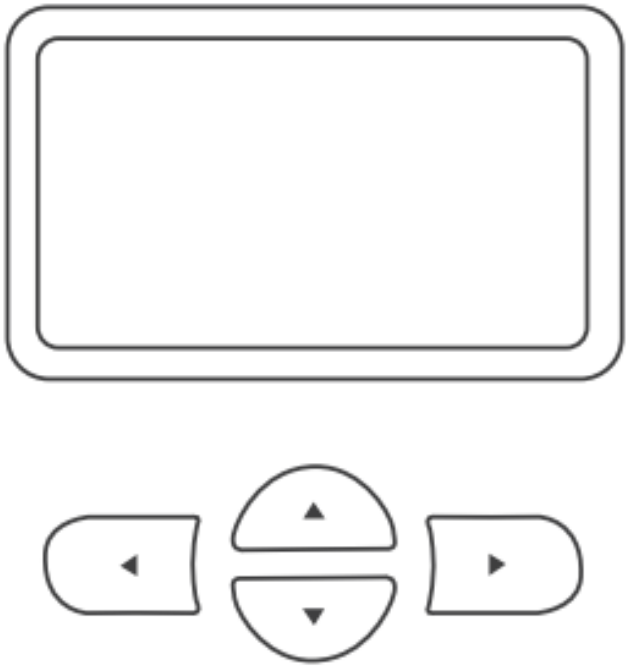
Startup Interface



Main Display



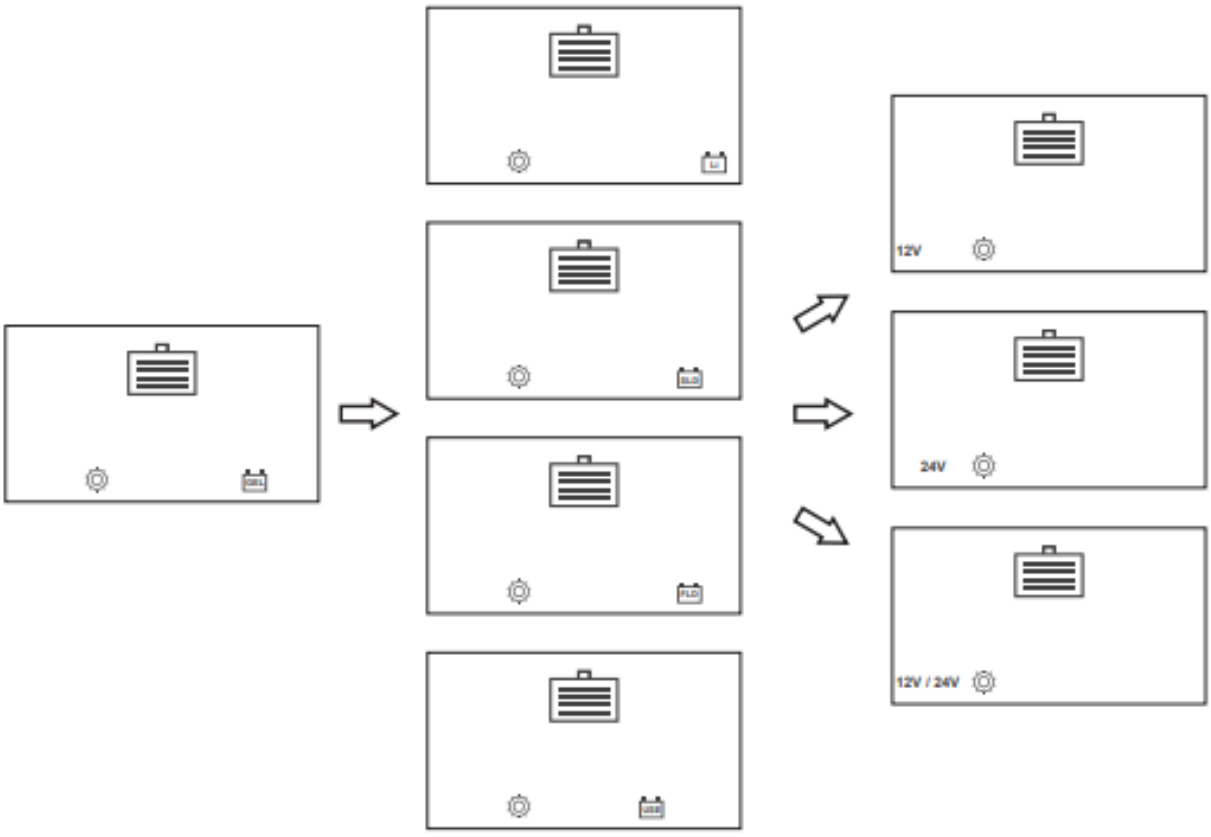
NOTE The Battery Capacity (SOC%) is estimated based on the charging voltage.



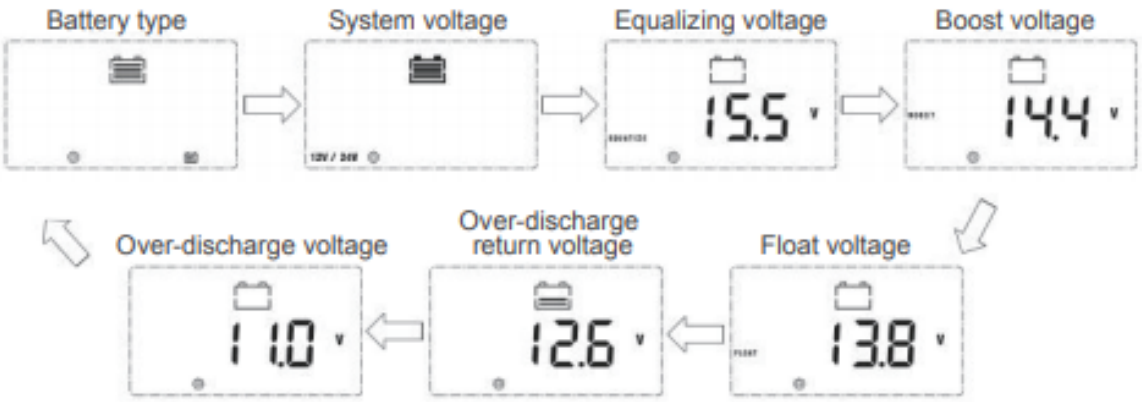
↑ / +	Page Up/ Increase parameter value
↓ / -	Page Down/ Decrease parameter value
←	Return to the previous menu
ENTER/ →	Enter sub menu/ save parameter value/ turn load on or off in manual mode

Programming Battery Type

To enter the battery programming settings hover over the Battery Voltage screen and press down the Enter button .When the battery type starts to flash press the Select button to cycle through the battery types and press Enter to finalize selection .When selecting the Lithium setting the user can change battery voltage from 12V to 24V and select the charging voltage.



Programming Parameters



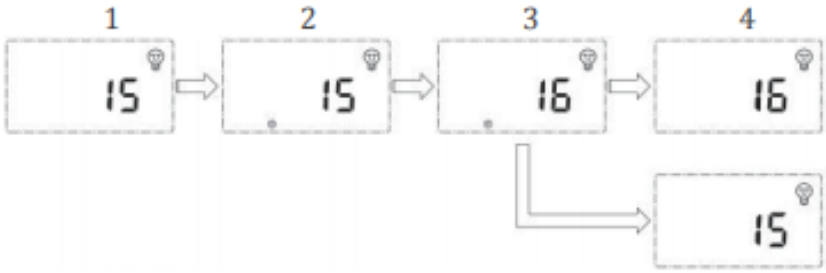
To enter the programming interface simply press and hold the right arrow button. After entering this feature press the Enter/Right button to switch between parameters. To change the parameters, press the Up or Down button. To save the parameter press and hold the Enter/Right button.

