

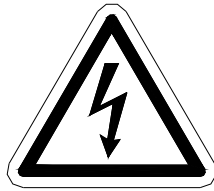


Gas and Flame Detection

Operation and Maintenance Manual

SP-12 Solar Power System (12W Continuous)

GDS Corp.
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CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.

ATTENTION: POUR DES RAISONS DE SÉCURITÉ, CET ÉQUIPEMENT DOIT ÊTRE UTILISÉ, ENTRETENU ET RÉPARÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ. ÉTUDIER LE MANUE D'INSTRUCTIONS EN ENTIER AVANT D'UTILISER, D'ENTREtenir OU DE RÉPARER L'ÉQUIPEMENT.

REVISION HISTORY

Revision 1.0 4/1/15 Initial release

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1 SAFETY INFORMATION

Important – Read Before Installation

Users should have a detailed understanding of the SP-12 Solar Power System operating and maintenance instructions. Read the following WARNINGS prior to use.

WARNINGS

- Please read this manual completely before installing the system.
- Even when all circuit breakers are off, the battery may contain significant energy that can cause sparks or fire. **Use care when working inside the battery enclosure at all times.**
- Cover the solar panel during installation with an opaque material before handling wiring. **Solar panels produce electricity when exposed to sunlight.**
- Do NOT install the SP-12 Solar Power System within 0.5 miles of an ocean or body of salt water or in areas where high levels of corrosion may be expected.
- Do NOT paint the battery enclosure or obstruct the vents at any time.
- Do NOT attempt to install the system during stormy or windy weather. **Solar panels are easily caught by high winds; Lighting is very dangerous and can kill you!**
- Never step on or bend the solar panel. The glass can break or the panel can be damaged beyond repair.
- Use the supplied hardware to properly mount the solar panel. Use of weaker components or screws that are too short may cause the installation to fail.
- Do NOT modify or cut parts.
- GDS Corp strongly recommends that the mounting pole or mounting structure be connected to a dedicated earth ground using a minimum of #10ga wire.
- Do NOT direct artificially concentrated sunlight at the solar panel.
- Wiring methods should be in accordance with NEC regulations and recommendations.

WARRANTY

GDS Corp. UPS products carry a 2-year limited repair or replacement warranty on electronics and workmanship. GDS Corp. reserves the right to void warranty claims based on evidence of misuse, abuse, or misapplication. Warranty period starts on date of shipment.

IF YOU HAVE QUESTIONS

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2 PRODUCT OVERVIEW

Designed properly, solar power systems are a long-lasting, reliable power solution for remote applications, and are a logical choice for powering gas detection systems or process monitoring systems located in remote areas.

The SP-12 Solar Power System is designed to provide up to 12 watts (1.0 amp at 12V) of continuous power in locations where there may be up to five consecutive days of low sun conditions.

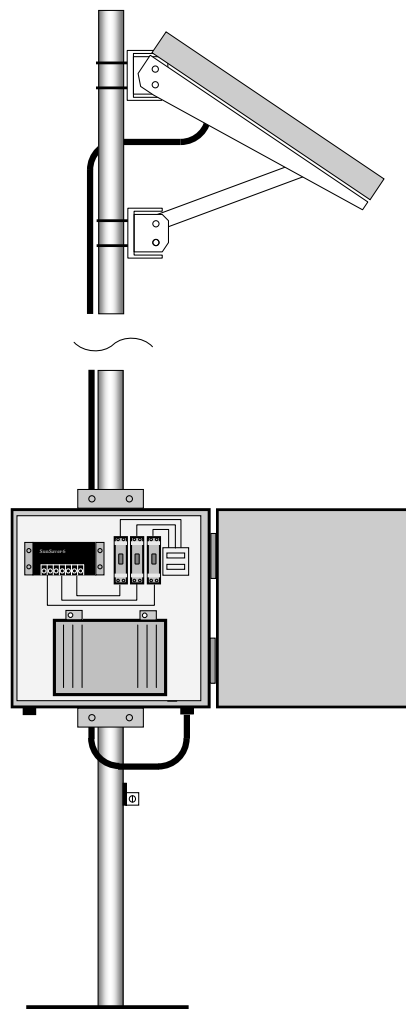
The solar panel converts light energy into electrical power. Full sunlight falling on a flat perpendicular surface can provide approximately 1000 watts per square meter, but sky cover and dust on the panel can reduce this value significantly.

Furthermore, with fixed panels, the angle of the sun with reference to the panel changes continuously during each day. Finally, the difference in solar elevation between winter and summer months also affects power output. Therefore, to provide a source of continuous each solar system must be designed to operate in both optimum conditions (clear sky, sun overhead) as well as at night and in less-than-optimum conditions.

The output from the solar panel is fed to the Charge Controller. This device monitors the level of charge on the battery and controls the amount of current that is delivered during peak charging times. The Charge Controller also monitors the battery output voltage and shuts off the DC output if the battery voltage drops below a minimum value. This protects downstream electronics from 'brown-out' conditions.

Finally, the system provides three 10A circuit breakers that allow each component in the system (load, battery and solar panel) to be independently disconnected from the system for maintenance or troubleshooting.

The SP-12 is ideal for powering GDS Corp systems such as the C2/TX Wireless Site Manager Controller, GDS-68XP Process Monitor for Low Oxygen Applications or GDS-78XP Process Monitor.



