HydroLynx Systems, Inc.

Model 5033-XX
Solar Panel

Instruction Manual

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Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify HydroLynx Systems immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. If the equipment was shipped via Parcel Post or UPS, contact HydroLynx Systems for instructions.

Returns

If equipment is to be returned to the factory for any reason, call HydroLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage during the return shipment. Call HydroLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available, take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with packaging. Please write the RA# on the outside of the box.

Warranty

HydroLynx Systems warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. HydroLynx Systems' obligations under this warranty are limited to, at HydroLynx's option: (I) replacing; or (ii) repairing; any product determined to be defective. In no case shall HydroLynx Systems' liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by HydroLynx Systems, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

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1.0 INTRODUCTION

1.1 General Description

The Model 5033-XX Solar Panel provides battery charging at remote sites which have power requirements that exceed battery capacity during the normal maintenance period.

1.2 Specifications

Solar Panel

Maximum Power:	See Manufactures Specifications
Open Circuit Voltage:	
Short Circuit Current:	
Voltage at Load:	
Current at Load:	

Voltage Regulator

Array Voc, Max:	26 Vdc
Voltage Drop:	0.55 Vdc
Charge Termination:	14.3 ±0.2 Vdc
Charge Resumption:	13.2 ±0.3 Vdc
Quiescent Current:	10 mA
Operating Temp.:	-20 to 50°C
Storage Temp.:	-55 to 85°C

2.0 INSTALLATION

2.1 Site Selection

When considering a solar site take panel alignment and shading into account. The panel must face south (in the northern Hemisphere) and the panel must not be shaded between 9:00 A.M. to 3:00 P.M. (solar time).

2.2 Tilt Angle

To achieve maximum output the panel should be *normal* (90°) to the sun; this is the *Tilt Angle* and is measured above the horizontal. The Tilt Angle is difficult to maintain at remote sites because the angle of the sun varies 47° through out the year. For year round operation the tilt angle is optimized for the winter months when the solar energy will be the lowest. The following table gives the tilt angle based on latitude of the site.

Latitude of Site	Tilt Angle
0 thru 4°	10°
5 thru 20°	Add 5° to local latitude
21 thru 45°	Add 10° to local latitude
46 thru 65°	Add 15° to local latitude
66 thru 75°	80°

2.3 Installation

WARNING: Solar panels generate electricity when exposed to any light source; electrical shock and burns can result from direct contact with the panel terminals. Cover the panel surface with an opaque material before handling the electrical connections to the panel. Additional hazards exist whenever the panels are wet..

Refer to Manufactures Mounting Bracket Assembly Diagram

- Attach mounting bracket to solar panel.
- Power Cable is threaded up the antenna mast and attached to the regulator.
- Attach mounting bracket to antenna mast, pole or standpipe with hose clamps.
- Thread power cable with 3-pin connector through standpipe cable port.
- Install antenna mast onto the standpipe.
- Align panel to face true south .
- Tighten clamps.
- Adjust panel to correct tilt angle.
- Tighten clamps.
- Attach the 3-pin connector to the 12 VDC IN port on the Data Transmitter.

Warning: Never operate the Data Transmitter on solar power only, always connect the solar panel after the battery is connected;

3.0 THEORY OF OPERATION

3.1 Solar Resource

The intensity of sunlight falling on a surface is called the solar *irradiance* and is commonly measured in units of *Watts per square meter* (W/m^2). Just outside the earth's atmosphere a nearly constant *irradiance* of 1360 (W/m^2) falls on a flat surface normal (90°) to the sun's rays. The earth's atmosphere reflects and absorbs about 30% of the solar spectrum giving a full sun *irradiance* of approximately 1000 (W/m^2) at the earth's surface; this value is called the *peak sunlight* irradiance.

The daily *insolation* refers to the *irradiance* integrated over time, the units of *insolation* are *Watts hours per square meter* (Whr/m²). A convenient way to estimate the solar panel output is to divide the *insolation* by the *peak sunlight* giving the normalized *peak sun hours per day*. The total electrical energy (Whr) produced by a solar panel in one day is equal to the *peak sun hours* multiplied by the *peak power* output of the panel.

This means the power output of the solar panel depends upon the location of the gauge. Across the continental United States the peak sun hours vary from one to five hours, increasing as the latitude decreases.

3.2 Solar Panel

A solar panel contains photovoltaic (PV) cells that convert sunlight into direct current (dc) electricity. The output depends on the number and configuration of PV cells, the intensity of the sunlight, the temperature of the PV cells, and the load being powered.

There are two methods used to rate solar panel outputs: the Standard Test Condition (STC) and the Normal Operating Condition (NOC). The STC simulates *peak sunlight* at room temperature (1 kW/m² @ 25°C) which allows for comparison of solar panel power ratings. The NOC tests the panel performance in actual field conditions which allow designers a better estimate of true field performance.

3.3 Voltage Regulator

The voltage regulator optimizes charging performance from the solar panel while providing overcharge protection for the system storage battery. A blocking diode is included in the regulator to prevent minor discharge losses through the solar panel at night.