The charging parameter setting (Equalizing voltage, Boost voltage, Floating charging voltage, over-discharge return voltage, Over-discharge voltage) are only available under the battery "USER" mode. Press and hold the right arrow to enter the programming settings and continue pressing the right arrow button until you see the desired voltage screen.

NOTE

Battery charging parameters can also be programmed using the Renogy BT APP. Read the corresponding user manuals for more information.

Programming Load Terminal

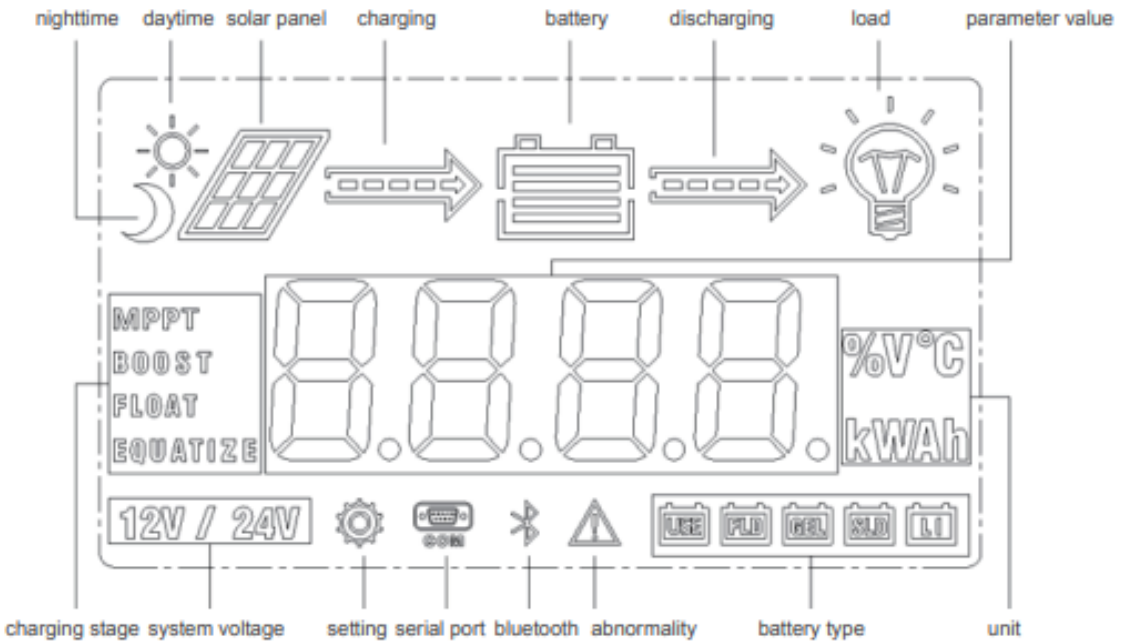


1. This screen is displaying the current Load Mode.
2. To enter screen 2 press and hold the Enter button. This screen will allow you to change the load mode.
3. To change the load mode press the up or down button.
4. Once you have selected the desired load mode press the Enter button to save the setting.
5. To exit the programming setting press the left button.

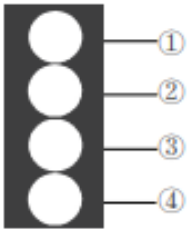
Load Mode Options

Setting	Mode	Description
0	Automatic(On/Off)	The load will turn on at night when the solar panel is no longer producing any power after a short time delay. The load will turn off when the panel starts producing power.
1-14	Time control	When the panel is no longer producing power the load will be ON for 1-14 hours or until the panel starts producing power.
15	Manual	In this mode, the user can turn the Load On/Off by pressing the Enter button at any time.
16	Test	Used to troubleshoot load terminal (No Time Delay). When voltage is detected load will be off and when no voltage is detected load will be on.
17	24Hr	The load will be on for 24 hours a day.

LCD Indicators



LED Indicators



①---PV array indicator	Indicating the controller's current charging mode.
②---BAT indicator	Indicating the battery's current state.
③---LOAD indicator	Indicating the loads' On/ Off state.
④---ERROR indicator	Indicating whether the controller is functioning normally.

PV Indicator (1)		Status
○	White Solid	The PV system is charging the battery bank
○	White Slow Flashing	The Controller is undergoing boost stage
○	White Single Flashing	The Controller is undergoing float stage
○	White Fast Flashing	The Controller is undergoing equalization stage
○	White Double Flashing	The oversized PV system is charging the battery bank at the rated current.
●	Off	The PV system is not charging the battery bank. PV not detected.
BATT Indicator (2)		**Status**
○	White Solid	Battery is normal
○	White Slow Flashing	Battery over-discharged
○	White Fast Flashing	Battery over-voltage
LOAD Indicator (3)		**Status**
○	White Solid	Load is on
○	White Fast Flashing	Load is over-loaded or short-circuited
●	Off	Load is off
ERROR Indicator (4)		**Status**
○	White Solid	System Error. Please check LCD for Error code
●	Off	System is operating normally

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Rover Protections

Protection	Behavior
PV Array Short Circuit	When PV shot circuit occurs, the controller will stop charging. Clear it to resume normal operation.
PV Overvoltage	if the PV voltage is larger than maximum input open voltage 100VDC. PV will remain disconnected until the voltage drops below 100VDC.
PV Overcurrent	The controller will limit the battery charging current to the maximum battery current rating. Therefore, an over-sized solar array will not operate at peak power.
Load Overload	If the current exceeds the maximum load current rating 1.05 times, the controller will disconnect the load. Overloading must be cleared up by reducing the load and restarting the controller.
Load Short Circuit	Fully protected against the load wiring short-circuit. Once the load short (more than quadruple rate current), the load short protection will start automatically. After 5 automatic load reconnect attempts, the faults must be cleared by restarting the controller.
PV Reverse Polarity	The controller will not operate if the PV wires are switched. Wire them correctly to resume normal controller operation.
Battery Reverse Polarity	The controller will not operate if the battery wires are switched. Wire them correctly to resume normal controller operation.
Over-Temperature	If the temperature of the controller heat sink exceeds 65℃, the controller will automatically start reducing the charging current. The controller will shut down when the temperature exceeds 85℃.

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System Status Troubleshooting