3 HARDWARE

The SP-12 Solar Power System consists of a high efficiency 140 watt solar panel with pole mounting hardware, solar charge controller, three 10-amp circuit breakers, two 8G31 108 amp-hour deep discharge battery and stainless steel battery enclosure.

The SP-12 is designed to provide up to 12 watts continuous DC power (1.0A @ 12V) for up to five days of low sun conditions.

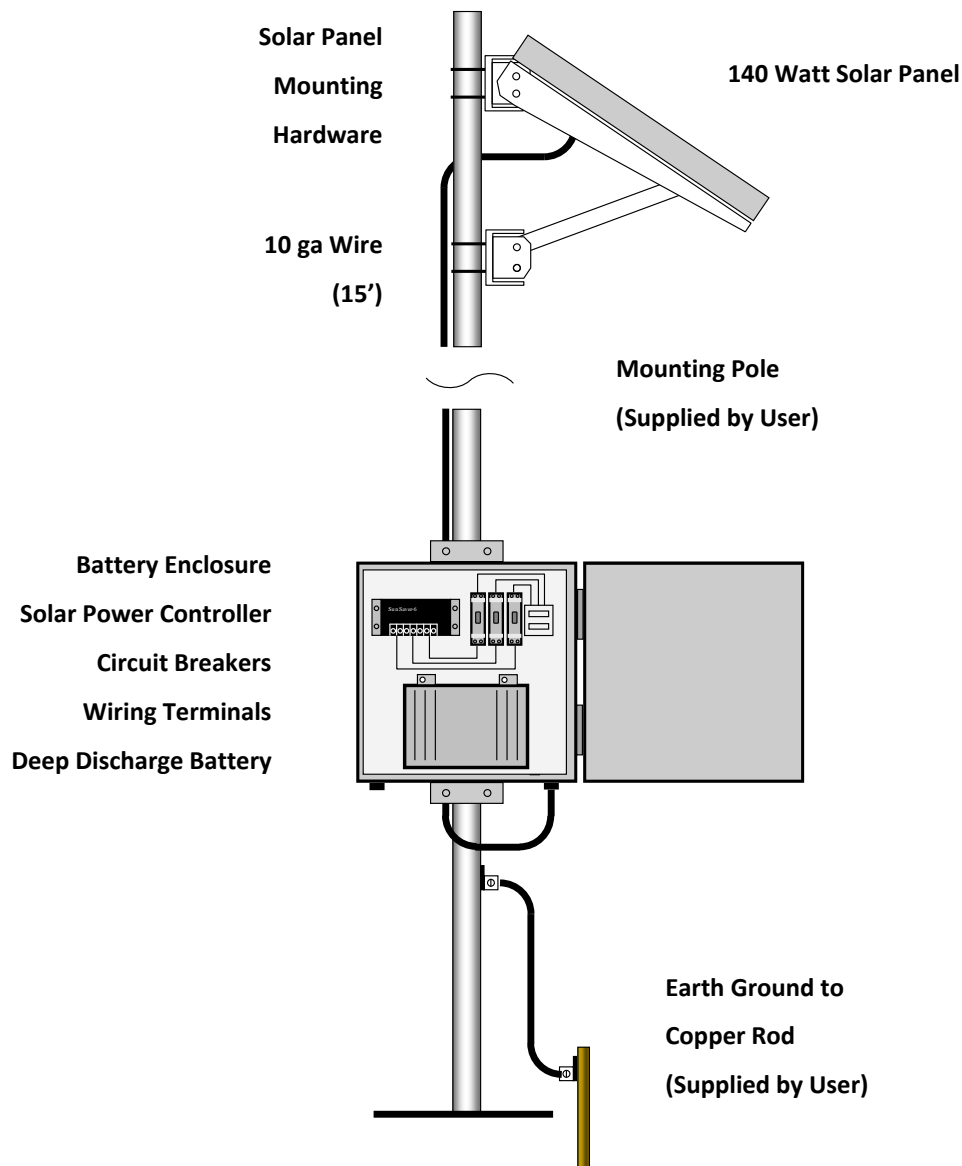


Figure 3-1: SP-12 Solar Power System

4 INSTALLATION

SELECTING A LOCATION

When selecting a location, consider the following guidelines:

- Locate the system such that the solar panel can 'see the sun' for much of the day as possible. In flat areas this is not difficult, but in mountainous areas keep in mind the fact that the sun's elevation will change dramatically between summer and winter months.
- Do not mount the SP-12 within ½ mile of any body of salt water or in areas where corrosion due to salt or other chemicals may be expected.
- Always make sure the solar panel is mounted SECURELY. The panel presents a large surface area to high or gusty winds.
- Mount the battery enclosure SECURELY at or below waist-high level. The batteries are very heavy and should not be mounted such that they can fall and injure personnel or damage equipment.

MOUNTING THE SOLAR PANEL ON A POLE

The preferred method for mounting the SP-12 Solar Power System is on a 2"OD or larger aluminum or steel pole. The pole should be mounted securely in at least 30" of concrete (pole height 8' or less) and should be grounded using #8 or larger stranded wire to a ¼" diameter copper rod driven at least 6 feet into the soil (see Fig. 3-1).

MOUNTING THE SOLAR PANEL ON A WALL OR STRUCTURE

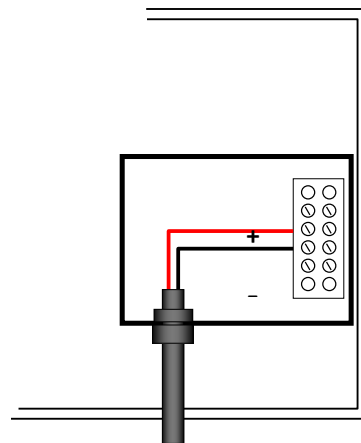
The SP-12 Solar Power System can also be mounted on a structure, but it is important that the direction and elevation of the panel be adjustable for optimum performance.

