

**INSTALLATION INSTRUCTIONS FOR SOLAR PANEL CONTROLLER****MODEL VREG JL-2/JL-2U****DESCRIPTION**

The model VREG-JL-2/JL-2U is a float charger that can be used with PV arrays or power supplies having power ratings as high as 40 watts. (Higher panel wattage can be handled under controlled conditions). The regulator features low current consumption, (typically less than 50 microamp), and internal battery temperature sensing and compensation. A kit is available which allows for the sensor to be external.

Battery temperature is sensed by an internal temperature sensor on the controller. By using the external sensor kit, a separate sensor is used that is held in contact with the battery case. This temperature sensor is connected to the controller by an 8 foot interconnecting cable. The float level of the regulator changes by approximately -23 millivolt per degree C (12 millivolt per degree C for 2U); colder temperatures causing a higher float level.

The float threshold of the regulator is adjustable via an adjustment screw located on the top of the assembly near the battery leads. The 20 degree C float threshold may be set to any level between 11 and 16 volts. The charge controller will charge a fully discharged battery at the full current output of the solar panel and will automatically taper the charging current to zero as the terminal voltage of the battery approaches the float level of the charger. The charger then supplies whatever trickle current is required by the battery to maintain the battery at the float level, assuming sufficient sunlight. Any additional current, due to the load on the battery, is automatically supplied as needed, so long as there is sufficient sunlight to produce the current.

An LED indicator on the unit indicates when the charger is charging or holding the battery at the float level. The main purpose of this indicator is to give an indication that the charger and solar panel are functional. The LED is powered from the solar panel, and will not be illuminated if there is no sunlight. A dimly lit LED will occur with low sunlight levels insufficient for battery charging.

**WIRING**

Refer to the label on the side of the unit for proper wiring. Terminal connections may be made to the solar panel and battery in any sequence. Reverse connection of polarities or reverse connection of the solar panel and battery will not cause damage, however no battery charging will result.

**SPECIFICATIONS**

Maximum input voltage: 28 volts. (If a dc power supply is substituted for the solar panel it is important that the worst case peak amplitude of the output voltage of the power supply not exceed 28 volts, otherwise the internal "transorb" of the controller will conduct, possibly damaging the "transorb" and/or power supply).

Maximum charging current and/or power dissipation: Typically 4 amps. The controller will conservatively handle currents to 10 amps so long as the power dissipated by the controller doesn't exceed approximately 15 watts, (heat sink positioned so fins are vertical). For example, assume the regulator is driven by a solar panel or power supply that is supplying 4 amps at a terminal voltage of 16 volts. Assume also that the battery terminal voltage is 13 volts. The power dissipated by the controller may be calculated as follows:

$$P = (16 - 13)(4) = 12\text{watts}$$

Higher charging currents can be handled if the terminal voltage of the solar panel or power supply is at a lower level. The maximum allowable solar panel or power supply terminal voltage for a given charging current can be calculated as follows:

$$V = (15/I) + V_{\text{bat}}$$

where:  $V$  = Maximum allowable terminal voltage of solar panel or power supply. (In no case should  $V$  be allowed to exceed 28 volts).

$I$  = Charging current

$V_{\text{bat}}$  = terminal voltage of battery

As an example, 7.5 amps of charging current can be handled by the regulator if the solar panel or power supply terminal voltage doesn't exceed:

$$V = (15/7.5) + V_{\text{bat}} = 2 + V_{\text{bat}}$$

Solar Panel Wattage: typically 40 Watts

Current consumption: less than 50 micro amps. The LED requires approximately 3 ma, however this current is supplied from the solar panel.

Temperature compensation: Approximately -23 millivolt/degree C (-12 millivolts/degree C for JL-2U).

Operating Temperature: -50 degree C to +55 degree C.

Storage Temperature: -55 degree C to +85 degree C.

**ADJUSTING FLOAT THRESHOLD**

This procedure assumes that the magnitude of the desired float level has been determined for the corresponding temperature of the temperature sensor. The float voltage can be determined as follows:

$$V_{\text{float}} = V_{20} + (20 - T_s)(.0234) \text{ or}$$

$$V_{\text{float}} = V_{20} + (20 - T_s)(.012) \text{ (JL-2U)}$$

where:  $V_{20}$  = The specified float voltage for the battery at 20 degrees C.

$T_s$  = actual ambient temperature of the temperature sensor in degrees C.

- Step 1 Disconnect the battery from the battery leads of the charge controller.
- Step 2 Connect a voltmeter across the battery leads of the charge controller.
- Step 3 If the adjustment is being made in the field, be sure that the solar panel is producing adequate voltage, (several volts higher than the float level desired for the battery). If the adjustment is being made in the shop, connect a power supply to the solar input terminals, (DO NOT SET THE POWER SUPPLY OUTPUT HIGHER THAN 28 VOLTS OR YOU MAY DAMAGE THE INTERNAL TRANSORB CONNECTED ACROSS THE INPUT TERMINALS OF THE REGULATOR).
- Step 4 Adjust the screwdriver adjustment control on the top of the regulator until the voltmeter reads the desired float voltage. (The adjustment control is located about ½ inch from the BLACK battery lead).
- Step 5 Remove the voltmeter and re-connect the battery to the battery leads.

### NOTES

If the unit is used as a float regulator in conjunction with a power supply, be sure that the maximum output voltage from the supply never exceeds 28 volts. If the power supply is unfiltered, then the peaks of the rectified cycles must not exceed 28 volts. (This provides a 2 volt margin before the units internal transient absorber begins to conduct). Keep in mind that a dc meter generally gives a reading that represents the average of the waveform, not the peak value. An oscilloscope should be used to accurately determine the peak value of the output waveform of a non filtered power supply. (allow a 20% or more margin for high power line voltage).

There is no current limiting in this regulator, so be careful not to short the BATTERY leads from the regulator, when the regulator is being powered by a power supply. Shorting the battery leads from the regulator will reflect the short back onto the power supply, and may damage the power supply and/or regulator. The regulator WILL NOT be damaged by shorts on the battery leads when the regulator is being driven by the solar panel.

**Combo JL-2/JL-2U configuration:**



Considered from the view shown at left above, all three switches are to be in the right position for configuration as a standard JL-2 regulator, and all three switches in the left position for configuration as a JL-2U regulator.

**DO NOT CHANGE SWITCHES WHEN UNIT IS CONNECTED TO A BATTERY. Also, changing switches will require a re-adjustment of the float voltage level. JL-2 settings are typically used for standard lead-acid type batteries. JL-2U settings are typically used for Gel-Cell type batteries**

**The regulator will charge either type battery with either set of switch positions. Setting the proper position for the particular type of battery will optimize the charging voltage over temperature and extend the life of the battery**

**The label on the opposite side of the heat-sink shows the proper connections for battery and solar panel to the regulator unit, as well as connections for the temperature sensing diode, which is connected to the green terminal block.**