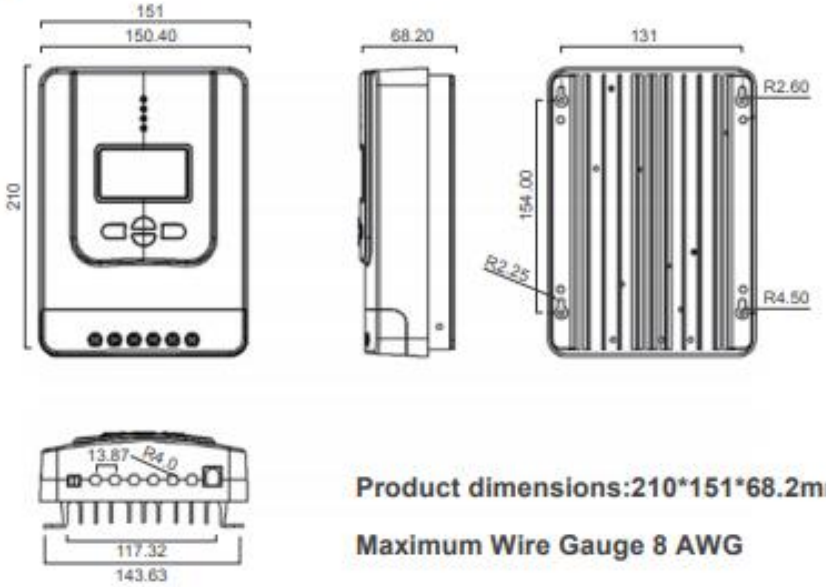
PV indicator	Troubleshoot
Off during daylight	Ensure that the PV wires are correctly and tightly secured inside the charge controller PV terminals. Use a multi-meter to make sure the poles are correctly connected to the charge controller.
BATT Indicator	**Troubleshoot**
White Slow Flashing	Disconnect loads, if any, and let the PV modules charge the battery bank. Use a multi-meter to frequently check on any change in battery voltage to see if condition improves. This should ensure a fast charge. Otherwise, monitor the system and check to see if system improves.
White Fast Flashing	Using a multimeter check the battery voltage and verify it is not exceeding 32 volts.
Load Indicator	**Troubleshoot**
White Fast Flashing	The Load circuit on the controller is being shorted or overloaded. Please ensure the device is properly connected to the controller and make sure it does not exceed 20A (DC).
Error Indicator	**Troubleshoot**
WhiteSolid	System Error. Please check LCD for Error code

Error Codes

Error Number	Description
E0	No error detected
E1	Battery over-discharged
E2	Battery over-voltage
E3	Battery under-voltage
E4	Load short circuit
E5	Load overloaded
E6	Controller over-temperature
E8	PV input over-current
E10	PV over-voltage

Dimensions

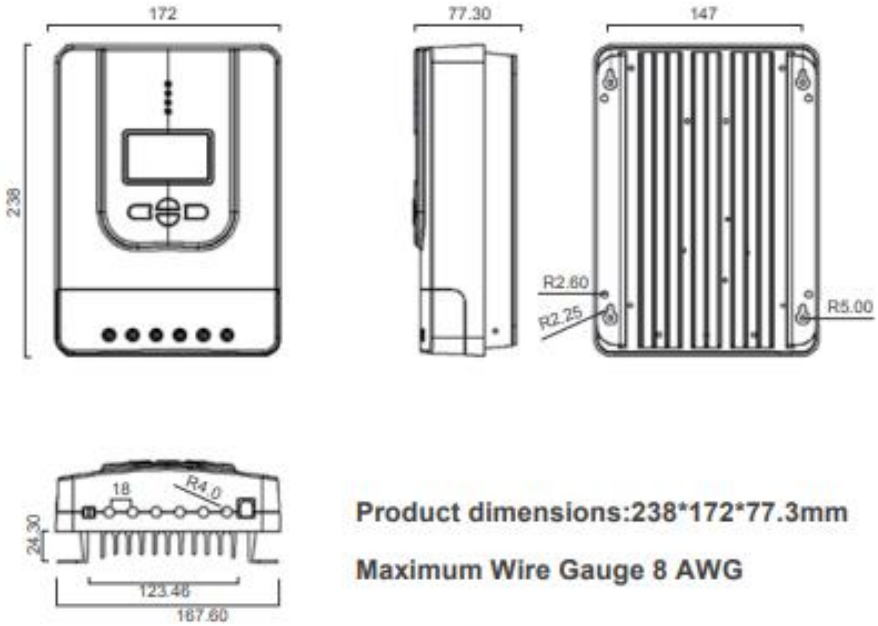
RVR-20



Product dimensions:210*151*68.2mm

Maximum Wire Gauge 8 AWG

RVR-30/40



Product dimensions:238*172*77.3mm

Maximum Wire Gauge 8 AWG

NOTE **Dimensions in millimeters (mm)**

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9

ELECTRICAL COMPONENTS – BATTERY CAPACITY METER

Waterwich Waterproof 12V DC Voltmeter

Specifications:
Voltage Measuring range: 5 - 30V (Blue digital display)
Battery Measuring range: LED multi-color, Green---full battery; Orange---half-full battery; Red---low battery.
Outer diameter: 36mm / 1.4"
Thread diameter: 29mm / 1.1"
Length: 41 mm / 1.61"
Interface Type: Anode and cathode
Application: Universal for all Cars, motorcycles and other universal models.

Description:
High Grade Flame Retardant Materials, IP65 Waterproof, CE and Rohs Certify, Totally Environment Friendly
Measurement range:5-15v dc for DC 12V battery
The indicator in the middle will twinkle to alarm when the voltage is more than 15V for DC 12V battery ,it will twinkle to alarm when the voltage is more than 30V for DC 24V battery.

Polarity reverse protection and multiple protection to make it safer to use

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9

ELECTRICAL COMPONENTS – INVERTER

SUNBOLT

RENOGY EMPOWERED

BATTERY POWER INVERTERS

12V Pure Sine Wave Inverter Manual

700W | 1000W | 2000W | 3000W

Version 1.3

Important Safety Instructions

Please save these instructions.

This manual contains important safety, installation, and operating instructions for the inverter. The following symbols are used throughout the manual:

WARNING	Indicates a potentially dangerous condition. Use extreme caution when performing this task.
CAUTION	Indicates a critical procedure for safe and proper operation of the inverter.
NOTE	Indicates a procedure or function that is important to the safe and proper operation of the inverter.

General Safety Information

- Installation and wiring must comply with the Local and National Electric Codes (NEC) and must be done by a certified technician.
- Read all of the instructions and cautions in the manual before beginning the installation.
- There are no serviceable parts for this inverter. Do NOT disassemble or attempt to repair the inverter.
- Make sure all connections going into and from the inverter are tight. There may be sparks when making connections, therefore, make sure there are not flammable materials or gases near installation.

Inverter Safety

- The inverters are suitable for 12V Battery Banks ONLY.
- ALWAYS make sure inverter is in OFF position and disconnect all AC and DC connecting when working on any circuit associated with the inverter.
- NEVER connect the AC output of the unit directly to an Electrical Breaker Panel/ Load Centre which is also fed from the utility power / generator.
- When connecting battery terminals, ensure the polarity of the battery connections is correct. Incorrect polarity may cause permanent damage to the unit.
- Be careful when touching bare terminals of capacitors as they may retain high lethal voltages even after power is removed.

Battery Safety

- Do NOT let the positive (+) and negative (-) terminals of the battery touch each other.
- Use only sealed lead-acid, flooded, or gel batteries which must be deep cycle.
- Explosive battery gases may be present while charging. Be certain there is enough ventilation to release the gases.
- Be careful when working with large lead acid batteries. Wear eye protection and have fresh water available in case there is contact with the battery acid.
- Over-charging and excessive gas precipitation may damage the battery plates and activate material shedding on them. Too high of an equalizing charge or too long of one may cause damage. Please carefully review the specific requirements of the battery used in the system.

Installation Safety

- The unit should be installed in a well-ventilated, cool, and dry environment. Make sure the fans of the unit and the ventilation holes are not blocked.
- Do not expose the unit to rain, moisture, snow, or liquids of any type.

SUNBOLT

Table of Contents

General Information

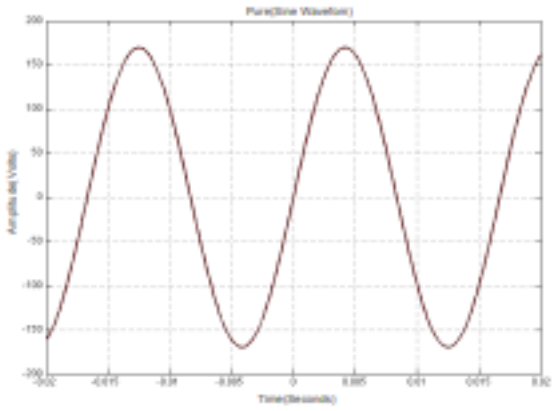
The Renogy Pure Sine Wave Power Inverter delivers superior performance for remote off-grid applications, capable of producing cleaner, smoother, and more reliable electricity for a user's electronic needs.