CONNECTING THE POWER CABLE TO THE SOLAR PANEL

GDS Corp recommends connecting the DC power wiring to the solar panel before assembling the solar panel frame or attaching the solar panel to the pole.

The SP-12 includes a 15' length of #10 ga wire. For longer runs, GDS Corp recommends using #8 ga wire.

Arrange the solar panel lengthwise with the wiring junction panel to the right. Remove the knock-out fitting from the lower left side of the wiring junction panel. Remove the nut from the feedthrough fitting and thread



one end of the #10 cable into the junction box. Install the nut on the backside of the fitting and tighten securely. Attach the RED (+) and BLACK (-) to terminals 3 (+) and 4 (-) as shown. Close the cover on the wiring junction box.

ASSEMBLING THE SOLAR PANEL & POLE MOUNTING HARDWARE

To assemble the solar panel and pole mounting hardware, perform the following steps:

- 1) Attach the two sections of vertical aluminum angle to the solar panel frame as shown using bolts, washers, lock washer and nuts supplied. **Be sure to close the door on the junction box BEFORE installing the aluminum angle.**
- 2) Attach the upper horizontal bracket to the vertical aluminum angle to the using two right-angle brackets and supplied hardware.
- 3) Attach the lower horizontal bracket using two right-angle brackets, extension angle and supplied hardware.
- 4) Attach the upper and lower brackets to the pole using **four** user-supplied U-bolts, washers, lock washers and nuts.



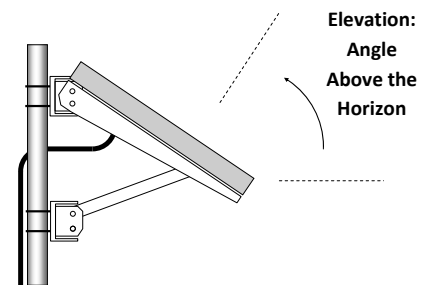
SETTING THE SOLAR PANEL DIRECTION AND TILT

Both the orientation and tilt angle should be adjusted to optimize performance.

Orientation: All solar panels should be oriented to face true SOUTH (not magnetic South).

Tilt Angle: The tilt angle is determined by considering the angle of the sun relative to the horizon as it varies with latitude (distance north/south of the equator) and time of year (summer or winter). The table below shows the minimum, maximum and average sun elevation for locations in the United States (contact GDS Corp for information on other locations). The Recommended Elevation is angled slightly lower (10%) due to the need for increased power production during winter months.

US State	Approx. Latitude	Max Sun Elevation (Summer)	Min Sun Elevation (Winter)	Average Elevation	Recommended Elevation*
Texas	32	84°	36°	60°	55°
Oklahoma	36	78°	30°	54°	49°
Kansas	38	74°	28°	51°	46°
Nebraska	42	72°	25	48°	43°
South Dakota	44	70°	22°	46°	41°
North Dakota	47	66°	18°	42°	38°



INSTALLING THE BATTERY ENCLOSURE

Once the solar panel assembled, the power cable attached and the panel mounted to the pole, install the battery enclosure on the pole using two user-supplied U-bolts, washers, lock washers and nuts. Tighten the bolts securely (batteries are HEAVY!).

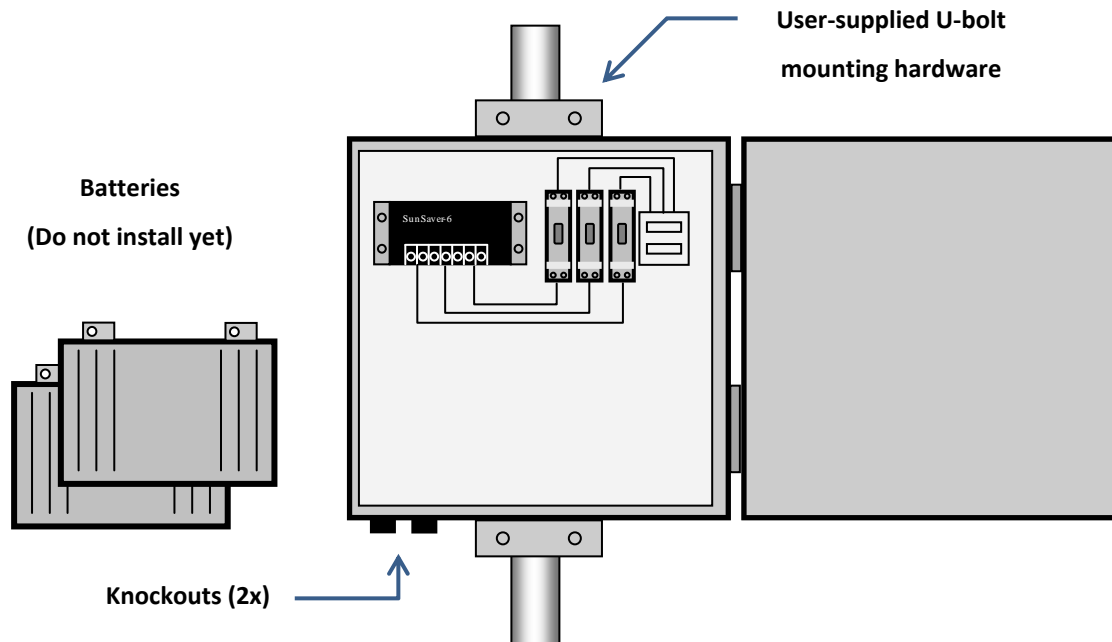


Figure 4-1: Battery Box

Remove the two pre-fabricated knock-outs located in the back left side of the battery enclosure. Remove the nut from the feedthrough fitting on the loose end of the #10 ga power cable and insert the cable through one of the knockouts. Adjust the wire length so that enough wire is inside the enclosure to easily reach the wiring terminals located on the upper right side. Slide the nut over the wire and tighten the fitting securely (See Fig. 4-2).