3.4 Power Requirements

Since Batteries are rated in Amp-Hours (Ahr) we calculate power requirements in this unit rather than Watt-Hours (Whr). To determine Power Requirements we first calculate all the current usages on a per day basis and then add these together for a daily total. We can then size the battery and solar panel based on system specifications for days without charging and hours of sun to fully recharge battery.

4.0 TESTING & MAINTENANCE

The Solar Panel requires yearly testing and maintenance under normal conditions. Locations where debris (i.e. dirt, bird droppings and leaves) builds up on the panel require more frequent maintenance. Whenever possible HydroLynx recommends reporting battery voltage on a six hour interval. These report, spaced throughout the day, will give the technician an indication of battery and solar panel fitness.

4.1 Testing

The tests included in this manual will insure proper solar panel operation and can be used to troubleshoot a faulty power system. Included in the Drawing section is a schematic for a solar panel test fixture which will help the technician with these tests.

Remove the panel from the Data Transmitter. These tests must be done on a sunny day between 9:00 AM and 3:00 PM (solar time).

4.1.1 Without Load Test - Voltage

This checks the regulator's *charge termination voltage* which keeps the battery from being overcharged.

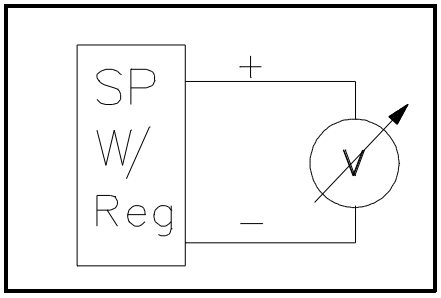

Figure 1 Without Load Test

(Test Fixture Switches: SW1-V, SW2-w/oL, SW3-no)

- Volt meter is connected as shown in Figure 1.
- Limit: Manufacture's specification

4.1.2 With Load Test - Power (watts)

Testing with a Load insures that the panel is able to supply current to charge the battery. The Load®) is determined by the minimum battery voltage(V) and the expected charging current (A); R = V÷A. The resistor power rating is found by multiplying the current(A) by the Voltage(V).

e.g. 0.6 A Solar panel:
R=V÷A, R=(12 ÷ 0.6) = 20 Ω
P=V×A, P=(12 × 0.6) = 7.2 Watts

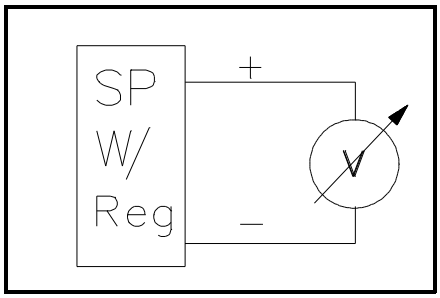

Figure 2 With Load Test -V

(Test Fixture Switches: SW1-V, SW2-w/L, SW3-no)

- Measure Voltage - Volt meter is connected as shown in Figure 2.

(Test Fixture Switches: SW1-A, SW2-w/L, SW3-no)

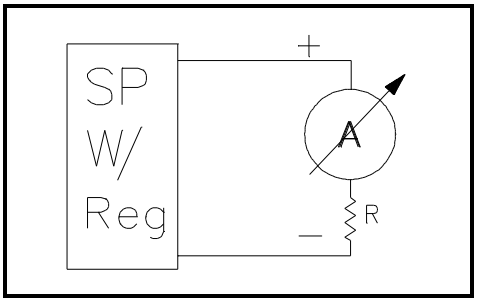

Figure 3 With Load Test - A

- Measure Current - Current measurement is shown in Figure 3; the test fixture uses a 1 Ohm sense resistor and Volt meter to make this measurement.

- Calculate Power: P = V x A
- Limit: Manufacture's specification

4.1.3 Reverse Dark Current Test

The panel should not draw current from the battery during periods of non-operation i.e. at night. This test verifies low Reverse Dark Current.

(Test Fixture Switches: SW1-A, SW2-w/oL, SW3-yes)

- Battery and current meter are connected as shown in Figure 4; the test fixture uses a 1 Ohm sense resistor and Volt meter to make this measurement.
- Cover solar panel completely.
- Press Pushbutton Switch (SW-3) for measurement.
- Limit: 15 mA.

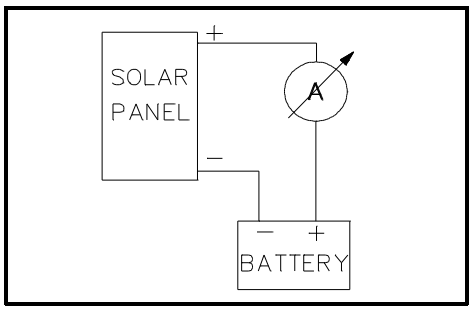

Figure 4 Reverse Dark Current

4.2 Maintenance

Inspect the module for overall integrity.

Check that all connections are tight and free of corrosion.

When the panel becomes dirty use water and a soft cloth or synthetic sponge to clean the glass surface. A mild, non-abrasive detergent can be used to remove persistent contaminants. Avoid using brushes or abrasive cleansers.

Warning: electrical shock can occur whenever the panel becomes wet! Wear rubber gloves whenever cleaning the panel.

5.0 DRAWINGS