Key Features

- Robust and sleek design
- Optimized for 12 VDC system voltage
- Clean power for safe operation of sensitive electronics
- Easy-to-read LED indicator display
- Multiple protection features (LVD, HVD, AC Overload and Over Temperature)
- Excellent Surge Rating : 2x the Power Rating
- Ground-fault circuit interrupter(GFCI) protection
- Build-in 5V/2.1A USB port

Pure Sine Wave

The Renogy Power Inverters output a pure sine wave similar to the waveform of the grid power. In a pure sine wave, the voltage rises and falls in a smooth fashion with very low harmonic distortion and cleaner utility-like power.



This gives users stable enough power to operate tools, fans, lights, computers, and other electronics without any interference. Pure sine wave inverters are in many cases more efficient, allowing users to use less energy and allow for more device capability. The main advantage to pure sine wave inverters is that they are used to operate sensitive electronic devices that require a high quality waveform with little harmonic distortion. Almost any electronic device could be powered using a pure sine wave inverter.

Included Components

The Renogy Pure Sine Wave Battery Inverters will be shipped with inverter cables and a remotecontrol for powering the inverter on or off.

Inverter Model	Gauge
700W	6 AWG 3ft
1000W	4 AWG 3ft
2000W	4 AWG*2 3ft
3000W	Does not include

Wired remote control

List dimensions	2.875 x 2.3125 x 0.9375in, 73 x 58.7 x 23.8mm
Thickness	0625in , 1.5mm
Wire length	Approx 19.8ft

Identification of Parts (AC Side)

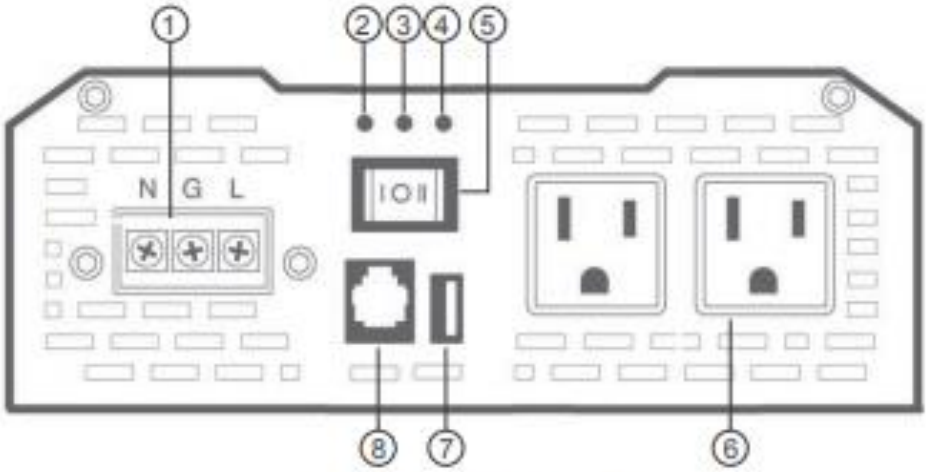


Figure 2: 1000W Inverter

Key Parts

1. **High Output AC Terminals** — These terminals are for connecting 115V AC devices that require more than 15 amps to operate or for connection to distributed wiring that has multiple AC outlets. Remove the two screws on protective cover to access the terminals. Any AC output wiring that is directly connected must comply with US National Electric Code (NEC) wiring gauge recommendations.

    - **Facing the front panel, the terminals are:**

LEFT	Middle	Right
Neutral (N)	Ground(G)	Live(L)

    NEUTRAL and GROUND are bonded inside the inverter to comply with theNational Electric Code (NEC) requirement that any AC source must have a neutral to ground connection.

2. **Power LED (Green)** — When this green LED is lit, the inverter is operating.
3. **GFCI LED (Yellow)** — When the yellow LED is lit, the ground fault circuit has been interrupted. Shut down the inverter and restart.

4. **Fault LED (Red)** — The red indicator turns on as the inverter shuts down due to overheating, overload, under voltage, or over voltage.

- Immediately turn off all AC appliances if the Fault LED is lit. Allow the inverter to cool before continuing. Make sure that the ventilation vents are not blocked.

- If an inverter shutdown was preceded by a buzzing sound, there may be an excessive load in combination with low voltage or a cable problem.

5. **ON/OFF Switch** — Controls AC output.

6. **AC Outlets** — 115V AC 60Hz, up to 15amps for 2000W and 3000W models, up to 6.1 amps for 700W,up to 8.7 amps for 1000W.

7. **USB Power Port** — 5 volts / 2.1A for charging tablets, smartphones, and other small electronic devices.

8. **Remote Switch Connection** — Insert wired remote switch to the connection port. Set ON/OFF switch to "remote" position.

NOTE **Alarm** —If there is a buzzing sound, the battery is low. The user should reduce the AC load, charge the battery, and check the DC cable for excessive losses.

Identification of Parts (DC Side)

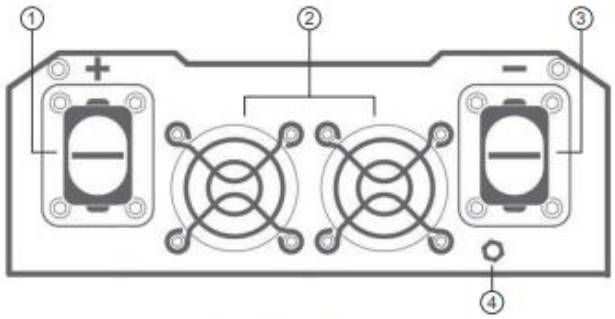


Figure 3: 1000W Inverter

KEY PARTS

1.Positive Terminal — Positive (+) DC Input (Red)
2.Cooling Fans — Thermally controlled
3.Negative Terminal — Negative (−) DC Input (Black)
4.Ground Terminal — For insulated safety ground wire.

Installation

WARNING Make sure inverter is in the off position before connecting anything.

CAUTION Do not over-torque or over tighten the terminals. This could potentially damage the unit.

CAUTION Refer to the technical specifications for max wire sizes on the controller and for the maximum amperage going through wires.

Location Recommendations

WARNING Never install the inverter in a sealed enclosure with flooded batteries. Gas can accumulate and there is a risk of explosion.

Ensure installation follows the following guidelines:

1. **Cool, dry, well-ventilated area —** Heat is the worst enemy for electronic equipment. Inverters must be in an area where the fans are not blocked or where they are not hit directly by the sun. They should be in an area free of any kind of moisture and allow for clearance of at least 10" around the unit to provide for adequate ventilation.
2. **Protection against fire hazard —** the unit should be away from any flammable material, liquids, or any other combustible material. The unit can spark and the consequences could be severe.
3. **Close proximity to battery bank—**prevent excessive voltage drop by keeping the unit close to the battery bank and having a properly sized wire going from the battery bank to the inverter.
4. WARNING **Do not install the inverter in the same compartment as the battery bank because it could serve as a potential fire hazard.**
5. **Limiting electromagnetic interference (EMI)** — ensure the inverter is firmly grounded to a building, vehicle, or earth grounded. Keep the inverter away from EMI receptors such as TVs, radios, and other audio/visual electronics to prevent damage/interference to the equipment.
6. **Secure inverter**—the inverter could be stand alone or mounted using the outlying terminals on the inverter.