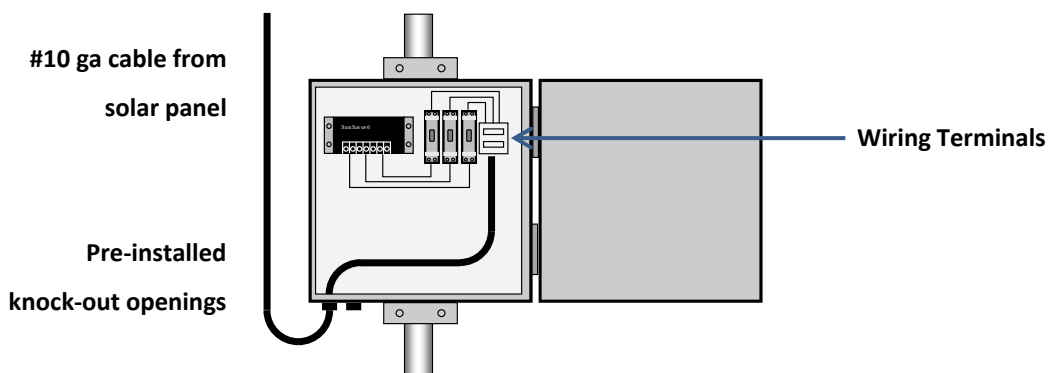


Figure 4-2: Installing Cable from Solar Panel

Make sure that all circuit breakers are turned OFF. Connect the red lead (+) of the power cable to pin 1 and the black lead to pin 2 as shown below. Tighten securely.

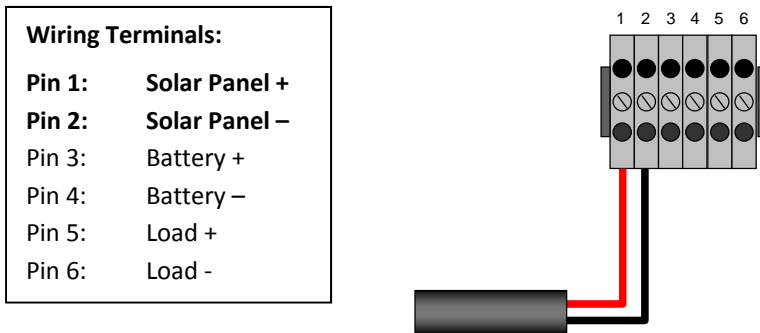


Figure 4-3: Wiring Solar Panel Cable to Wiring Terminals

INSTALLING AND CONNECTING THE BATTERIES

Install the two batteries in the battery enclosure as shown below (top view). The positive side of each battery is on the left and the negative side is on the right. Connect the red and black jumper wires between battery #1 (inside) and battery #2 (outside). Connect the pre-installed red (+) and black (-) cables that are connected to the charge controller to battery #1. Securely tighten all connections.

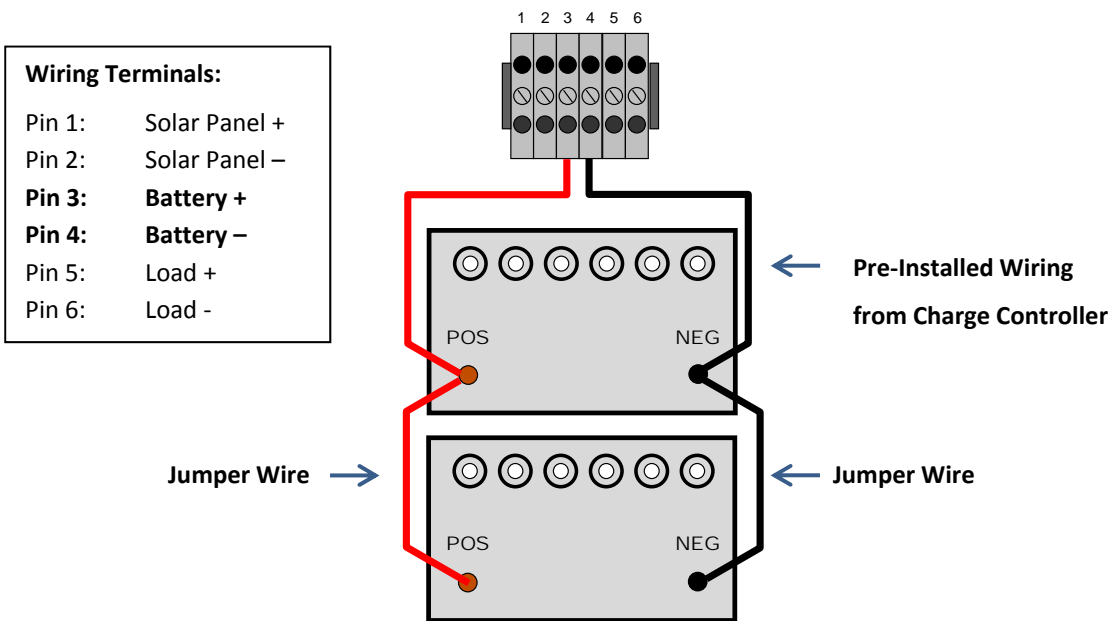


Figure 4-4: Battery Wiring (Top View)

CONNECTING THE LOAD

Power to the load is connected to terminals 5 and 6 as shown below. Load power is controlled by circuit breaker #3. Depending on battery charge, sunlight levels and load current, load voltage can range from +14.4 VDC to +11.5 VDC.