   WARNING **The inverter should never be mounted vertically on a vertical surface since it would present a hazard for the fan opening which is crucial for cooling the inverter.**

Sizing a Battery Bank

- **Determine the amount of Watts (Amps * Volts) for the load, and how long the load needs to operate—**each electrical appliance has technical specificationsindicating the watts, or the volts and amps required for operation.
- **Estimate load run-time—**Battery size depends on load watts and run-time. Most loads are not constant, so estimation is very important.
- **Utilize the formula Watts = Volts * Amps**
- **Determine Amps used for how many hours – Amp-hour (Ah)**

For this Renogy inverter, the battery bank will be 12 volts direct current (12 VDC)

Example	
A Microwave oven = 700 Watts 12V battery bank	700 Watts to run microwave oven using the batteries as if it was a 12VDC microwave requires 58 Amps 700 Watts / 12 Volts = 58 Amps
Load Operation = 3 hours	Now that amps have been determined, the amp-hours need to be determined. The microwave will be used for approximately 3 hours a day. 58 Amps * 3 hours = **174 Ah**
At least a 174 Ah battery must be selected in order to use the 700-Watt microwave at 3 hours a day. However, determining a battery size is also dependent on the battery that is able to handle repeated discharge/charge cycles.	

NOTE **This is just an example. Actual quantities vary by battery capacity and rates of discharge.**

NOTE **To power the microwave in the example, the user must use an inverter that is at least 1000 watts, if not more.**

Grounding

The Renogy Pure Sine Wave inverters come equipped with a grounding lug to appropriately ground to earth or to another designated ground (for example, a metal frame of an RV). The connections to ground must be tight and against bare metal. Whether using the inverter in a mobile application, such as an RV, or in a building, grounding is highly recommended. The recommended wire size for grounding is 10 AWG insulated copper strand wire. For more information regarding grounding, users and/or installers must consult with the Local and National Electric Codes (NEC) for more specific grounding regulations and suggestions as they can change per scenario.

DC Side Connection

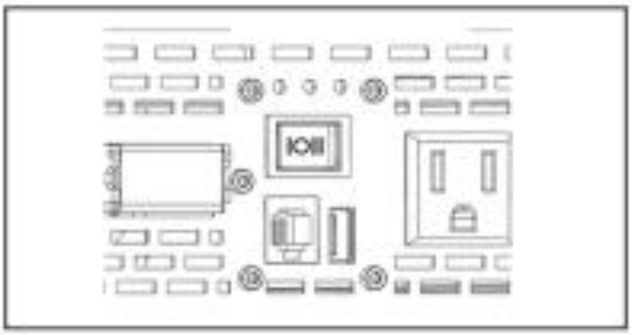
WARNING **The Renogy Pure Sine Wave Inverters are suitable for 12V battery bank systems ONLY. Not following the minimum DC requirement will cause irreversible damage to the unit.**

CAUTION **Be careful of the positive and negative poles. Reversing the poles might cause permanent damage to the inverter. It will surely blow the internal fuse.**

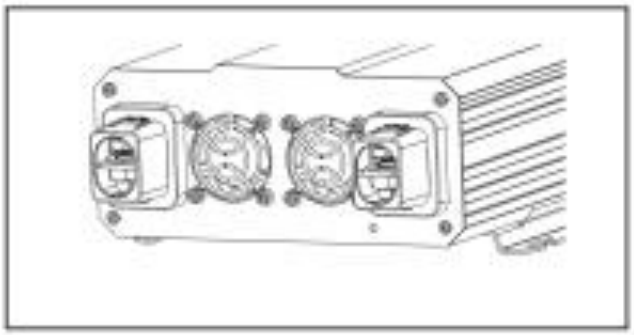
NOTE **Damage to the Renogy inverters due to reverse polarity is NOT covered by warranty.**

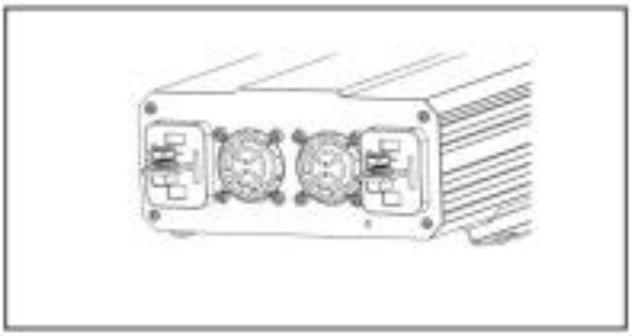
NOTE **The input terminals of the inverters have large capacitors connected to them. Once a positive and negative wire are connected to the terminals, it will complete the circuit, and commence drawing a heavy current momentarily. As a result, there may be a sparking occurring even if the inverter is in the off position. To minimize sparking, it is recommended that the user have the appropriate size wire feeding into the inverters and/or install an external fuse leading into the inverter.**

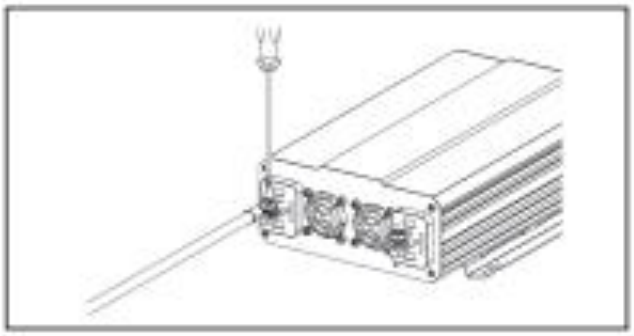
1.Flip inverter power to OFF position (on AC side)

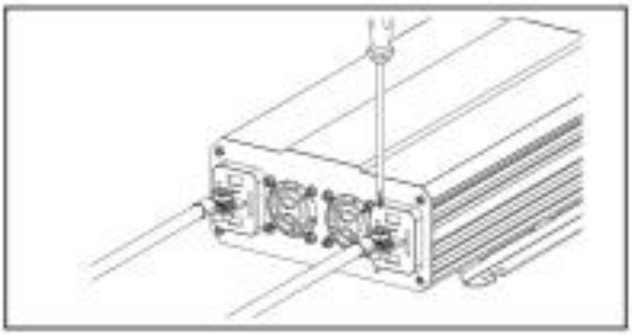


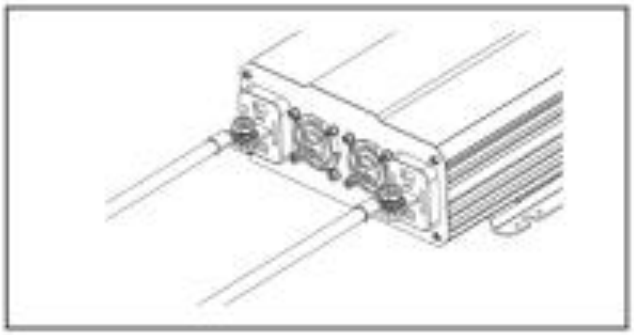
2.Remove Cap, then unscrew inverter terminals and connect battery connections. Then tighten.









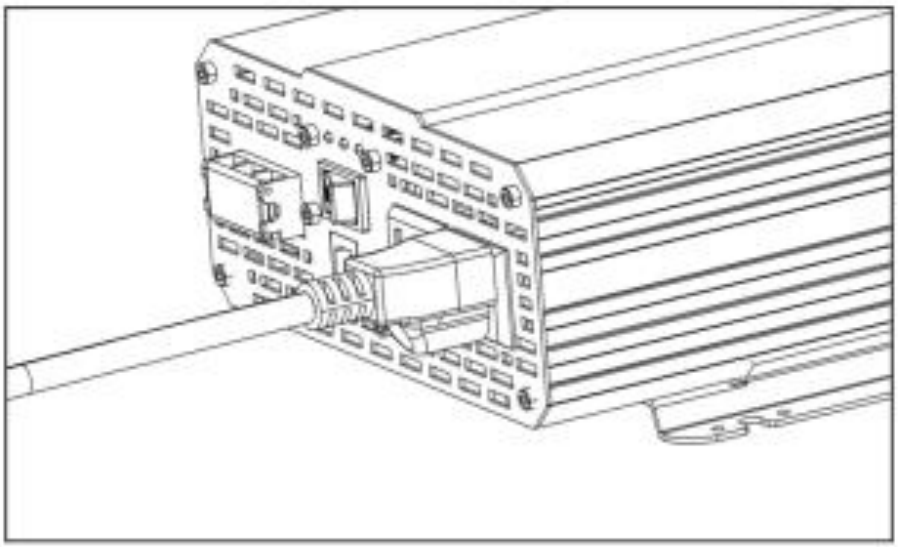


Operation

Assuming proper battery connection, the inverter is now ready for use.

AC Side Operation

1.Connect electronic devices to electrical socket(s) on inverter. Flip inverter power to ON position (on AC side)



2. When finished, switch AC devices off FIRST, then turn off inverter switch

CAUTION **Avoid switching on the inverter with the load (electronic devices) already switched on. This may trigger an overload since some electronic devices have an initial high power surge to start.**

CAUTION **When switching off the inverter, turn off the electronic devices first. Although the inverter is off, the capacitors will still have a charge, so the DC and AC terminals must be disconnected if altering the circuitry.**

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Inverter Troubleshooting

Indicator	Potential Issue	Troubleshoot
Alarm beeps	Input voltage is below 10.5V	Keep input voltage above 10.5V
	Input voltage is above 16.0V	Keep input voltage below 16.0V
Fault LED Lit, inverter shut down and alarm on	Input voltage is below 10V	Keep input voltage above 10V
	Input voltage is above 16.5V	Keep input voltage below 16.5V
	Inverter overheats	Allow inverter to cool down
		Check for adequate ventilation
		Reduce the load on inverter
	Operating equipment draws too much power	Use a higher wattage inverter or use a lower powered device
	Inverter is short circuited	Disconnect the inverter and turn off the ON/OFF switch to reset
Yellow LED Lit - Inverter shut down	GFCI tripped	Disconnect appliances and turn off the ON/OFF switch to reset

External Fusing

Fusing is a recommended in PV systems to provide a safety measure for connections going from panel to controller and controller to battery. Remember to always use the recommended wire gauge size based on the PV system and the controller.

NEC Maximum Current for different Copper Wire Sizes									
#AWG	16	14	12	10	8	6	4	2	0
Max. Current	10A	15A	20A	30A	55A	75A	95A	130A	170A

SUNBOLT

Specifications

Model	RNG-INVT-700-12V-P2	RNG-INVT-1000-12V-P2	RNG-INVT-2000-12V-P2	RNG-INVT-3000-12V-P2
Continuous Power	700 W	1000 W	2000 W	3000 W
Input Voltage	12V DC			
Output Voltage	115V AC			
Peak surge	1400 W	2000 W	4000 W	6000 W
Efficiency	> 90%			
Frequency	60Hz			
Total harmonic distortion (THD)	< 3%			
No load current draw	< 0.8A	< 1.0A	< 2.0A	< 2.5A
Battery low alarm	10.5V ± 0.5V DC			
Battery low shutdown	10.0V ± 0.5V DC			
Over voltage shutdown	16.5V ± 0.5V DC			
Cooling fan	Thermally controlled			
AC output sockets	2	2	3	3
USB power port	5V/2.1A			
Power output control	AC On/Off Switch			
Dimensions	12.2×7.4×3.3 in	12.9×6.8×3.3 in	17.8×8.6×4 in	18.9×9×4 in
Net weight (approximate)	5.6 lb	6.0 lb	11.7 lb	12.5 lb
Certification	ETL Listed to UL 458 and CSA 22.2 NO 107.1-01			
	FCC Part 15 class B			

Wired remote control	
List dimensions	2.875 x 2.3125 x 0.9375in, 73 x 58.7 x 23.8mm
Thickness	0625in , 1.5mm
Wire length	Approx 19.8ft

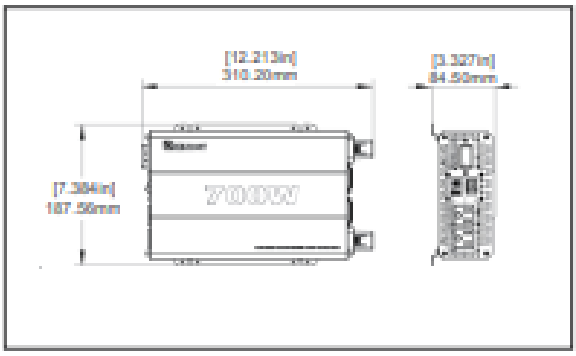
This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

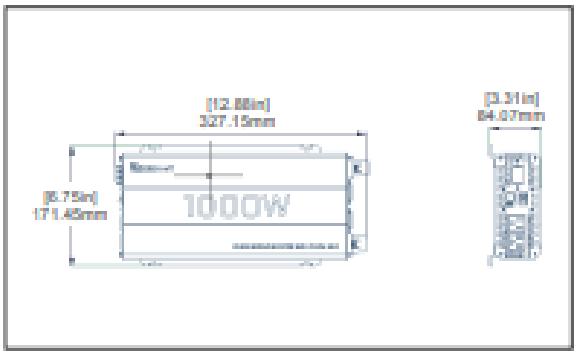
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Dimensions