Route the load power cable out the bottom of the enclosure via a user-supplied ½" conduit cable gland. Be sure to tighten the gland securely.

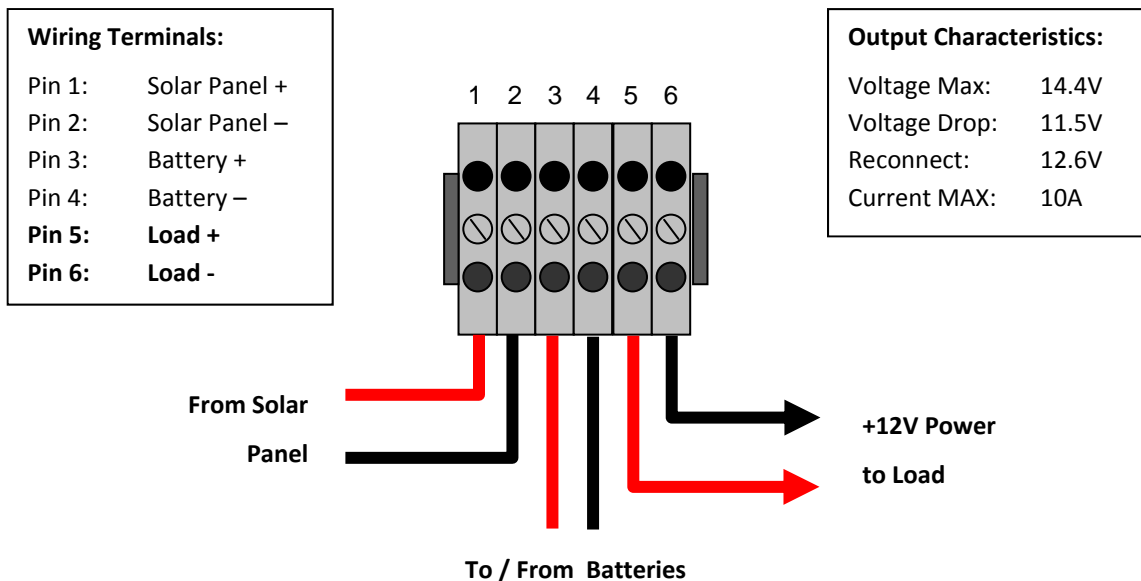


Figure 4-5: Connecting A 12V Load

BEFORE APPLYING POWER

Before applying power, check the following items:

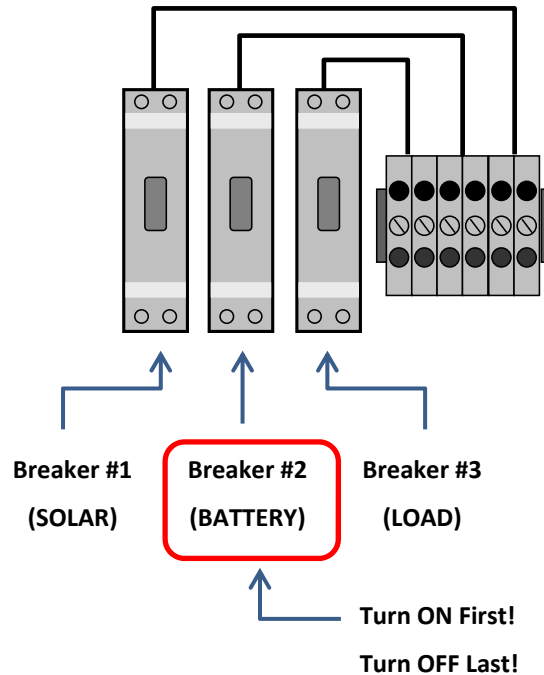
- 1) Make sure the solar panel has been oriented correctly for the location installed.
- 2) Make sure all mounting hardware is tightened securely.
- 3) Make sure the cable glands are tightened securely.
- 4) Make sure the #10 ga power cable is secured to the pole and is not allowed to 'flap' in the wind.
- 5) Make sure there is sufficient air flow around the battery box.
- 6) Make sure the pole is properly grounded to minimize damage from lightning strikes.
- 7) Double check the battery polarity.
- 8) Make sure the battery connections and wiring connections are tightened securely.

5 SETUP AND OPERATION

TURNING ON THE SYSTEM

The first time that any system is turned on, the charge level in the batteries is unknown and the wiring has not been verified by operation. To safely power-up the solar power system for the first time, perform the following steps in order:

- 1) Start with all breakers in the OFF position.
- 2) Turn ON the BATTERY circuit breaker (#2, middle breaker)
- 3) If no RED light is showing on the charge controller, turn ON the SOLAR circuit breaker (#1, left breaker).
- 4) If sunlight is present, a GREEN light will indicate solar charging. At this stage, a RED light will indicate bad wiring or a defective battery.
- 5) If no RED light is seen, turn ON the LOAD circuit breaker (#3, right breaker).
- 6) The system is now operational. Monitor the battery charge LEDs for information on the state of the batteries.