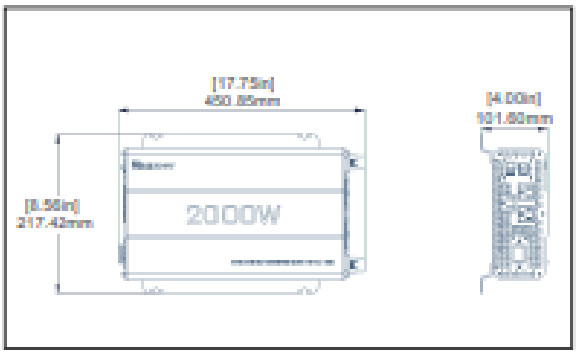
700W



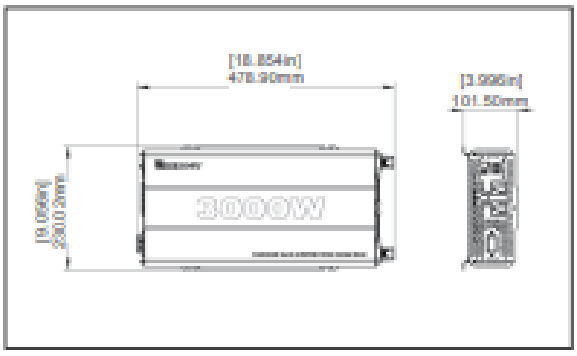
1000W



2000W



3000W



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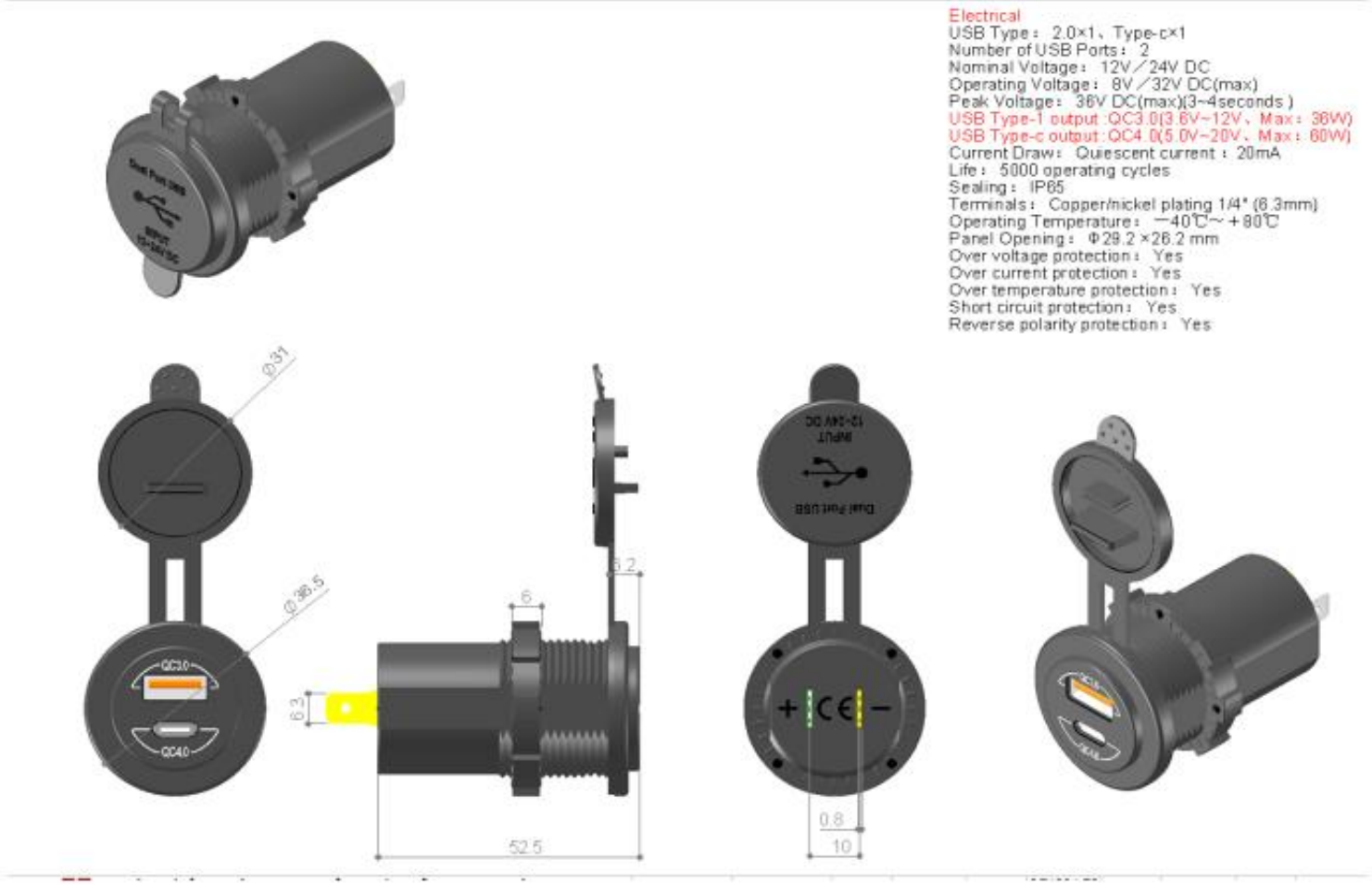
ELECTRICAL COMPONENTS – 60W USB CHARGER



Laptops:

Our USB-C Power Delivery charging socket can support for a huge range of USB-C laptops that require 60W full-speed charging or less including Macbook 12" / Pro 13"/ Pro 15" / Air 2018, Dell XPS 13 / XPS 15, HP Elite X2 / EliteBook X360 / Spectre 13 / Spectre 15 / Spectre 360, Lenovo ThinkPad X1 / YOGA730, Ultrabooks, Chromebooks, Probooks and more.

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ELECTRICAL COMPONENTS – RECEPTACLES

SUNBOLT

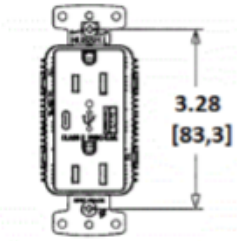
Straight Blade Devices
15A, 125V, 2 Pole, 3 Wire Grounding

USB Charger Receptacles

HUBBELL

Features

- High Power 5 Amp, 5 Volt USB Output
- Combination Ports, One Type A, One Type C
- Tamper Resistant Commercial Grade Duplex Compatible



15A STANDARD GRADE DEVICE

Ordering Information

Description	Color	UPC Number	Catalog Number
Tamper Resistant 15A/125V Duplex, 5 Amp, 5 Volts USB Ports	White	883778307171	**USB15AC5W**

Listings

cULus Listed to UL498, UL1310

Specifications

Face	RTP
Base	RTP
Indicator	Green LED
Contacts	Brass
Clamp	Plated Steel
Terminal Screws	Plated Steel
Mounting Strap	.040" Zinc Plated Steel
Mounting Screws	Zinc Plated Steel
USB Port	Stainless Steel

Online Resources

eCatalog

Performance

Electrical

Current Interrupting	Certified for current interrupting at full rated current

Environmental

Flammability	UL 94V-2

Product Identification

Ratings are a permanent part of the device	Complies with USB BC1.2 Battery Charging and 3.0 Power Delivery Specifications

Dimensions in inches (mm)

Hubbell Wiring Device-Kellems • Hubbell Incorporated (Delaware) • 40 Waterview Drive • Shelton, CT 06484
Phone (800) 288-6000 • Fax (800) 256-1081 • Specifications subject to change without notice.

HUBBELL Wiring Device-Kellems

SUNBOLT

HUBBELL

Straight Blade Devices
20A, 125V, 2 Pole, 3 Wire Grounding
Commercial Specification Grade Style Line® Decorator Duplex Receptacles

Features

- Aesthetic Style Line® decorator design
- Smooth face
- Triple wipe contacts

Ordering Information

Description	Device Color	UPC	Catalog Number
Smooth face, Style Line® decorator, back and side wired	White	783585127903	DR20WHI

Listings

UL Listed to UL498 File No. E2186
Certified to CSA, C22.2, No. 42
Fed. Spec. W-C-596
NEMA® WD-6 Compliant

Specifications

Face	Nylon
Base	Nylon
Power Contacts	.030 in. (.8) Brass
Ground Contacts	Brass
Wire Clamp	.062 in. (1.6) Nickel plated steel
Terminal Screws	Plated steel
Mounting Strap	.040 in. (1) Galvanized steel
Automatic Self-grounding Staple	Stainless steel
Mounting Screws	Galvanized Steel

Performance

Electrical

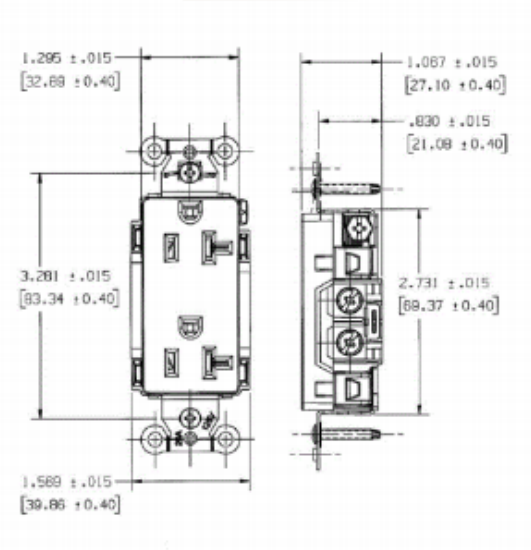
Current Interrupting	Certified for current interrupting at full rated current
Dielectric Voltage	Withstands 2,000V minimum

Mechanical

Product Identification	Ratings are a permanent part of the device
Terminal Accommodation	#12-#10 AWG copper stranded or solid conductor only
Terminal Identification	Terminals identified in accordance with UL 498 and CSA

Environmental

Flammability	UL 94 V-2
Operating Temperatures	Maximum continuous 75°C; minimum -40°C (w/o impact)



Accessories

Wallplate or Weatherproof Cover StyleLine® Decorator Opening

Resources

Customer Use Drawing
eCatalog

Ground Fault Products

Commercial Tamper-Resistant and Weather Resistant GFCI Receptacles

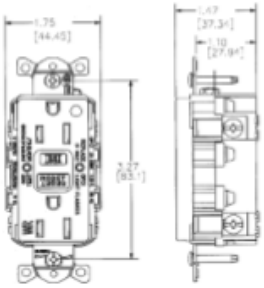
HUBBELL

Features

- Patented shutter design for tamper-resistant protection
- Meets NEC requirements for TR (517-18c) and WR (406.9), UV and corrosion resistance for harsh and damp applications
- Patented AUTOGUARD® self test technology
- Protects against line and load reversal, no power to the face or downstream if device is miswired

Ordering Information

Description	Color	UPC	Catalog Number
20A, 125V, Style Line®, AUTOGUARD® self test GFCI receptacle, tamper-resistant and	White	883778122712	**GFTWRST20W**



Listings

UL Listed - Canadian and U.S.
Meets ADA Standards
Meets all NEC® requirements
CSA Certified
NEMA® WD-6 Compliant

Online Resources

eCatalog

Specifications

Face	Nylon
Base	Nylon
Power Contacts	Brass
Ground Contacts	Brass
Mounting Strap	Zinc plated steel
Mounting Screws	Zinc plated steel

Dimensions in inches (mm)

VELOCITY

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ELECTRICAL COMPONENTS – COUNTDOWN TIMER

SUNBOLT

Push Button Timer

Product information

Color:**Blue**

Technical Details

Brand	Ulincos
Item Weight	0.32 ounces
Product Dimensions	1.6 x 0.9 x 0.9 inches
Item model number	U19C1
Manufacturer Part Number	U19C1
Folding	No
Cover Included	Pushbutton Switch^Wiring Instruction
Voltage	12 volts

- Latching switch: Push it, ON; Push it again, OFF
- Metal shell,100% brand new and high quality, mechanical life for 500,000 cycles
- The switch and LED are separated, LED can be on all the time or only on when switch is on, depending on how you wire it
- Can be use as a switch for various additional electric equipment, inside & outside the car.(Such as critical lights, chassis lamp, fog lamps, dome light)
- There is a wiring instruction in the packaging. You can get the wiring diagram in it, that can help you to install

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ELECTRICAL COMPONENTS - Qi CHARGING

SUNBOLT

SCANSTRUT

TECHNICAL DATA SHEET

ROKK waterproof wireless charger

PART NO. SC-CW-01E, SC-CW-02E, SC-CW-03E

1.

Hidden.

(route pocket to 3mm or bond)
SC-CW-01E

2.

Surface.

(65mm hole saw install)
SC-CW-02E

3.

Bezel.

(10mm (0.39") drill install)
SC-CW-03E

The IPX6 waterproof 12/24V Qi certified wireless charger range enables phone charging on board. Choose the right mounting preference for your installation from one of our 3 easy install options.

Input Voltage Range	10-30V DC (12/24V system)
Input Current Max	1.5A
Standby Power Draw	< 0.03W
Power Output	5W (5V, 1A)
Rating	IPX6 waterproof
Dimensions	96mm outside diameter (surface)
Materials	PC , TPE, ABS UV resistant sealed unit
1) Hidden Install	i) + 3mm material thickness = 67mm ⌀ rebate ii) 3mm material thickness or less = bond direct
2) Surface Install 3) Bezel visible Install	64-65 mm (2-½" - 2-9/16") 10mm (0.39")
Management system	Foreign object detection Thermal management
Cable	Tinned Copper 300mm (12") (L)
Approvals	CE FC RoHS
Product Highlights	1. The first 12/24V wireless waterproof Qi certified charger 2. Marine grade materials 3. IPX6 waterproof 4. Easy install 5. U.V stable 6. Qi certified 6. Non slip surface 7. No sealant required 8. Heat resistance
Application	

For the most direct access to Scanstrut technical support and your local sales representative visit

sales@scanstrut.com

www.scanstrut.com

+44 (0) 1392 531280

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ELECTRICAL COMPONENTS – BATTERY INLINE FUSE

RKURCK 60 Amp Circuit Breaker Manual Reset Inline Fuse

Brand	RKURCK
Current Rating	60 Amps
Voltage	12 Volts
Item Dimensions LxWxH	3.86 x 1.69 x 1.57 inches
Circuit Breaker Type	Standard

About this item

- Model:Car Audio Inline Breaker Circuit Fuse 12V-24V DC 60A For Choose
- Size: 98mm (L) x 43mm (W) x 40mm (H)
- Current: 1A-60A ,Voltage: 12V-24V DC
- Material: Plastic and Metal
- Use for: Car audio video system, boat, marine, bike use. Stops power surges from damaging your amps. Mount on panel or firewall.

Product Specifications

Color	Fuse Holder
Control Type	Power
Current Rating	60 amps
Ean	0889250987275
Exterior Finish	Metallic Finish
External Testing Certification	Automatic Day/Night
Model Number	YBT002HT-CX60A
Mounting Type	Panel Mount

MOMENTUM

SOLAR WORKSTATION

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WARRANTY

Sunbolt warranties the Velocity installation and components as follows:

Installation, Structural Steel Assembly, Powder Coat, and Wood Finishes (where applicable)	1 year
SureSine Wave Inverter, 100 Amp Hour Battery	2 years
Structural Steel Components, MPPT Solar Controller, Battery Capacity Meter.	5 years
Solar Panel Power Output	25 years or more
Tangent Poly-Force Recycled Plastic Lumber	50 Years

Please see the technical specifications provided in the operations manual for more information. Model specifications and details may be subject to change. Sunbolt is not responsible for any damage related to subsequent product alterations, misuse, or abuse once customer receives. Individual manufacturers reserve the right to change their warranty terms.

If Sunbolt has provided troubleshooting services by utilizing customer staff for onsite fault determination and the resolution is unsuccessful, the customer may request that Sunbolt mobilize a 3rd party electrical contractor to perform troubleshooting and problem resolution. In this event, the following terms and conditions shall apply:

1. In the event that the Sunbolt mobilized electrical contractor finds that the fault is caused by a defective component or resulted from a defect in installation, and it has occurred within the initial 12 months after installation, then Sunbolt shall be 100% responsible for payment of any and all costs of the contractor provided services.

2. In the event that the Sunbolt mobilized electrical contractor finds that the fault is caused by any (whether observed, identified, or previously known to customer) user of the table plugging in a device to any table outlet, resulting in a safety shutdown of the inverter and/or a circuit breaker and/or a GFCI device trip, then the customer shall be 100% responsible for the payment of any and all charges incurred for the contractor provided services. Such charges shall be invoiced to the customer by Sunbolt in itemized form, including a copy of the contractor's original invoice to Sunbolt.