CHARGE CONTROLLER OPERATION

The Charge Controller monitors the power coming into the system from the solar panel, manages the charge current flowing into the batteries (during sunlight) and load current flowing out of the batteries (night, low sun) and limits the power flowing to the load to minimum and maximum values.

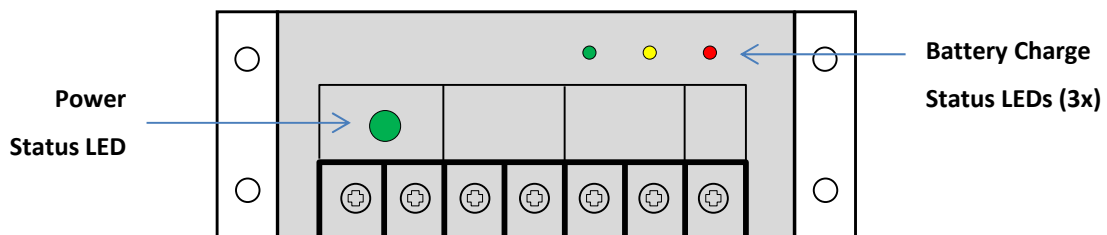


Figure 5-1: Charge Controller

The 100% solid state charge controller uses power MOSFET transistors to control the flow of power into and out of the batteries. It uses a four-stage battery charging process (Bulk, absorption, float, equalize) and temperature compensated charge current to maximize battery life. A low-voltage disconnect circuit cuts power to the load if the battery voltage drops below 11.5 VDC.

The Power Status LED indicates GREEN when power is flowing into the system (solar power > load current) and RED when power is flowing to the load from the batteries (load > solar power). The three battery status LEDs provide information on the level of battery charge.

TURNING OFF THE SYSTEM

When turning the system OFF for maintenance or troubleshooting, perform the following steps:

- 1) Turn OFF the SOLAR breaker FIRST (#1, left breaker).
- 2) Turn OFF the LOAD breaker SECOND (#3, right breaker)
- 3) Turn OFF the BATTERY breaker LAST (#2, middle breaker).

USING A DC/DC CONVERTER

Most GDS Corp equipment is capable of running on voltages between +12VDC and +30VDC. Such equipment, including the GASMAX II and GASMAX CX gas monitors and C1 Protector, C2 Quad Protector and C64 Protector Controller, can be directly connected to the output of the SP-12.

However, some equipment, such as the GDS-68XP Process Monitor or GDS-IR infrared sensor, requires a source of +24VDC. For these applications GDS Corp recommends a DC/DC converter, P/N 2000-0087. This solid state module accepts input voltages that range from +8.4 VDC to +16.2 VDC and outputs +24VDC at up to 4A (96 watts).

The DC/DC Converter can be mounted inside the battery box or inside the piece of equipment that requires +24VDC. Contact GDS Corp for more information.

6 MAINTENANCE

Normal maintenance involves cleaning dust or other contaminants off the solar panel, checking the battery status indication for trouble and making sure the wiring connections and mounting hardware are properly tightened.

Normal battery life is between two to five years, and is adversely affected by temperature extremes and total number of deep-discharge cycles.

7 TROUBLESHOOTING GUIDELINES

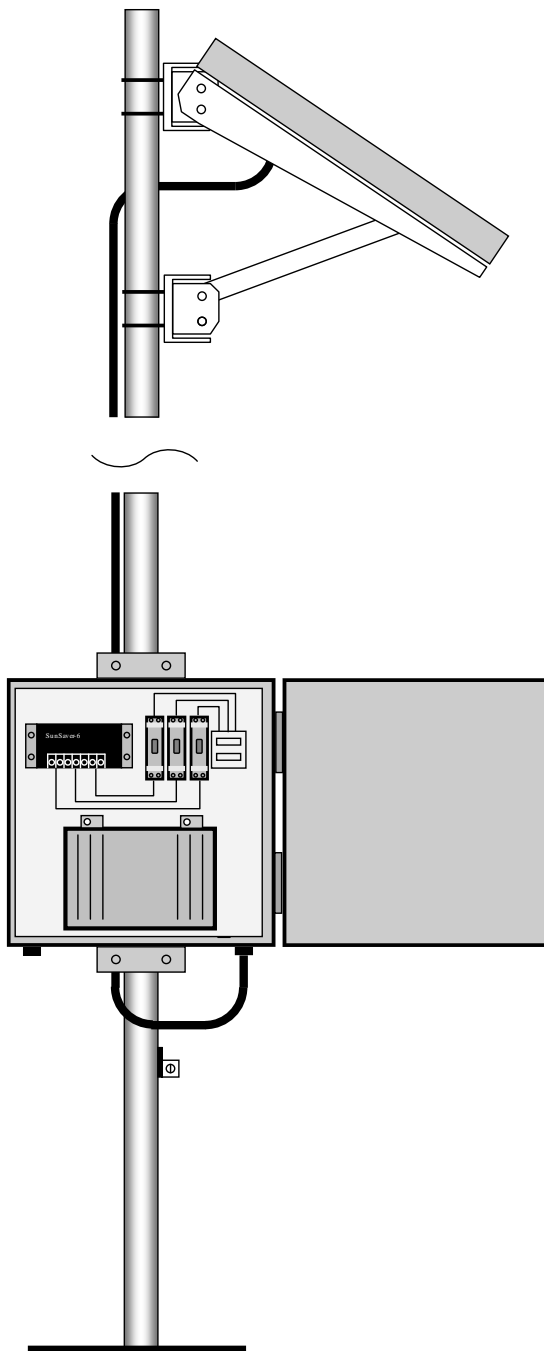
POWER DROPOUT

- Power dropout occurs on regular basis. Load power too high for size of solar power system. Increase number of batteries or size of solar panel.
- Power dropout occurs occasionally during winter months. Excessively long number of days with low sun / no sun conditions; System should recover once sun returns. Increase number of batteries or size of solar panel.
- Power dropout starts to occur often. Battery not holding charge; replace battery.
- Power drops permanently. Charge controller or solar panel failure. Replace.

8 SPECIFICATIONS

Model	SP-12 Solar Power System
Power Output	1.0A @ 12.0 volts (nominal) for up to 5 days of low sun / no sun conditions
Solar Panel	140 Watt, 59" x 27" x 2" Rated for use in Class 1 Division 2 hazardous areas
Mounting Hardware	Two-part mounting bracket that allows for easy adjustment of direction and tilt angle. Supports poles from 2" OD to 4" OD
Charge Controller	Sun Saver SS-10L-12VDC Regulation voltage 14.4 VDC Low voltage load disconnect 11.5VDC Maximum solar panel voltage input 30VDC Transient surge protection: 1500W per connection Rated for use in Class I Division 2 hazardous areas
Circuit Protection	Three (3) 10A circuit breakers (Note: Circuit breakers are for general use areas only)
Battery	Two (2) 8G31 class 108 amp-hour deep discharge batteries Total 216 amp-hour capacity (new)
Battery Enclosure	Aluminum, 18" x 18" x 18" with screened vents on door and sides. Two ½" conduit knockouts in lower left side. Approximate weight with two 8G31 batteries: 155 pounds / 70 kg
Load Output	14.4VDC to 11.5VDC Overload, short circuit and high voltage protection
Temperature	-40°C to +60°C Note: Battery output will be diminished in cold weather
Approvals	For use in general purpose areas only
Warranty	Two years

9 SPARE PARTS



Solar Panel Assembly:

2000-0185	Solar Panel, 140 Watts
2000-0321	Pole Mounting Hardware
2000-0192	Cable, 15', #10 ga with cable feed-thru

Battery Enclosure:

2000-0098	Charge Controller
2000-0200	Backplate + Circuit Breaker (3x)
2000-0113	Wiring Terminal Assembly
2000-0197	Battery, 8G31, 108AH (2x)
2000-0320	Battery to Battery Jumper Cables
2000-0202	Battery Enclosure, 18"x18"x18"

Figure 9-1: SP-12 Assembly (Spare Parts)

10 DRAWINGS AND DIMENSIONS

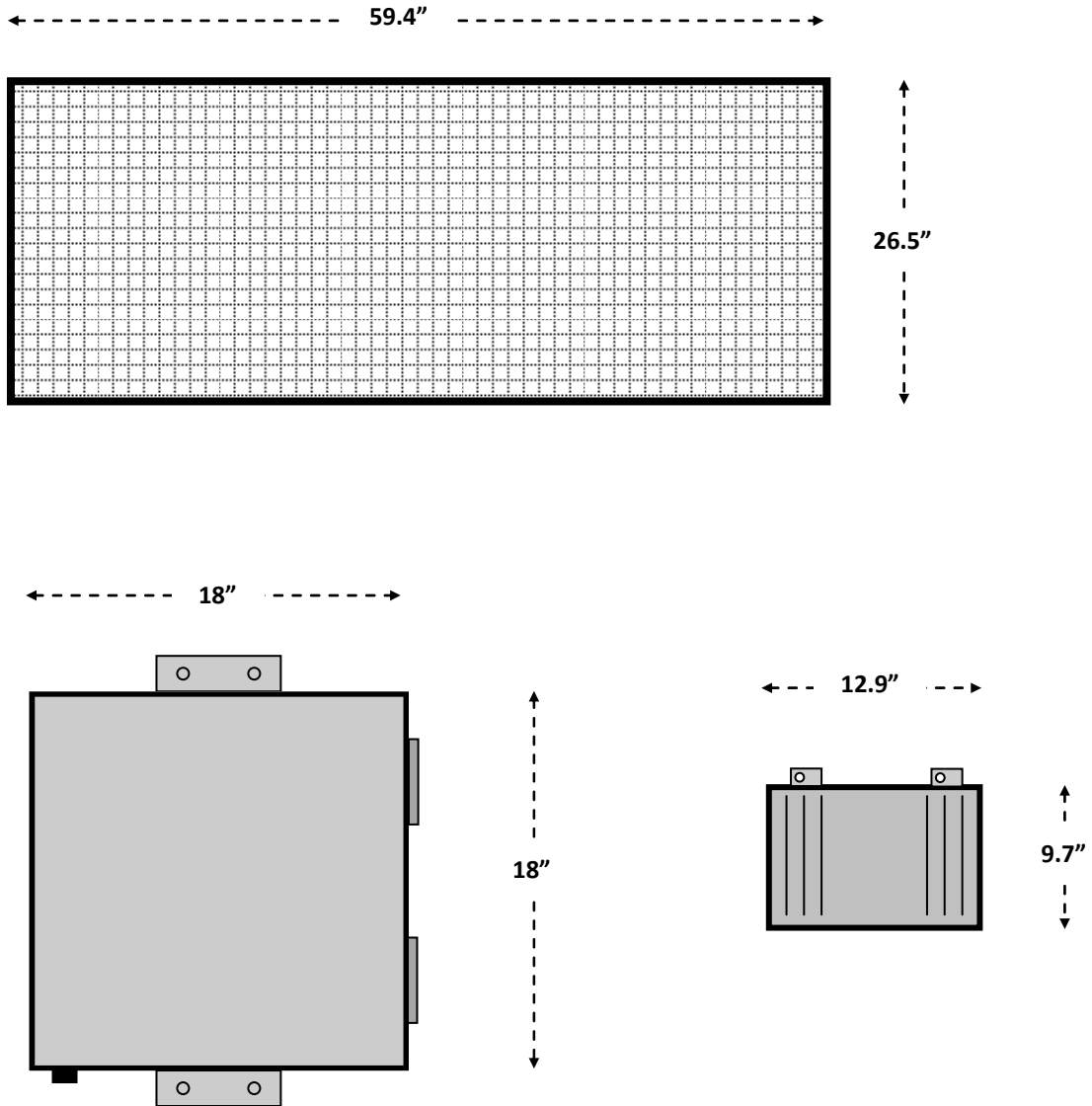


Figure 10-1: SP-12 Dimensions

11 WIRING DIAGRAMS

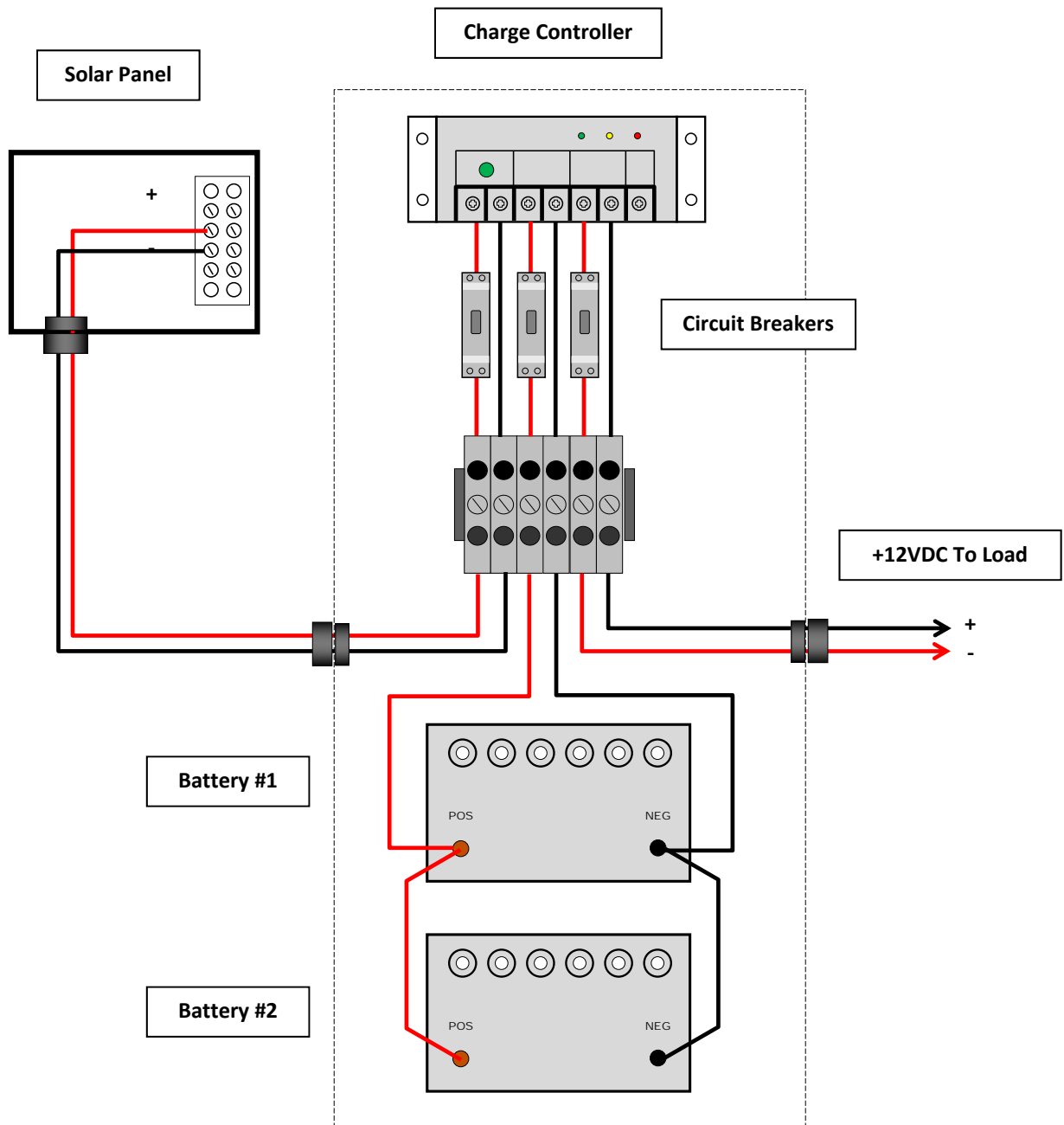


Figure 11-1: SP-12 Wiring Diagram